Eliminating Tobacco-Related Disease and Death: Addressing Disparities

A Report of the Surgeon General

U.S. Department of Health and Human Services

Eliminating Tobacco-Related Disease and Death: Addressing Disparities—A Report of the Surgeon General

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Message from Xavier Becerra

Secretary, U.S. Department of Health and Human Services

Twenty-five years after the release in 1998 of the first Surgeon General's report to focus specifically on racial and ethnic disparities in commercial tobacco use, we have made substantial progress in reducing tobacco use at the population level. However, many disparities in the use of tobacco products continue to be observed by race and ethnicity, level of income, level of education, sexual orientation and gender identity, occupation, geography, behavioral health status, and disability status.

Everyone deserves to live a healthy life free from commercial tobacco-related disease and premature death. Using a multidisciplinary perspective, this Surgeon General's report reviews the latest scientific evidence about drivers of tobacco-related health disparities and interventions to prevent and reduce them. It concludes with a bold vision to advance tobacco-related health equity.

At the federal level, pivotal steps are being taken to advance public health across the whole population through both regulatory and administrative actions, including actions that will also promote tobacco-related health equity. The U.S. Food and Drug Administration (FDA) has announced that it intends to advance a product standard that would establish a maximum nicotine yield to reduce the addictiveness of cigarettes and certain other combusted tobacco products to minimally addictive or nonaddictive levels (*Federal Register* 2018; FDA 2022). This action would have significant impact on public health if promulgated. Additionally, the FDA has proposed product standards to prohibit menthol as a characterizing flavor in cigarettes and prohibit characterizing flavors (except tobacco) in cigars (*Federal Register* 2022a,b)—actions with strong potential to benefit public health.

Many people who now use commercial tobacco products have the least resources for, and face the greatest barriers to, quitting. It is critical to couple any regulatory efforts to reduce the appeal and addictiveness of commercial tobacco products with evidence-based, accessible support to help people quit their use of these products. To advance this goal, the U.S. Department of Health and Human Services (USDHHS) released the USDHHS Framework to Support and Accelerate Smoking Cessation (USDHHS 2024). This framework provides direction to enhance collaboration and coordination across USDHHS, drive further progress toward smoking cessation, and ensure equitable outcomes for all persons in America.

In addition to these critical efforts to address the use of combusted tobacco products—which are responsible for the overwhelming burden of tobacco-related death and disease in the United States—additional efforts are also underway to prevent and reduce youth access to and use of all tobacco products, including e-cigarettes. In June 2024, the Justice Department and FDA announced the creation of a federal multi-agency task force to combat the illegal distribution and sale of e-cigarettes (U.S. Department of Justice 2024). This report underscores the importance of such actions to curb harmful industry tactics, documenting how tobacco companies, including e-cigarette manufacturers, have attempted to circumvent national, state, and local tobacco prevention and control policies—such as by introducing products containing synthetic nicotine—and to use litigation to challenge policies proven to benefit the public's health.

Taken together, these initiatives are expected to meaningfully advance efforts to eliminate the burden of death and disease caused by commercial tobacco use. But to be successful, we must engage all sectors of society. Now is the time to close the gap in tobacco-related health disparities in the United States—for everyone.

Foreword

This decade, cigarette smoking among youth and adults reached the lowest levels ever recorded, representing a major public health milestone. Yet over 36 million U.S. adults (as of 2022) and 760,000 middle and high school students (as of 2024) smoke combustible tobacco products—including cigarettes, cigars, and other smoked products (Jamal et al. 2024; Centers for Disease Control and Prevention [CDC] 2024), and these products continue to have an enormous impact on health. E-cigarettes emerged in 2014 as the most commonly used tobacco product among U.S. youth and young adults and remain so in 2024, despite recent declines in use among high school students (Jamal et al. 2024). These and other noncombustible tobacco products such as nicotine pouches have the potential to undermine overall progress in preventing and reducing young people's use of tobacco products.

This Surgeon General's report documents the persistence of disparities in tobacco product use and exposure to secondhand tobacco smoke. As was true in the 1998 Surgeon General's report—the first to exclusively examine racial and ethnic disparities in tobacco use—the present report finds that American Indian and Alaska Native people experience the highest prevalence of smoking of any racial and ethnic group. Even while overall youth tobacco product use declined between 2023 to 2024, use among American Indian and Alaska Native youth increased (Jamal et al. 2024). People who identify as lesbian, gay, bisexual, or transgender use tobacco products at substantially higher rates than those who identify as heterosexual or cisgender, respectively. Evidence in this report substantiates that menthol-flavored tobacco products increase the likelihood of tobacco initiation, addiction, and sustained use; are target marketed to certain population groups; and are disproportionately used by Black people, Native Hawaiian and Pacific Islander people, women, and people who identify as lesbian, gay, or bisexual. Disparities in exposure to secondhand tobacco smoke by race and by poverty level have persisted for at least three decades.

Preventing future generations from starting tobacco use and helping people quit is key to advancing the CDC's mission to protect health and improve lives. Preventing and reducing tobacco use and tobacco-related health disparities not only reduces preventable death and disease caused by smoking but also enhances our protections against infectious disease and other disease risks. CDC engages in specific efforts to prevent and reduce tobacco use among groups disproportionately burdened by tobacco use through our expertise, response, and investments, including:

- Funding the National Tobacco Control Program (NTCP), which supports all 50 states, the District of Columbia, 28 tribes and tribal-serving organizations, and 8 territories and freely associated states. NTCP includes advancing health equity as one of four goals.

- Funding a consortium of national organizations (the National Networks) that works to reduce tobacco use and cancer incidence among minoritized racial and ethnic groups; people with lower socioeconomic status; people who identify as lesbian, gay, bisexual, transgender, queer or questioning, intersex, and other sexual orientation and gender identities (LGBTQI+); people with mental health conditions and substance use disorders; and various geographically defined populations. Operating since 1997, the National Networks consortium is the longest running federally funded initiative designed to address tobacco-related health disparities in diverse populations.

- Investing in the Good Health and Wellness in Indian Country (GHWIC) initiative that supports tribes, tribal organizations, and Tribal Epidemiology Centers across the United States through community-driven strategies to reduce tobacco use and other risk factors in tribal communities.

- Reaching people who smoke through *Tips From Former Smokers* (*Tips*), the first federally funded national tobacco education campaign. The campaign features real stories from real people living with serious long-term health effects from smoking and exposure to secondhand tobacco smoke. *Tips* advertisements have featured people from multiple population groups who experience tobacco-related health disparities and include specific placement designed to reach people who experience tobacco-related health disparities.

- Supporting culturally competent and free quitline services in every state, the District of Columbia, Guam, and Puerto Rico; in multiple languages; and with unique services or outreach to groups who are facing tobacco-related health disparities.

- Funding and supporting a $15 million initiative in 2023 to 8 communities to build a community of practice for state tobacco control programs and collaborators to develop and advance culturally competent interventions that (a) reduce initiation and use of menthol and other flavored tobacco products and (b) support and encourage sustained cessation among people who use menthol-flavored tobacco products.

CDC's support to states and communities for tobacco prevention and cessation is a vital component to advancing health across all communities. This support serves as a foundational component of comprehensive efforts from USDHHS to prevent and reduce the harms of commercial tobacco use and their impact on other health conditions. Working in partnership across sectors, we must sustain and build upon these important efforts to prevent and reduce tobacco use and tobacco-related health disparities, measure collective progress, and be jointly accountable for results.

Mandy Cohen, M.D., M.P.H.
Director
Centers for Disease Control and Prevention

Preface
from the Surgeon General

In 1964, the year of the first Surgeon General's report on smoking and health, nearly one in two U.S. adults smoked cigarettes. We've made remarkable progress since then. Today, about one in nine adults smokes cigarettes. Sixty years later, the elimination of all tobacco-related disease and death for our nation is a bold yet attainable goal.

To reach this ambitious public health goal, we must first acknowledge that progress has not been even. In his 1998 report, then U.S. Surgeon General Dr. David Satcher marked a historic step in recognizing the disproportionate burdens of tobacco-related disease, disability, and death among certain racial and ethnic groups (U.S. Department of Health and Human Services [USDHHS] 1998). Today, as we show in this report, cigarette smoking among men and women living in poverty is more than twice as common compared to those not living in poverty. American Indian and Alaska Native adults and youth have the highest prevalence of cigarette smoking by race and ethnicity in the United States, and among people who do not smoke, exposure to secondhand tobacco smoke remains disproportionately higher among Black people than among people in other racial and ethnic groups. Youth who identify as lesbian, gay, or bisexual have a prevalence of cigarette smoking that is nearly double that of their heterosexual peers. The gap in tobacco use between youth living in rural areas and those living in urban areas has widened since 1998. Across the country, income, race and ethnicity, level of education, sexual orientation and gender identity, geography, and mental health play a significant role in determining who uses tobacco and who suffers from its harmful health consequences.

Industry-designed tobacco products such as menthol cigarettes and flavored cigars also contribute to tobacco-related health disparities. Today, the tobacco industry continues to outspend tobacco control efforts by a factor of at least 12 to 1 annually with more than $8.5 billion spent in tobacco-related advertising and promotion (Campaign for Tobacco-Free Kids 2023; Federal Trade Commission 2023a,b).

It doesn't have to be this way. We have the chance and the choice to free our society from tobacco industry influence and create a tobacco-free America for all. This Surgeon General's report—the 35th on smoking and health—summarizes key progress at national, state, and local levels toward eliminating tobacco-related disparities in the United States. Protecting public health for the whole population, including eliminating disparities, requires equitable access to evidence-based strategies, such as cessation programs and quitlines; mass media campaigns; and retail, product, and marketing regulations. There are additional concrete steps we can support today. A product standard that establishes a maximum nicotine yield to reduce the addictiveness of cigarettes and other combusted tobacco products could prevent more than 33 million people from starting to smoke, avert more than 8 million deaths, and result in an adult smoking prevalence of under 2% by year 2100 (Apelberg et al. 2018). A product standard to prohibit the sales and marketing of menthol cigarettes could avert up to 654,000 deaths over the next four decades (Levy et al. 2023). As of 2024, two states and nearly 200 U.S. communities prohibit the sale of menthol cigarettes and other flavored tobacco products, protecting about one-sixth of the population (Truth Initiative 2023; Campaign for Tobacco-Free Kids 2024). And, in the boldest step yet, two communities have chosen to eliminate the sale of all commercial tobacco products (City of Beverly Hills 2019; Action on Smoking & Health 2020; City of Manhattan Beach n.d.). Importantly and appropriately, these strategies focus on product manufacturing, distribution, and sales—and do not include a prohibition on individual consumer possession or use.

Today, cigarette smoking and exposure to secondhand tobacco smoke continue to cause nearly half a million deaths in the United States each year—nearly one in five of all deaths. It is difficult to adequately describe the profound human toll of these deaths on loved ones who are left behind. The financial consequences of tobacco-related death and disease are also staggering—nearly $600 billion in healthcare spending and lost economic productivity in 2018 (Shrestha et al. 2022). More work remains to close key gaps and finally eliminate the leading cause of preventable disease and death for Americans today. This report offers a vision for a tobacco-free future, focused on those who bear the greatest burden, and a call to action for all sectors of society to realize that vision.

As a father of two young children, few things are more important to me than ensuring they have the best possible chance of good health and a bright future. I want this for all our kids. I believe the vast majority of Americans feel the same about our sacred responsibility to protect our kids. Nine in 10 adults who smoke began smoking as youth (USDHHS 2012, 2014). Children should not have to worry about a multibillion-dollar commercial tobacco industry that profits at the expense of their health. The time is now to accelerate a whole-of-society effort to reach the tobacco endgame: a world in which zero lives are harmed by or lost to tobacco use. By driving down the appeal, availability, and addictiveness of tobacco products, we can make this more than just a possibility. We can make it a reality. Can we summon the moral courage as a nation to do so, for one another, for our children, and for generations to come?

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Introduction

Since 1964, the U.S. Surgeon General has released 34 reports on smoking and health. In 1998, the first Surgeon General's report on tobacco-related health disparities, *Tobacco Use Among U.S. Racial/Ethnic Minority Groups,* examined four racial and ethnic groups (the aggregate groups of African American, American Indian and Alaska Native, Asian American and Pacific Islander, and Hispanic persons) (U.S. Department of Health and Human Services [USDHHS] 1998). Additional reports of the Surgeon General have examined health disparities to include additional factors beyond race and ethnicity, such as socioeconomic status (SES), age, educational attainment, and geography (USDHHS 2006, 2014, 2020). This Surgeon General's report—the 35th on tobacco—summarizes current progress toward meeting the challenge of eliminating tobacco-related health disparities in the United States. Tobacco-related health disparities are defined for this report as "differences in

- the patterns, prevention, and treatment of tobacco use;
- the risk, incidence, morbidity, mortality, and burden of tobacco-related illness that exist among specific population groups in the United States; and
- related differences in capacity and infrastructure, access to resources, and [exposure to secondhand tobacco smoke]" (Fagan et al. 2004, p. 211).

This definition acknowledges that disparities can occur throughout the tobacco use continuum—from tobacco use initiation, to current tobacco use, to cessation-seeking behaviors and ultimately, cessation—and that disparities exist in numerous indicators, including the number of cigarettes smoked per day, access to and utilization of screening and treatment for tobacco product use and dependence, rates of cessation and relapse, health consequences of tobacco use, exposure to tobacco marketing, and exposure to secondhand tobacco smoke. Tobacco-related health disparities are not simply differences in the prevalence of tobacco product use between population groups; instead, the definition extends further to account for historical and societal factors that affect both differential exposure to tobacco and tobacco-related outcomes. Many communities disproportionately burdened by tobacco-related health disparities have notable strengths—such as social support infrastructure and social cohesion (Munford et al. 2020)—but poverty, systematic discrimination, and other social determinants of poor health have resulted in cumulative and compounding disadvantages over the lifespan of community members (Smith et al. 1997; Graham et al. 2006; Mitchell et al. 2019; *The Lancet Healthy Longevity* 2021). These disadvantages include differences in access to and quality of healthcare and access to other resources—such as education, transportation, healthy food, and safe jobs that provide living wages—that, if absent or compromised in quality or quantity, can lead to health disparities (Institute of Medicine 2003; National Cancer Institute [NCI] 2017; Stepanikova and Oates 2017).

The present report examines tobacco-related health disparities among minoritized racial and ethnic groups and sexual orientation and gender identity groups; persons with lower incomes; persons with lower educational attainment; occupational groups, including workers in manual labor and service sector jobs; persons with mental health conditions or substance use disorders; and persons who reside in rural areas or specific geographic regions. Since the 1998 Surgeon General's report, scientific evidence has reinforced that inequitable policies, practices, and conditions disproportionately impact unique and intersectional groups (i.e., people with membership in two or more risk groups), exacerbating disparities in use of commercial tobacco products, exposure to secondhand tobacco smoke, and tobacco-related health outcomes (Cole 2009; NCI 2017). The present report is the first to document, in a single volume, patterns and trends related to (a) use of commercial tobacco products, (b) exposure to secondhand tobacco smoke, (c) exposure to marketing of tobacco products, and (d) tobacco-related health outcomes and the ways in which disparities in these outcomes are affected by intersectionality.

Although this report provides the most comprehensive examination of tobacco-related health disparities in a single Surgeon General's report to date, it does not address every group subject to structural or social disadvantage or every aspect of tobacco-related health disparities. The report's scope was limited by available data, scientific literature, coverage in previous and/or planned Surgeon General's reports on tobacco product use, and practical considerations (e.g., feasibility and timeliness).

Moving forward, future reports of the Surgeon General might focus on additional topics, including but not limited to the rapidly evolving science on strategies to (a) advance health equity and (b) examine specific population groups in greater detail, such as persons with mental health conditions and/or substance use disorders; persons with physical and developmental disabilities; older adults; youth and young adults; specific occupational groups, including military service members and veterans; or people with a history of involvement with the criminal justice system.

Purposes of this Report

This report serves dual purposes. First, it summarizes progress toward meeting the challenge of preventing and controlling commercial tobacco use and exposure to secondhand tobacco smoke among groups historically subjected to inequitable policies, practices, and conditions. It has been 25 years since the 1998 Surgeon General's report documented that cigarette smoking is a persistent burden to African American, American Indian and Alaska Native, Asian American and Pacific Islander, and Hispanic persons (USDHHS 1998). In the preface of the 1998 report, then Surgeon General David Satcher stated, "I challenge federal and state agencies as well as researchers and practitioners in the social, behavioral, public health, clinical, and biomedical sciences to join me in the pursuit of effective strategies to prevent and control tobacco among racial/ethnic groups" (USDHHS, 1998, p. iv). Progress toward reducing tobacco use at the population level has occurred in the United States since 1998. Yet, improvements in tobacco-related policies, regulations, programs, research, surveillance, evaluation, health education, health systems, and clinical care and practices have not necessarily resulted in protections that are equitable across all population groups (NCI 2017) and across the places where members of these groups are born, live, learn, work, play, worship, grow, age, and seek healthcare (Centers for Disease Control and Prevention [CDC] 2015; USDHHS 2020; Office of Disease Prevention and Health Promotion n.d.a).

Second, this report provides a vision for eliminating tobacco-related health disparities while simultaneously advancing the goal of eliminating tobacco-related morbidity and mortality for all. Commercial tobacco product use, exposure to secondhand tobacco smoke, and subsequent health consequences are preventable; and most people who use tobacco products have been targeted for marketing of these products during youth and young adulthood—when they are especially vulnerable to both social influences and addiction (USDHHS 2012). Yet, it is important to distinguish between *equality* (concerned with equal opportunity and resources) and *equity* (concerned with ensuring full health potential for all groups). Equality is inferior to equity as a tobacco-control objective; the pursuit of tobacco-related health equity seeks not to attain the same unacceptable rates of tobacco use and exposure to secondhand tobacco smoke for all, but the "opportunity for everyone to reach their full health potential, regardless of any socially determined circumstance" (CDC 2015, p. 2, citing Whitehead and Dahlgren 2006). With this framing, this report builds on discussions of endgame strategies in previous Surgeon General reports (USDHHS 2014, 2020) by outlining key considerations to ensure that such strategies do not inadvertently introduce or exacerbate tobacco-related health disparities.

Finally, preparation of this report was guided by and responds to core principles emerging from the theory of social justice: knowledge and understanding, equal respect, and sharing power (Powers and Faden 2019; Wallerstein et al. 2019). Powers and Faden (2019) specify that knowledge and understanding are dependent on the institutional structures within which knowledge is generated. As such, institutions at the local, state, and federal levels have the capacity to create and transmit *knowledge and understanding* that increase access to information and equip people with skills and abilities across the lifespan to facilitate the achievement of the highest level of health for all people. It is important for institutions to guide practitioners and researchers to develop effective commercial tobacco prevention and control programs and to engage in research that has specific utility for and relevance to historically disadvantaged groups (Powers and Faden 2019), as assessed by members of these groups. *Equal respect* recognizes that everyone deserves to be treated with an equal moral standard and respect and that all people have intrinsic value (Powers and Faden 2019). As such, institutional documents, such as this report, play critical roles in acknowledging the inherent value of all people and advancing the public's perception of their value in the world. Groups that have been socially and economically marginalized by society as a whole and targeted by the commercial tobacco industry have been subjected to decades of inequitable treatment and manipulative tactics that impact tobacco-related health consequences (Mialon 2020). This report summarizes the historical and societal factors that contribute to differences in health consequences along the tobacco use continuum. Finally, *sharing power* is critical to achieving tobacco-related health equity. The principle of sharing power is a continual commitment to eliminating power differences between impacted community members and institutions with the shared vision of a tobacco-free world (Wallerstein et al. 2019).

Terminology About Population Groups

This is the first Surgeon General's report on tobacco to consistently use "person-first" language that avoids the use of labels (i.e., "smoker," "tobacco user"). The intent of person-first language is to humanize people as having a condition, characteristic, or circumstance; or engaging in a behavior—not being a condition (CDC 2022a).

Consistent with and building on previous Surgeon General reports, this report analyzes seven broad racial and ethnic groups established by the U.S. Office of Management and Budget (see Appendix 1.1): American Indian and Alaska Native, Asian, Black or African American, Hispanic or Latino, Native Hawaiian and Pacific Islander, White, and Multiple Race (Federal Register 1997). Additionally, throughout this report, careful consideration was applied to identifying diverse groups while not perpetuating "minoritization" of populations (Witherspoon et al. 2020; Flanagin et al. 2021) or flawed notions of race as a biological construct (Cooper and David 1986; Jones 2000). Race, ethnicity, and minority status are social constructs. Racialization is a social process that involves categorizing, marginalizing, or regarding according to race (Witzig 1996; Mendez and Spriggs 2008; Merriam-Webster n.d.). Ethnicity is a social construct that encompasses shared sociocultural factors and identities and reflects relations within ethnically defined groups and the society in which that group is situated (Ford and Harawa 2010). Minoritized refers to socially constructed groups who have been historically marginalized based on their racial, ethnic, sexual orientation, gender identity, or other social identity (Flanagin et al. 2021; National Institutes of Health [NIH] 2024). Numerous population groups across the world are defined by ancestry, history, language, shared cultures, religion, and other factors—the aggregation of which may be used for reporting and understanding underlying shared risks. However, these aggregated categories may not necessarily reflect important nuances within groups—including their tobacco product use behaviors—which may be masked when disaggregated data are not available. Further supporting the notion of race, ethnicity, and minority status as social constructs, the terms used to refer to these various groups change over time and may depend on the social, cultural, and political climates that govern how groups label themselves or are labeled by others. Relevant chapters of this report retain the original terminology used to refer to groups in published primary sources for accuracy in reporting results; however, contemporary terms are used to refer to groups when synthesizing the evidence across sources. Given these developments, the present report uses—where appropriate—the term *minoritized population group* in place of *racial and ethnic minorities, sexual and gender minorities, people of color,* and *non-White*. The terms used in the present report are expected to evolve as members of groups that have been marginalized continue to author and inform language used in scientific publications (Sotto-Santiago 2019).

Similarly, it is important to recognize diversity in sexual orientation and gender identity, including self-identification with straight, lesbian, gay, bisexual, transgender, queer, intersex, nonbinary, or other communities (Office of the Chief Statistician of the United States 2023). Data on the range of sexual orientations and gender identities are limited because of the lack of sexual orientation and gender identity inclusion in some federal, state, and local surveillance systems. This report synthesizes available data while acknowledging the need to improve measures of sexual orientation and gender identity, including transgender identity, to inform efforts to reduce health disparities among these populations. This report also acknowledges that terms referring to sexual orientation and gender identity have changed and continue to change over time; therefore, a multitude of terms may be relevant across studies.

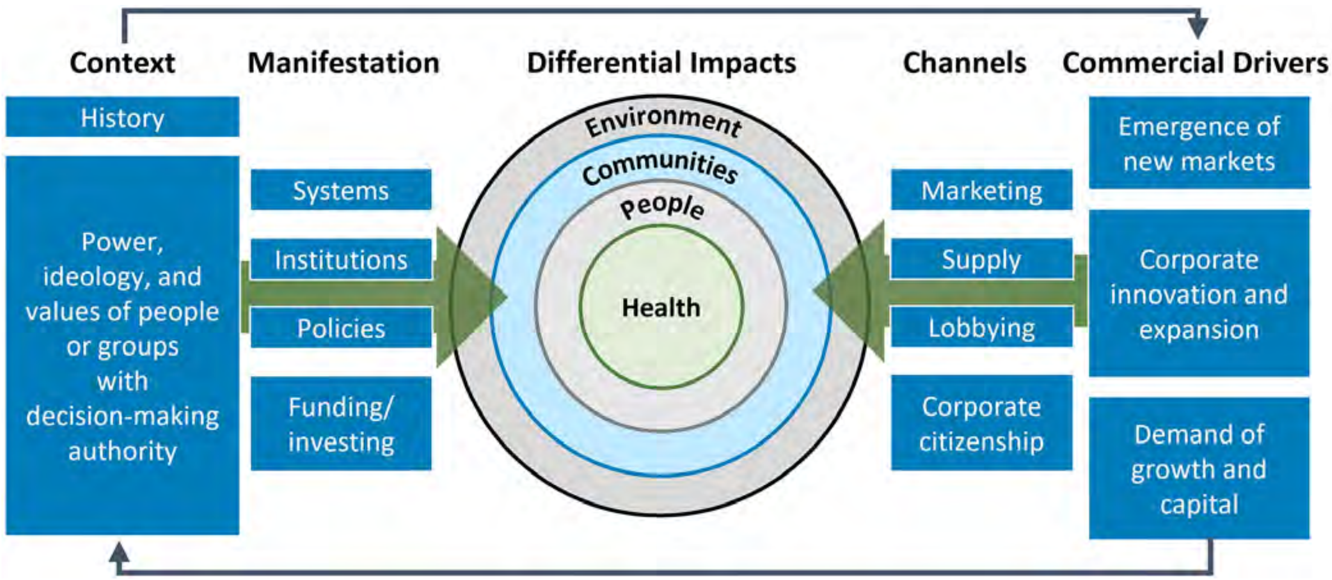
Terminology About Tobacco Products

Except where noted, the term *tobacco* in this report refers to commercial tobacco products and not to the sacred and traditional use of ceremonial tobacco by some American Indian communities (Unger et al. 2006; Keep It Sacred n.d.). *Tobacco products* refers to products made, containing, or derived from tobacco or containing nicotine from any source that are intended for human consumption, including but not limited to cigarettes (including menthol cigarettes), cigars (including premium cigars, little cigars, and cigarillos), waterpipe or hookah tobacco, pipe tobacco, electronic cigarettes (e-cigarettes), heated tobacco products, smokeless tobacco, and other oral tobacco or nicotine products without an approved therapeutic purpose. (See Appendix 1.1 for definitions that clarify terminology used in this report.) The landscape of tobacco products continues to rapidly diversify to include noncombustible, combustible, heated, electronic, and oral nicotine products, challenging surveillance systems and intervention efforts. Where nationally representative data are available, data on use are provided in Chapter 2 by tobacco product type. In general, unless otherwise specified, *smoking* refers to cigarette smoking, and *people who smoke* refers to people who smoke cigarettes.

Influences on Tobacco Use and Interventions to Reduce Tobacco-Related Health Disparities

Tobacco-related health disparities have multifaceted influences that go beyond individual and intrapersonal

Figure 1.1 Dynamics that can predispose, enable, and reinforce health disparities



factors, including the tobacco industry's aggressive marketing and promotion of flavored and fragranced products, including mentholated products. Chapters that examine evidence about influences on tobacco product use and relevant protective interventions leverage a socioecological model that situates individual behaviors within a multilevel framework of interpersonal, community, or neighborhood environments and larger societal, systemic, and policy contexts (McLeroy et al. 1988; NCI 2017). Central to the report's organization is the premise that individual use of commercial tobacco products is heavily influenced by the social determinants of health, defined as "conditions in the environments where people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks" (Office of Disease Prevention and Health Promotion n.d.b).

This report builds on the socioecological model by acknowledging that multiple, multilevel social and commercial dynamics predispose, enable, and reinforce health disparities. Figure 1.1 presents how historical context, differential power structures, and the ideology and values of people and groups with decision-making authority manifest as systems, institutions, policies, and investment in research, interventions, and markets. Historical, political, and ideological contexts shape commercial drivers of health, including the emergence of new markets, corporate innovation and expansion, and demand of growth and capital, which Kickbusch and colleagues (2016) suggest manifests as product marketing, supply, lobbying, and corporate citizenship. Together, these social and commercial dynamics converge to create differential opportunities for health and, specific to this report, emerge as commercial tobacco-related health disparities. Leveraging this model, this report concludes by identifying multilevel opportunities to advance commercial tobacco-related health equity—fair, equitable, and just opportunities and conditions for all people to live a healthy life, free from commercial tobacco-related disease, disability, and death (CDC 2015).

Organization of the Report

This report includes eight chapters. The current chapter ("Introduction, Summary, Conclusions, and History of Tobacco-Related Health Disparities") introduces the report and its framework and presents major conclusions and the conclusions from each chapter. It concludes with a review of the history of tobacco-related health disparities in the United States and provides context for understanding such disparities in the changing landscape of tobacco prevention and control. Chapter 2 (“Disparities in Tobacco Use and Exposure to Secondhand Tobacco Smoke”) uses epidemiological data to document the persistence of a high prevalence of commercial tobacco use among certain segments of the population and the greater exposure to secondhand smoke that affects some disaggregated population groups. Chapter 3 (“Physiological, Chemosensory, and Genetic Influences of Menthol and Other Flavors in Tobacco Products”) summarizes the current knowledge about the chemosensory and physiological mechanisms through which menthol and other flavor chemicals in tobacco products act, and the genetic factors that may influence these mechanisms and may contribute to flavored tobacco product use disparities. This research may help to explain the appeal of flavored tobacco products that elicit multisensory experiences among youth, women, and people within certain racial and ethnic groups.

Chapter 4 (“Social and Environmental Influences on Tobacco-Related Health Disparities”) and Chapter 5 (“Tobacco Industry Influences on Tobacco-Related Health Disparities”) examine the social, environmental, and industry factors that influence tobacco-related health disparities in a broader set of populations than were reported in previous Surgeon General’s reports, including sexual orientation and gender identity groups, socioeconomically disadvantaged populations, and persons with behavioral health conditions. Chapter 6 (“Disparities in Smoking-Caused Disease Outcomes and Smoking-Attributable Mortality”) describes disparities in incidence and mortality due to smoking-caused diseases—including cancer, COPD, and cardiovascular disease—and in smoking- and secondhand-smoke-attributable mortality using various analytic and modeling techniques.

Chapter 7 (“Promising Interventions to Reduce Tobacco-Related Health Disparities”) uses a socioecological perspective to highlight opportunities to address tobacco-related health disparities at multiple levels, such as implementing smokefree policies; regulating tobacco products, including reducing nicotine levels; eliminating flavored tobacco products; enacting policies to reduce the supply of and demand for tobacco, including regulating where retailers are located; and regulating commercial tobacco pricing through taxation and other price-related strategies. The chapter also reviews evidence about mass media campaigns; interventions, policies, and practices in organizational and institutional settings, such as schools, healthcare systems, and workplaces; interpersonal interventions; and individual interventions. Chapter 8 (“A Vision for Eliminating Commercial Tobacco-Related Health Disparities”) outlines broad strategies to address tobacco-related health disparities moving forward.

Preparation of the Report

This Surgeon General’s report was prepared by the Office on Smoking and Health, National Center for Chronic Disease Prevention and Health Promotion, CDC, which is part of USDHHS. This report was compiled using a longstanding, balanced, and comprehensive process designed to safeguard scientific rigor and practical relevance from influences that could adversely affect impartiality (King et al. 2018). This process helps to ensure that the report’s conclusions are defined by the scientific evidence, rather than by the opinions of the authors and editors. In brief, an external editorial team of senior scientists selected 58 experts for their knowledge of specific topics to write the initial drafts of the chapters. These contributions, which are presented as Chapters 2–7, were evaluated by 21 peer reviewers. After this initial stage of peer review, 13 senior scientists and other experts—primarily external to CDC—examined the scientific integrity of the entire manuscript as part of a second stage of peer review. After each round of peer review, the report’s scientific editors revised each draft based on reviewers’ comments. Chapter 8, written by the editorial team after Chapters 1–7 had completed the second stage of peer review, outlines broad strategies to accelerate progress in eliminating tobacco-related health disparities.

Subsequently, the report was reviewed by various institutes and agencies in the U.S. government, including those in USDHHS. Throughout the review process, the content of each chapter was revised to include studies and information that were not available when the chapters were first drafted; updates were made until shortly before the report was submitted for publication. These updates are intended to reflect the full scope of identified evidence, including new findings that confirm, refute, or refine the content in the initial drafts at the time the report was submitted for publication. However, updates made during the review process may not capture all recently published findings, since systematic reviews could not be conducted again so close to publication date. Conclusions are based on the preponderance and quality of scientific evidence available at the time of publication.

Scientific Basis of the Report

The statements and conclusions throughout this report are based on an extensive review of the existing scientific literature and analyses of new data from various sources. The report primarily cites peer-reviewed journal articles, including reviews that integrate findings from numerous studies and books that were published between 1998 and 2021, the period after the last Surgeon General's report on the topic of tobacco-related health disparities among population groups (USDHHS 1998). The report focuses primarily on tobacco-related health disparities among U.S. population groups in the context of adults because this is the population for which the preponderance of scientific literature exists on this topic. However, data on youth and young adults are presented where available given the importance of continuing to work to prevent and reduce the use of all forms of tobacco products among young people.

This report also refers, on occasion, to unpublished research, such as presentations at professional meetings, personal communications from researchers, and information available in various media. These references are used when acknowledged by the chapter authors, editors, and reviewers as being scientifically valid and reliable and a critical addition to the emerging literature on a topic. Throughout the writing and review process, highest priority was given to peer-reviewed scientific research. Following the model established in 1964, this report includes comprehensive compilations of the evidence on its topic of focus. The evidence was analyzed to identify causal associations according to enunciated principles as outlined in Chapter 3 of the 1964 report, including

- "Consistency of the association,
- Strength of the association,
- Specificity of the association,
- Temporal relationship of the association, and
- Coherence of the association" (U.S. Department of Health, Education, and Welfare [USDHEW] 1964, p. 20).

In the 2004 Surgeon General's report (USDHHS 2004), the framework for interpreting evidence on smoking and health was revisited in depth for the first time since the 1964 report. The 2004 report provided a four-level hierarchy of categories for interpreting evidence, and this current report follows the same model:

1. "Evidence is sufficient to infer a causal relationship.
2. Evidence is suggestive but not sufficient to infer a causal relationship.
3. Evidence is inadequate to infer the presence or absence of a causal relationship (which encompasses evidence that is sparse, of poor quality, or conflicting).
4. Evidence is suggestive of no causal relationship" (USDHHS 2004, p. 18).

The categories acknowledge that evidence can be "suggestive but not sufficient" to infer a causal relationship, and the categories allow for evidence that is "suggestive of no causal relationship." Consistent with past Surgeon General's reports on tobacco use, conclusions are not limited to causal determinations and frequently include recommendations for research, policies, or other actions.

Similar to previous reports, this report assesses evidence from studies using a variety of measures and levels of analysis, including studies of main effects, interactions, stratified samples, and nested designs. The report also considers policy analysis studies, which vary greatly in their approaches and applications of theoretical frameworks. This consideration of complex and varied methodologies, as well as the fact that effects change strength and direction by population groups, challenged the development of four-level hierarchical causal conclusions that encompass all racial and ethnic groups and other population groups.

Major Conclusions

1. Despite strong progress in reducing tobacco use at the population level, disparities in use persist by race and ethnicity, level of income, level of education, sexual orientation, gender identity, type of occupation, geography, and behavioral health status. Exposure to secondhand tobacco smoke remains

disproportionately higher among Black people than among people in other racial and ethnic groups, youth than among adults, and people from lower socioeconomic backgrounds than among those from higher socioeconomic backgrounds.

2. Tobacco-related health disparities are a social injustice, in addition to an economic and health burden. Addressing disparities requires reflection on the complex history of the commercialization of tobacco and both past and present-day experiences of racism, discrimination, and targeted marketing by the tobacco industry.

3. Social, structural, and commercial determinants of health—such as persistent poverty and inequitable economic and social conditions—lead to inequitable opportunities for living a life free from tobacco-related death and disease. Racism, discrimination, and targeted marketing by the tobacco industry; geographic disparities in evidence-based policy protections; preemptive laws that thwart communities from protecting their residents' health and safety; and financial and other structural barriers to accessing cessation treatments also drive tobacco-related health disparities.

4. The tobacco industry has designed, engineered, and marketed menthol cigarettes and other tobacco products that deliver multisensory flavor experiences which increase the likelihood of tobacco initiation, addiction, and sustained use. Policies that restrict the availability of menthol cigarettes can reduce smoking initiation and prevalence among adolescents, young adults, Black people, and other population groups that have disproportionately higher use of menthol cigarettes.

5. For decades, the tobacco industry has targeted its products and marketing to specific groups, including through concentrated marketing in neighborhoods with greater percentages of Black people, Hispanic people, and residents with lower incomes. Tobacco companies employ multiple tactics to undermine tobacco prevention and control efforts and enhance their corporate image.

6. Cigarette smoking remains a major cause of death and disease—including cancer, cardiovascular disease, and chronic obstructive pulmonary disease—among all racial and ethnic groups. More than 490,000 deaths attributable to cigarette smoking and exposure to secondhand tobacco smoke are estimated to occur in the United States each year—about one in five of all deaths in the United States. This includes more than 473,000 deaths attributable to cigarette smoking and more than 19,000 deaths attributable to exposure to secondhand tobacco smoke.

7. Each year, more than 50,000 Black adults, 15,000 Hispanic adults, and 400,000 White adults are estimated to die from causes attributable to cigarette smoking. Despite large absolute differences in the numbers of smoking-attributable deaths by race and ethnicity, smoking accounts for a similar proportion of deaths among non-Hispanic Black (18%) and non-Hispanic White (20%) people and for approximately 10% of deaths among Hispanic people.

8. Data from surveillance and intervention research are limited for many groups known to be at high risk for tobacco use, exposure to secondhand tobacco smoke, and targeted marketing by the tobacco industry. While protecting recent gains in measurement, further efforts are warranted to assess structural and social determinants of health across the lifespan, disaggregate data, oversample disparate populations, and increase understanding of the impact of interventions on tobacco-related health disparities.

9. Endgame efforts to eliminate tobacco-related disease, disability, and death should create opportunities and conditions for all people to live healthy lives that are free from commercial tobacco. Interventions designed to reduce the use of tobacco products and the influences of the tobacco industry on society should accompany efforts to remove the underlying social, structural, commercial, and political drivers of health inequities.

10. In addition to social and structural interventions, a comprehensive and multilevel effort toward health equity must include a combination of complementary approaches to reduce the affordability, accessibility, appeal, and addictiveness of tobacco products; eliminate exposure to secondhand tobacco smoke; conduct high-impact media campaigns; and promote barrier-free access to cessation support with broad reach to disparate populations. Strategies should be implemented equitably and with fidelity in all jurisdictions.

Chapter Conclusions

Chapter 1. Introduction, Overview, Conclusions, and History of Tobacco-Related Health Disparities

1. The complex and centuries-long historical context of tobacco commercialization is a foundational driver of present-day tobacco-related health disparities.

2. For decades, tobacco-related health disparities have not received the necessary investments of research, time, and resources.

3. Poverty, racism, and discrimination are important and long-standing social and structural determinants that marginalize minoritized racial, ethnic, gender identity, and sexual orientation groups and provide the context in which tobacco-related health disparities have occurred for many decades.

4. Not all vulnerable groups are disparate groups. A disparate group is not only vulnerable to tobacco use but may also face social determinants of poor health (e.g., poverty), cumulative indicators of social disadvantage across the lifespan, and historical injustices (e.g., discrimination, colonization).

5. Tobacco industry marketing has historically targeted minoritized racial and ethnic groups and minoritized sexual orientation and gender identity groups.

6. States and localities have helped to build momentum to enact and implement policies that prohibit the sale of menthol cigarettes and other flavored tobacco products.

Chapter 2. Disparities in Tobacco Use and Exposure to Secondhand Tobacco Smoke

1. Racial and ethnic disparities in cigarette smoking have persisted since 2000, with prevalence remaining highest among American Indian and Alaska Native adults. Frequency, type, and amount of tobacco use; long-term cessation success; and patterns of use across the life course also differ by race and ethnicity. Within aggregate racial and ethnic groupings, disparities in tobacco use vary by ethnic group, nativity, and acculturation in the United States.

2. Disparities in cigarette smoking by educational attainment have notably widened in the past 50 years; the prevalence of smoking is substantially higher among people without college diplomas than it is among those with college diplomas.

3. The prevalence of tobacco use is higher among adults living in poverty than it is among adults living at or above the poverty level. Disparities in cigarette smoking by poverty status have persisted over four decades, and these differences remain when looking at the prevalence of smoking by poverty status and other demographic characteristics, including sex, race, ethnicity, and sexual orientation.

4. The prevalence of tobacco use is higher overall among youth and adults who identify as gay, lesbian, and bisexual than it is among youth and adults who identify as heterosexual, but the prevalence of tobacco use varies by different populations, such as gay, lesbian, or bisexual populations, and by specific tobacco products. Increased availability and improvements in the measures to assess sexual orientation and gender identity in federal, state, and local surveillance systems will assist efforts to better address disparities among these populations.

5. The prevalence of ever and current smoking is higher among manual labor and service workers than it is among workers in other occupational groups. Conversely, the prevalence of cigarette smoking cessation is lower among manual labor and service workers than it is among workers in other occupational groups. Accommodation and food service, construction, and mining are the occupation groups with the highest prevalence of current cigarette smoking. These settings may warrant greater support for smoking cessation interventions.

6. The prevalence of tobacco use is generally higher in the South and Midwest than it is in other regions of the United States. Additionally, the prevalence of cigarette and smokeless tobacco use is higher among people living in rural areas than it is among people living in urban areas.

7. People living with any mental health condition or substance use disorder are at increased risk of

tobacco use. The intersection of mental health, substance use, and sociodemographic characteristics—such as age, sex, race and ethnicity, sexual orientation, and socioeconomic status—adds to the risk of tobacco use.

8. Despite progress in the adoption of smokefree policies, the prevalence of exposure to secondhand tobacco smoke remains disproportionately high among (a) children compared with adults, (b) nonsmoking African American youth and adults compared with nonsmoking White or Mexican American youth and adults, (c) families in lower income groups compared with families in higher income groups, and (d) adults without college diplomas compared with adults with college diplomas. The magnitude of these disparities has increased since 2000.

Chapter 3. Physiological, Chemosensory, and Genetic Influences of Flavors and Menthol in Tobacco Products

1. The evidence is sufficient to infer that some natural and synthetic chemicals and flavorants that are added to tobacco products have pharmacological effects; act as cues and reinforcers; and, in some cases, act centrally to modulate the brain reward circuitry.

2. Natural and synthetic chemicals and flavorants added to tobacco products elicit multisensory experiences, including odorant (olfactory) effects; basic taste perceptions (e.g., sweet, bitter); and somatosensory effects, such as cooling.

3. Sweeteners are used in tobacco products to mask aversive tastes and have been detected at high levels in certain oral tobacco products. Sweet taste appeals more to young people than it does to older people.

4. Smoking status; use of flavored tobacco products; and related disparities by age, gender, and race and ethnicity result from multilevel influences. Targeted marketing, societal and cultural factors, and genetic variations that affect underlying chemosensory and physiological mechanisms result in differences in the appeal of and ability to perceive certain flavor qualities, such as bitter taste.

5. Determinations that flavorants are "generally recognized as safe" for use in foods are not applicable to the inhalation of tobacco products. These ingredients, when inhaled, may be directly toxic to the lungs or could result in higher absorption of toxicants. Commonly used natural and synthetic chemicals and flavorants may be safe to ingest in foods but might be harmful when inhaled.

6. Animal studies suggest that menthol and sweeteners influence nicotine uptake. Menthol and other flavorants, such as farnesene and farnesol, directly affect the dopaminergic reward circuitry and may potentiate the addictive effects of nicotine.

7. Natural and synthetic cooling agents that have been found in some tobacco products (a) act on different parts of the oral cavity and the respiratory system to enhance the experience of smoking or use of other tobacco products and (b) can mimic the pharmacological and somatosensory effects of menthol but may not have a distinguishing taste or odor. Cooling agents, even those without a taste or odor, have the potential to increase the appeal of tobacco products, facilitate their use, and contribute to tobacco-related health disparities. Comprehensive flavor policies that account for these agents will better protect public health.

8. Genetic studies provide suggestive evidence that variations in genes involved in sensory mechanisms and taste perception may influence menthol smoking in youth, women, and some minoritized racial and ethnic groups. The emerging science on the role of genes in flavor experiences should be understood in context with multilevel commercial, societal, and cultural factors that influence tobacco-related health disparities.

Chapter 4. Social and Environmental Influences on Tobacco-Related Health Disparities

1. Tobacco use among peer groups increases the likelihood of smoking initiation for White, Black, and Hispanic adolescents.

2. For adolescents, participating in extracurricular activities or feeling a sense of belonging at school can reduce the likelihood of cigarette smoking initiation. However, Black and Hispanic adolescents report lower school connectedness than White adolescents, which may increase the likelihood of smoking initiation.

3. As Asian American and Hispanic or Latino immigrants undergo acculturation to life in the United States, there is a greater risk of cigarette smoking among women and a reduced risk of smoking among men.

4. Inequitable smokefree protections for people living in multi-unit housing contribute to disparities in exposure to secondhand tobacco smoke.

5. Although smokefree policies in the workplace can reduce the use of tobacco products and encourage quitting, not everyone is evenly protected by these policies. Work-related stress and exposure to occupational hazards are linked to smoking initiation and difficulty quitting smoking.

6. Disparities in utilization of evidence-based cessation treatments exist, including by race and ethnicity, socioeconomic status, and health insurance status. Disparities persist in having received advice to quit smoking from a healthcare professional, particularly among minoritized racial and ethnic groups and lower socioeconomic status groups.

Chapter 5. Tobacco Industry Influences on Tobacco-Related Health Disparities

1. Tobacco marketing in general and marketing for menthol cigarettes in particular are more prevalent in neighborhoods with greater percentages of African American residents or of residents with lower incomes compared with neighborhoods with lower percentages of African American residents or of residents with higher incomes.

2. Communities with high concentrations of people from diverse racial and ethnic population groups, residents with lower income, and adolescents tend to have greater availability of cheaper tobacco products, including menthol cigarettes, that are widely available at local retailers.

3. Members of the LGBTQI+ community and people with lower socioeconomic status are more likely to receive and use a coupon or price discount code to purchase tobacco products compared with their heterosexual and cisgender counterparts and those of higher socioeconomic status. Use of coupons appears to increase the likelihood of tobacco initiation among people who have never used tobacco and to reduce the likelihood of quitting among people who use tobacco.

4. Seismic shifts in the media environment have produced rapid changes in marketing strategies for commercial tobacco. Tactics such as influencer marketing that allow more focused and segmented targeting have the potential to exacerbate existing disparities in tobacco initiation and use.

5. The tobacco industry continues to employ political, legal, economic, corporate social responsibility, and community tactics to enhance its image among the communities it targets in marketing—including minoritized racial and ethnic groups and sexual orientation and gender identity groups that are subject to tobacco-related health disparities—and/or to counter efforts that would benefit public health and advance health equity.

Chapter 6. Disparities in Smoking-Caused Disease Outcomes and Smoking-Attributable Mortality

1. Smoking is the primary cause of lung and bronchus cancers—the leading cause of cancer death in the United States. Recent declines in the lung and bronchus cancer death rate have occurred among both men and women. Among men, the death rate for lung and bronchus cancer is highest among Black men, followed by White men, American Indian and Alaska Native men, Asian and Pacific Islander men, and Hispanic men. Among women, the death rate for lung and bronchus cancer is highest among White women, followed by American Indian and Alaska Native women, Black women, Asian and Pacific Islander women, and Hispanic women.

2. Cigarette smoking is a primary cause of COPD and the primary risk factor for the worsening of COPD. The overall prevalence of COPD is highest among American Indian and Alaska Native adults and lowest among Asian adults. There is a clear socioeconomic gradient for COPD prevalence and mortality, with higher prevalence and mortality occurring among people with lower income and lower educational attainment.

3. Cigarette smoking and exposure to secondhand tobacco smoke have adverse effects on overall cardiovascular health and cause cardiovascular disease.

Among men, the prevalence of cardiovascular disease in 2017–2020 was highest among non-Hispanic Black (11.3%) and non-Hispanic White (11.3%) men, followed by Hispanic (8.7%) and non-Hispanic Asian (6.9%) men. Among women, the prevalence of cardiovascular disease was highest among non-Hispanic Black women (11.1%), followed by non-Hispanic White (9.2%), Hispanic (8.4%), and non-Hispanic Asian (4.9%) women.

4. From 2010 to 2018, an estimated 4.26 million smoking-attributable deaths occurred among non-Hispanic Black, Hispanic, and non-Hispanic White adults in the United States. Among those groups, at least 473,000 cigarette smoking-attributable deaths are estimated to have occurred each year. The number of smoking-attributable deaths is likely underestimated due to insufficient data among additional racial and ethnic groups.

5. Smoking causes about 1 in 5 deaths among non-Hispanic White and non-Hispanic Black people and about 1 in 10 deaths among Hispanic people.

6. An estimated 19,600 deaths attributable to exposure to secondhand tobacco smoke occurred among non-smoking people in the United States based on data from 2019 and 2020. Deaths attributable to exposure to secondhand tobacco smoke have declined considerably since 2006, but this is largely due to the declines in death observed among non-Hispanic White people. Declines occurred at lower rates during this period among non-Hispanic Black, Hispanic, and other non-Hispanic racial groups.

7. Simulation models can be useful tools to project the potential effects of large-scale interventions on smoking-attributable morbidity and mortality and on disparities in tobacco use across various populations. Future modeling efforts would benefit from (a) more detailed data on patterns of smoking and the use of noncigarette tobacco products; and (b) more robust data for racial and ethnic groups; minoritized sexual orientation and gender identity groups; urban and rural communities; and other focused populations.

8. Aggregation of data on tobacco product use, disease incidence, and mortality may mask disparities within population groups, such as within Asian American and Native Hawaiian and Other Pacific Islander groups. Disaggregation of data reporting and oversampling among disparate populations will foster greater understanding of tobacco-related health disparities.

Chapter 7. Promising Interventions to Reduce Tobacco-Related Health Disparities

1. Preemption at the federal and state levels can pose a significant obstacle for pursuing innovative policies to advance tobacco-related health equity and limits the ability of population groups that experience disparities to benefit from proven tobacco control interventions.

2. The evidence is sufficient to infer that comprehensive smokefree laws that apply to all indoor areas of public places and workplaces, including casinos, as well as smokefree policies for multi-unit housing would reduce disparities in smokefree protections and reduce exposure to secondhand tobacco smoke if fully and equitably adopted, implemented, and enforced.

3. Reducing nicotine in cigarettes and other combustible tobacco products to minimally addictive or nonaddictive levels should reduce tobacco use among many population groups experiencing tobacco-related disparities.

4. The evidence is sufficient to infer that policies that prohibit the sale of flavored tobacco products reduce sales of tobacco products and can reduce tobacco use. Eliminating the sale of flavored tobacco products, including flavored cigars, should also reduce tobacco use among groups experiencing disparities in tobacco use, especially if the policies are comprehensive and equitably implemented.

5. The evidence is sufficient to infer that policies that prohibit the sale of menthol cigarettes reduce the sale of cigarettes and increase smoking cessation. Given the disproportionate burden of menthol cigarette use among some population groups, removing menthol cigarettes from the marketplace should also reduce disparities in tobacco initiation, nicotine dependence, cessation success, and tobacco-related health outcomes, especially if policies are comprehensive and equitably implemented.

6. Policies that regulate the location of and reduce the number of tobacco retailers in neighborhoods with a high proportion of lower income, Black, or Hispanic people could help reduce disparities in retailer density, exposure to tobacco product advertisements and displays, and sales and use of tobacco products.

7. The evidence is sufficient to conclude that increases in tobacco product prices will reduce tobacco use to a greater extent among people of lower SES than they do for people of higher SES. Youth are especially price-sensitive, and price increases could help reduce tobacco use among people from all population groups at the age when they are most likely to begin smoking.

8. The evidence is sufficient to infer that quitlines can increase access to cessation treatments among population groups affected by tobacco-related disparities, particularly when quitline promotion and services are developed, delivered, and evaluated with attention to their reach and relevance to these groups.

9. The evidence is sufficient to infer that mass media countermarketing campaigns are effective at increasing quit attempts among many population groups affected by tobacco-related disparities, particularly when designed and delivered with attention to reach and relevance to these groups. However, it remains unclear if campaigns designed specifically for a single focus population are more or less effective at decreasing disparities in initiation or cessation than campaigns designed for multiple focus populations.

10. Cultural tailoring of cessation interventions (versus nontailored interventions) shows promise for increasing quitting readiness and quit attempts among African American adults and for increasing successful quitting among Asian American adults, though tailoring may not increase long-term cessation among African American adults.

11. The evidence is suggestive, but not sufficient, to conclude that incentives paired with cessation treatments increase smoking cessation among populations with lower socioeconomic status.

12. As additional research is undertaken to advance understanding of the impacts of tobacco control interventions—including cessation, media campaign, and policy interventions—on health disparities, extra considerations should be taken to ensure that such research is designed to allow for the examination of the impact of interventions among populations experiencing health disparities (e.g., ensuring enrollment of diverse populations, oversampling of population groups, attention to sample recruitment and retention, and community-engaged participatory research approaches).

History of Tobacco-Related Health Disparities

Addressing tobacco-related health disparities requires a reflection on the complex history of the commercialization of tobacco. This section provides an overview of the history of tobacco-related health disparities and context for understanding some patterns of disparities in the United States. Table 1A.1 in Appendix 1.2 includes a chronology of key events related to tobacco-related health disparities.

A Complex History of Tobacco Commercialization

The centuries-long historical context of tobacco commercialization is a foundational driver of present-day tobacco-related health disparities in the United States, as well as intergenerational socioeconomic disparities. When Europeans arrived in the Americas, tobacco had been cultivated for centuries across much of North and South America by Indigenous peoples for spiritual and ceremonial purposes; some of these practices endure today (Hodge 1910; Sherman 1972). Colonization resulted in the forced removal of Indigenous people from their lands, and colonial landowners repurposed ceremonial tobacco into a commercial product grown on those lands (Pérez-Stable and Webb Hooper 2021; Nez Henderson et al. 2022).

Postcolonial policies further disrupted these traditional practices. Beginning in the late 19th century, federal laws (e.g., *Code of Indian Offenses* [1883], *Dawes Act of 1887*) had the cumulative effect of prohibiting Indigenous people from ceremonial uses of tobacco. For example, in 1883, the Code of Indian Offenses outlawed many traditional American Indian religious practices that incorporated ceremonial tobacco, including ghost and sun dances, the use of medicine men, funeral practices, and ritualized gift-giving ceremonies (Nez Henderson et al. 2022; National Geographic n.d.). Additionally, the *Dawes Act of 1887* reduced Indigenous lands by 65% and allotted the remaining land in parcels to Indigenous families. Allotted land was often barren and unsuitable for growing tobacco, minimizing the supply of traditional tobacco (Keep It Sacred n.d.; National Archives n.d.). House Concurrent Resolution 108 (1953) and other U.S.

policies through 1968 sought to further abolish tribes, relocate Indigenous people, and sell their land. This displacement resulted in the relocation of many Indigenous people to urban areas and termination of federal obligations to tribes—including federal aid, services, and protections—and further challenged the cultivation of traditional tobacco (Native Voices 1953). Although practices involving traditional tobacco were outlawed, commercial tobacco use was legal (Nez Henderson et al. 2022). With the intent to keep cultural practices alive, some American Indian communities began to substitute commercial tobacco products for traditionally grown tobacco at ceremonies (Nez Henderson et al. 2022). Not until 1978 did Indigenous people formally regain their ability to exercise their traditional religious practices without penalty through the passage of the *American Indian Religious Freedom Act* (*American Indian Religious Freedom Act of 1978* 1978; *American Indian Religious Freedom Act Amendments of 1994* 1994; Nez Henderson et al. 2022).

The sacred and traditional meanings of ceremonial tobacco endure today for many American Indian communities and are an example of the resilience of Indigenous communities (Nez Henderson et al. 2022). Distinguishing between ceremonial tobacco and commercial tobacco products is important to enhance efforts to address present-day disparities in commercial tobacco use among Indigenous Americans (USDHHS 1998).

As documented in the 1998 Surgeon General's report, the commercialization of tobacco also has historical ties to the enslavement of people of African descent (USDHHS 1998). Prior to the first recorded landing of African people in the United States in 1619, White people imprisoned in Europe were brought to the colonies to cultivate tobacco as a form of employment in exchange for shorter sentences (Encyclopedia Virginia 1737). However, as demand for commercial tobacco grew in Europe, colonial landowners sought a larger and less expensive labor force, often turning to African indentured servants and later to the enslavement of African people and their descendants (Kulikoff 1986). After the Emancipation Proclamation was issued in 1863 and into the early 1900s, the "dirtiest, unhealthiest, and lowest paying jobs" in tobacco factories were performed by Black women in the United States(USDHHS 1998, p. 208, citing Jones 1984). At the time, White women were viewed as the only group to have the manual dexterity to operate the machines in these facilities; it was also regarded as socially unacceptable for Black men and women to work alongside White women. Thus, factory workers who were Black were relegated to less skilled and lower paying jobs (USDHHS 1998). By the early 20th century, the tobacco industry began relying on Black people, not only as laborers but also as consumers. Advertising and product design targeting Black people, particularly for menthol cigarettes, increased in the 1950s (Robinson et al. 1992; Gardiner 2004).

Native Hawaiian and other Pacific Islander people have also been negatively impacted by commercial tobacco. The introduction of commercial tobacco products into the Pacific region and the use of commercial tobacco as payment for products and services in this region have had lasting impacts on the health of Native Hawaiian people and other Pacific Islander people (Marshall 2013; CDC 2022b). As documented in Chapter 5, the tobacco industry has viewed Native Hawaiian people as an important market for menthol cigarettes since at least the 1980s; approximately three in four Native Hawaiian and other Pacific Islander adults who smoke use menthol cigarettes (see Chapter 2). Additionally, Native Hawaiian people who engage in lower intensity smoking behaviors may face disproportionate health risks. Specifically, data from the Multiethnic Cohort Study showed that Native Hawaiian people and Black people had a higher risk for lung cancer than White, Japanese American, and Hispanic or Latino people who smoked a similar number of cigarettes; disparities more pronounced among people who smoked 10 cigarettes per day than among those who smoked 35 cigarettes per day (Haiman et al. 2006; Stram et al. 2019).

Today, cigarette smoking is higher among American Indian and Alaska Native youth and adults than it is among any other racial and ethnic group in the United States, and menthol cigarette smoking is highest among Black adults, followed by Native Hawaiian and other Pacific Islander adults (see Chapter 2). The intergenerational consequences of these and other historical factors—such as housing discrimination and residential segregation and inequities in education, employment opportunities, wages, and access to quality health care—contribute to present-day socioeconomic and health disparities, including tobacco-related health disparities (Hood et al. 2016; Pérez-Stable and Webb Hooper 2021; Swope et al. 2022). Acknowledging the historical origins of these inequities can reduce the potential for impacted communities to be unfairly blamed for present-day experiences of disparities. Chapter 5 documents present-day examples of targeted marketing by the tobacco industry to specific groups, including but not limited to American Indian and Alaska Native, Black/African American, and Native Hawaiian and Pacific Islander people.

Tobacco-Related Health Disparities and Surgeon General's Reports

Previous Surgeon General's reports provide a historical review of efforts to reduce the prevalence of smoking in the United States (USDHHS 2000b). The first Surgeon General's Report on smoking and health, released in 1964, was based on epidemiologic studies that helped establish a causal relationship between smoking and chronic diseases, such as cancer. However, most studies investigating the impact of smoking were limited to White men. Thus, the report concluded that cigarette smoking is a significant cause of overall mortality, causes lung and larynx cancer in men, and is a probable cause of lung cancer in women. Few studies at the time reported data on women and other population groups defined by age, race, ethnicity, geography, occupation, income level, educational attainment, and sexual orientation or gender identity. The 1980 Surgeon General's Report, *The Health Consequences of Smoking for Women,* definitively concluded that women experienced the same health outcomes from smoking as did men (USDHHS 1980).

Later, the 1998 Surgeon General's report, *Tobacco Use Among U.S. Racial/Ethnic Minority Groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: A Report of the Surgeon General,* became the first to highlight the associations between tobacco use among racial and ethnic groups and intersections with sex, income, and education (USDHHS 1998). The report issued the first call to action to prevent unnecessary disease, death, and disability caused by tobacco use, exposure to secondhand tobacco smoke, and exposure to commercial tobacco products among racial and ethnic groups.

Before the release of the 1998 Surgeon General's report, scientific data were limited, and no comprehensive synthesis of data was available to inform the development of effective tobacco prevention and control programs or guide future research related to tobacco-related health disparities among U.S. racial groups. The 1998 report recognized that America was becoming more racially and ethnically diverse and that the future health of all American people would depend on the nation's capacity to eliminate tobacco-related health disparities (USDHHS 1998).

The 1998 Surgeon General's report was also the first to provide the historical context in which tobacco use influences the economic, spiritual, and social lives of Black or African American, American Indian and Alaska Native, Asian American, Native Hawaiian and Other Pacific Islander, and Hispanic or Latino people. This historical context is critical to understanding how tobacco—as a cash crop, commercial product, and ceremonial artifact—has been embedded into certain societies, communities, and neighborhoods.

Subsequent to the 1998 report, the 2000 Surgeon General's report, *Reducing Tobacco Use,* identified the elimination of tobacco-related health disparities as a top priority and encouraged researchers, practitioners, and advocates to continue to address this significant challenge (USDHHS 2000b). In 2017, NCI published Tobacco Control Monograph 22, *A Socioecological Approach to Addressing Tobacco-Related Health Disparities,* which was the first major report published by the federal government since the 1998 Surgeon General's report to highlight tobacco-related health disparities in the United States. The monograph documented continued disparities attributable to multilevel factors, the need for enhanced and additional interventions, and the need for research and improved surveillance (NCI 2017). Finally, the 2014 and 2020 Surgeon General's reports documented large disparities in tobacco use and in key indicators of smoking cessation by race and ethnicity, geography, poverty status, and educational attainment (USDHHS 2014, 2020).

Defining Tobacco-Related Health Disparities

No comprehensive definition of tobacco-related health disparities existed prior to the early 2000s. The 1998 Surgeon General's report (USDHHS 1998) and *Healthy People 2010* (USDHHS 2000a) provided the impetus for developing a clear definition for tobacco-related health disparities. *Healthy People 2010* established two main goals: (1) enhance life expectancy and quality of life and (2) eliminate health disparities between different segments of the U.S. population (USDHHS 2000a; National Center for Health Statistics 2012). *Healthy People 2010* also included a focus on eliminating differences in tobacco use and subsequent tobacco-related outcomes by sex, racial and ethnic group, education level, income level, disability status, geographic location, and sexual orientation status (USDHHS 2000a; National Center for Health Statistics 2012). These objectives focused on tobacco use, smoking cessation and the availability of cessation treatment programs, exposure to secondhand smoke, attitudes of adolescents toward smoking, and tobacco control laws.

The National Conference on Tobacco and Health Disparities: Forging a National Research Agenda to Reduce Tobacco-Related Health Disparities (Fagan et al. 2004) met in 2002 to identify gaps in knowledge and develop a research agenda to eliminate tobacco-related health disparities (Fagan et al. 2004; King 2005). Tobacco-related health disparities were defined at the conference as "differences in patterns, prevention, and treatment of tobacco use; the risk, incidence, morbidity, mortality, and burden of tobacco-related illness that exist among specific population groups in the United States; and related differences in capacity and infrastructure, access to resources, and environmental tobacco smoke exposure" (Fagan et al. 2004, p. 211).

Fagan and colleagues (2007) later modified the definition to capture more details about the patterns of tobacco use that affect prevention and treatment—that is, differences in the tobacco use continuum: exposure to, or being around other peoples' tobacco products; exposure to secondhand smoke; marketing; initiation; current use; number of cigarettes smoked per day; quitting or treatment; relapse; and health consequences—and differences in capacity, infrastructure, and access to resources were updated to include differences in access to care, quality of healthcare, socioeconomic indicators that affect healthcare, and psychosocial and environmental resources. Underlying this definition is an acknowledgment that tobacco-related health disparities are not simply differences between groups. Many people are born into groups whose members have historically been poor, marginalized, or subjected to systematic discrimination—resulting in cumulative disadvantage over the lifespan (Smith et al. 1997; Graham et al. 2006). The recognition of groups that may experience disparities or be classified as disparate does not suggest that such communities or their individual members lack strengths and assets.

This report treats *disparate* and *vulnerable* as distinctly different terms. The term *vulnerable population* has been used to define the groups of people among whom tobacco-related health disparities exist and to determine focal areas of research and resources that are needed to reduce tobacco-related health disparities (Fagan et al. 2007; Lee et al. 2023). *Vulnerable* has been used to describe groups whose rates differ from other groups across the tobacco use continuum (initiation, current use, number of cigarettes smoked per day, addiction, quitting, access to treatment, relapse) (Fagan et al. 2007), However, *vulnerable* does not take into consideration cumulative disadvantage across the lifespan.[1] For example, rates of tobacco use are higher among men than among women (USDHHS 1980, 1998, 2001). Thus, men may be seen as being vulnerable to tobacco use, but men as an aggregate sex group do not constitute a disparate group per se.

To distinguish disparate from vulnerable groups, Fagan and colleagues (2019) delineated the fundamental assumptions underlying the 2004 and 2007 definitions of tobacco-related health disparities. That is, tobacco-related health disparities are

- Not merely differences between groups along the continuum of tobacco use;
- Associated with social determinants of poorer health, such as poverty, lower education, and discrimination, which make the observed differences inequitable;
- Cumulative across the life cycle, representing a chain of events that often begins with social indicators of disadvantage; and
- Caused by social injustices (such as being uninsured) that are avoidable and can be ameliorated through policy interventions.

The definition of tobacco-related health disparities has evolved over the years and shaped a scientific discipline that influences research practices and standards and sets priorities for improving the health of all people.

Evolution of Terminology to Describe Groups

The terms used to describe population groups affected by health disparities have changed over time. Such terms influence the reporting of scientific data and its perception. For example, the word *minority* originates from the Latin word *minoritas,* meaning less or smaller, and was used in the early 1900s, particularly during World Wars I and II, to describe political and social groups that differed from the majority (Dalle Mulle 2019; WordSense n.d.). The term *minority groups* has been used to describe racial groups in the United States that were not considered part of the majority. The term *minority* has also been used to describe people from different sexual orientation and gender identity groups. For the past two decades, researchers have questioned how such terms as *race* and *minority* are used in scientific work and have instead defined race as a social construct because race itself lacks a scientific basis (King 1997). See "Terminology About Population Groups" earlier in this chapter for additional details about terms used in the present report, which refers to "minoritized groups."

Emerging Recognition of Social Determinants of Health

Underlying social, economic, and historical factors contribute to differences in health indicators along the tobacco use continuum (i.e., from initiation to health outcomes, including disease, disability, and death) and to the collective capacities and resources to ameliorate tobacco-related health disparities across the life course. Social determinants of health can perpetuate health inequities among minoritized people (CDC 2022c; Hacker et al. 2022). As noted in *Healthy People 2030,* social determinants of health—which are grouped into the domains of economic stability, education access and quality, healthcare access and quality, neighborhood and built environment, and social and community context—"are the conditions in the environments where people are born, live,

[1]More recently, CDC (2022a) has recommended avoiding using the term *vulnerable,* noting that it implies an inherent condition rather than causal factors.

learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcome and risks" (Office of Disease Prevention and Health Promotion n.d.b). *Healthy People 2030* further states that "just promoting healthy choices won't eliminate these and other health disparities. Instead, public health organizations and their partners in sectors like education, transportation, and housing need to take action to improve the conditions in people's environments."

It is well documented that people living in poverty, those with lower educational attainment, and those working in manual labor or service jobs continue to experience disproportionately higher tobacco-related health disparities (NCI 2017) (also see Chapter 2 of the current report). Furthermore, there is extensive evidence on (a) the roles of racism and discrimination in overall health and (b) the link between societal structures—including how health systems are organized—and the health of members of minoritized racial, ethnic, and other communities (Pérez-Stable and Webb Hooper 2021). Experiences of discrimination also have direct links to tobacco-related health disparities. Discrimination has historically been associated with increased tobacco use (Kendzor et al. 2014b; Chavez et al. 2015; Agunwamba et al. 2017; Crockett et al. 2018; Holmes et al. 2019), reduced cessation (Kendzor et al. 2014a; Chavez et al. 2015; Agunwamba et al. 2017; Crockett et al. 2018; Holmes et al. 2019; Webb Hooper et al. 2020) reduced access to health resources (Shavers et al. 2012), and poor treatment outcomes (Shavers et al. 2012; Simmons et al. 2016). Furthermore, in part due to the legacy of redlining,[2] people in lower income and minoritized racial groups are more likely to live in multiunit housing, which is a physical environment that places residents at elevated risk for exposure to secondhand tobacco smoke compared with residents living in detached housing (Helms et al. 2017). In addition, studies have found that Black or African American men with similar lung cancer diagnoses and staging were not offered the same treatment regimens for lung cancer as were White men (Shavers and Brown 2002; Lathan et al. 2006).

NIH, as part of its UNITE initiative (NIH n.d.), now acknowledges that structural and systemic racism impact health disparities. Acknowledging both systemic racism (i.e., "structures, policies, practices, and norms that assign values and determine opportunities based on the way people look or the color of their skin" [CDC n.d.e]) and structural racism (i.e., racism that is "codified in our institutions of custom, practice, and law so there need not be an identifiable perpetrator" [Jones 2000, p. 1212]) is critical to addressing health disparities. Similarly, recognition of sexual orientation and gender identity diversity and of self-identification as straight; lesbian, gay, bisexual, transgender, queer, or intersex (LGBTQI+); nonbinary; or another sexual orientation or gender identity matters because (a) the tobacco industry has targeted these groups in its marketing and (b) people who identify as LGBTQI+ use tobacco at higher rates than do people who identify as heterosexual or straight.

Social disadvantage in all forms—including that predicated on race and ethnicity, income and income inequality, social and occupational status, educational attainment and opportunities, geography and place-based inequalities, sexual orientation and gender identity, and the intersections of any of these factors that groups experience—can impact tobacco-related health disparities (Dankwa-Mullan and Pérez-Stable 2016). Documenting these disparities provides the relevant data needed to inform the development of effective tobacco prevention and control programs.

History of Tobacco Industry Marketing and Countermarketing Efforts

The tobacco industry has launched a variety of campaigns to promote tobacco products to disparate groups, including but not limited to people who are Hispanic or Latino, Native Hawaiian and Other Pacific Islander, Black or African American, and American Indian and Alaska Native; residents of rural areas; LGBTQI+ groups; and young people who identify with hip-hop culture (USDHHS 1998; Hafez and Ling 2006).

The industry's targeting of specific populations is often informed by the industry's in-depth psychographic research, resulting in marketing approaches that may be direct, subtle, or both (Robinson et al. 1992; Gardiner 2004; Yerger et al. 2007). Tobacco industry research and marketing has often been based on socially constructed, problematic assumptions about minoritized racial groups, including assumptions about literacy levels (Johnston 1982) and such motivations as status seeking and willingness to trust advertising (USDHHS 1998). Industry documents further show that whereas menthol brands like Kool were deliberately marketed to African American people, Marlboro cigarettes—the leading non-menthol cigarette brand—were deliberately *not* marketed to African American people, suggesting that marketing was not only

[2]Established by the federal government in the 1920s and 1930s, redlining was a discriminatory housing policy that discouraged banks from offering mortgages in neighborhoods that had a high percentage of residents from certain racial and ethnic groups (U.S. Department of Justice 2021; Legal Information Institute n.d.).

racially and ethnically targeted but was also racially segregated by brand (Johnston 1982; Cummings et al. 1987; Landrine et al. 2005).

Marketing to the LGBTQI+ community has been similarly problematic. For example, R.J. Reynolds documents from 1995 to 1997 reveal the company's attempts to market to the LGBTQI+ community, including through "Project Scum," which aimed to promote Camel and Red Kamel cigarettes to "consumer subcultures" of an "alternative life style" in the San Francisco area (R.J. Reynolds 1997; Washington 2002, p. 1093). Project Scum also proposed to exploit high rates of drug use among LGBTQI+ youth by targeting head shops (i.e., shops specializing in articles of interest to drug users).

The tobacco industry outspends tobacco control efforts by a factor of at least 12 to 1 (Campaign for Tobacco-Free Kids 2023a; Federal Trade Commission 2023); the industry continues to target minoritized racial and ethnic groups, lower SES communities, and other populations (Pucci et al. 1998; Hackbarth et al. 2001; Balbach et al. 2003; Lee et al. 2004; Primack et al. 2007; Brown-Johnson et al. 2014; Trinidad et al. 2017). Chapter 5 describes contemporary examples of tobacco industry tactics that influence disparities.

Emergence of National Tobacco Countermarketing Campaigns

State and community interventions, cessation interventions, federal regulations, and health communication interventions can effectively counter messaging from the tobacco industry (USDHHS 2014). Using revenues from state cigarette taxes and other sources, some states have launched innovative and highly successful tobacco countermarketing campaigns that have paved the way for national campaigns; the earliest such campaigns occurred in California and Massachusetts (Balbach and Glantz 1998; Tsoukalas and Glantz 2003).

The twenty-first century saw the emergence of major, national countermarketing campaigns with reach to specific groups, including,

- The *Truth* campaign launched by American Legacy Foundation (now Truth Initiative) in 2000 to prevent smoking among at-risk youth 12–17 years of age (Zucker et al. 2000).

- CDC's *Tips from Former Smokers* launched in 2012, the first federally funded national tobacco education campaign that encourages quitting among adults. *Tips* advertisements have featured people who are Black or African American, American Indian and Alaska Native, Asian American, Hispanic or Latino, HIV+, LGBTQI+, military members, veterans, and pregnant women, as well as people with mental health conditions.

- FDA's *The Real Cost* directed to youth, including male youth in rural areas at risk for smokeless tobacco use.

- FDA's *Fresh Empire* prevention campaign targeting "at-risk multicultural youth, 12–17 years of age who identified with hip-hop culture, specifically African American, Hispanic, and Asian American/Pacific Islander youth" (FDA 2022a).

- FDA's *This Free Life* directed to LGBTQI+ young adults who occasionally smoke cigarettes (FDA 2022b).

Public health mass media campaigns with relevance and reach to minoritized racial, ethnic, sexual orientation, and gender identity groups; people with lower SES; and other populations that experience tobacco-related disparities can help counter the efforts of the tobacco industry and address inequities in exposure to marketing. Continued development, testing, implementation, and evaluation of public health campaigns that reach disparate populations are critical to reducing tobacco-related health disparities (Cruz et al. 2019).

Funding Initiatives Aimed at Reducing Tobacco-Related Health Disparities

The tobacco industry has a long history of investing in and cultivating relationships with minoritized communities. Although public health, state, and local agencies cannot compete with the vast resources of the tobacco industry, public health efforts have helped to successfully reduce the share of adult cigarette smoking by more than 70% since publication of the 1964 Surgeon General's report (USDHHS 2014). However, this progress has not resulted in equitable outcomes for all groups.

In 1991, NCI launched the American Stop Smoking Intervention Study for Cancer Prevention (ASSIST) (NCI 2006). This $165-million investment by NCI did not specifically address tobacco-related health disparities, but it was influential at the state and local levels and later in its evolution engaged a multicultural committee that aimed to eliminate disparities among high-priority population groups. The 1998 Surgeon General's report provided the impetus for a new focus on investing in the public health of minoritized racial and ethnic communities to blunt the effects of years of investments by the tobacco industry. Table 1.1 lists CDC-funded initiatives launched from 1997 to 2023 that are designed to address disparities. In addition to these efforts, NCI has played a key role in supporting communities in their efforts to reduce the tobacco-caused cancer burden in underserved and minoritized racial and ethnic communities and in sponsoring research on tobacco-related health disparities, including through its partnership with the American Legacy Foundation to develop the Tobacco Research Network on Disparities (TreND) (Clayton 2006; Okuyemi et al. 2015).

Nongovernmental initiatives, including those funded by the 1998 Master Settlement Agreement (MSA), have also been critical sources of funding for efforts to address disparities. The 1998 MSA between the four largest tobacco companies at the time and 46 states, 4 U.S. territories, the Commonwealth of Puerto Rico, and the District of Columbia remains the largest civil settlement in U.S. history (Public Health Law Center 2019). The MSA's purpose was to alleviate the burden of Medicaid costs for treating tobacco-related illnesses and to develop and fund educational programs to prevent and reduce underage smoking (Public Health Law Center 2019; National Association of Attorneys General n.d.). The MSA also created the American Legacy Foundation (now Truth Initiative), which created opportunities for funding initiatives that

Table 1.1 Select programmatic initiatives funded federally by CDC and designed to reduce tobacco-related health disparities, 1997–2023

Funding agency and program	Year	Purpose	Populations of focus include	No. of grants and investments
CDC National Networks	1997	Build capacity for smoking prevention, cessation, education, and public policy	African American people, Hispanic or Latino people, Asian American and Pacific Islander people, and American Indian and Alaska Native people, along with youth, women, males (12–24 years of age), "blue-collar" and/or agricultural workers, lower education groups, and military personnel	8 grants; $3 million
Cooperative Agreements for National Networks for Tobacco Prevention and Control Program	2000	Build capacity for smoking prevention, cessation, education, and public policy	African American people, Hispanic or Latino people, Asian and Pacific Islander people, and American Indian and Alaska Native people, along with youth, women, males (12–24 years of age), "blue-collar" and/or agricultural workers, lower education groups, and military personnel	8 awardees; up to $3 million per year for 6 years
Cooperative Agreements for National Networks for Tobacco Prevention and Control Program	2006	Prevent and reduce tobacco use and exposure to secondhand tobacco smoke and eliminate tobacco-related health disparities	African American people, American Indian and Alaska Native people, Asian American and Pacific Islander people, and Hispanic or Latino people	6 awardees; $1.8 million per year for 2 years
National Network for Tobacco Prevention	2008	Develop a consortium of national networks to expand the science of tobacco control in populations experiencing tobacco-related health disparities.	African American people, American Indian and Alaska Native people, Asian American and Pacific Islander people, Hispanic or Latino people, and people with lower SES	6 awardees; $12.5 million (total) over 5 years
CDC—Consortium of National Networks to Impact Populations Experiencing Tobacco-Related and Cancer Health Disparities	2013	Establish partnerships to provide leadership on and promotion of evidence-based approaches for preventing commercial tobacco use and cancer	African American people; American Indian and Alaska Native people, Asian American people, Pacific Islander people, Native Hawaiian people, Hispanic or Latino people, LGBT people, people with lower SES, people with mental health conditions and substance abuse disorders, and geographically defined populations with high commercial tobacco use and related disparities	Up to 10 grants; $26 million (total) over 5 years

Table 1.1 Continued

Funding agency and program	Year	Purpose	Populations of focus include	No. of grants and investments
Good Health and Wellness in Indian Country	2015	Promote health, prevent disease, reduce health disparities, and strengthen connections to culture and lifeways that improve health and wellness	American Indian and Alaska Native people	35 grants; $78 million (total)
Networking2Save and CDC—National Network Approach to Preventing and Controlling Tobacco-related Cancers in Special Populations	2018	Implement population-specific, public health-oriented strategies that impact the prevalence of commercial tobacco use and tobacco-related cancers	African American people, American Indian and Alaskan Native people, Asian American people, Pacific Islander, and Native Hawaiian people, Hispanic or Latino people, LGBT people, people of lower SES, people with mental health conditions and substance use disorders, and geographically defined populations with high commercial tobacco use and related health disparities	8 grants; $5.2 million (total)
Good Health and Wellness in Indian Country	2019	Promote health, prevent disease, reduce health disparities, and strengthen connections to culture and lifeways that improve health and wellness	American Indian and Alaska Native people	27 grants; $19.3 million per year
Building Capacity to Reduce the Burden of Menthol and Other Flavored Commercial Tobacco Products in Communities that Experience Health Disparities	2023	Advance health equity through strategic partnerships and community engagement by addressing disparities caused by menthol and other flavored tobacco product marketing and use	People who use menthol cigarettes	8 recipients; $15 million (total) over 5 years

Notes: **CDC =** Centers for Disease Control and Prevention; **LGBT =** lesbian, gay, bisexual, or transgender; **SES =** socioeconomic status.

focused on priority populations. For example, in 2001, the American Legacy Foundation launched the Priority Populations Initiative, which provided $25 million to 83 grantees with the goal of reducing tobacco-related health disparities (American Legacy Foundation n.d.).

However, the settlement did not require states to track their spent funds to determine how the money was being used to fund tobacco prevention and control efforts, including prevention and control efforts that focus on population groups who are disproportionately burdened by tobacco use, such as Medicaid recipients. In fiscal year 2024, states will collect an estimated $25.9 billion from the MSA and related taxes, but they are projected to spend only 2.8% of it on tobacco prevention and cessation programs—less than one-fourth of the total funding recommended by CDC (CDC 2014; Campaign for Tobacco-Free Kids 2024). Furthermore, differences in total amount spent as a function of CDC-recommended funding are noted by state, with only one state (Maine) funding tobacco prevention and cessation programs at or above the level recommended by CDC (Campaign for Tobacco-Free Kids 2024). In contrast, 19 states fund tobacco control efforts at less than 10% of the CDC-recommended level, many of which also have a higher burden of tobacco use (CDC 2021; Campaign for Tobacco-Free Kids 2024). It is not known how much of the settlement funds are spent on Medicaid or to alleviate tobacco-related Medicaid costs, and many states have used their MSA funds to subsidize budgetary shortfalls and for other general purposes unrelated to addressing tobacco-related health disparities specifically, or tobacco prevention and control generally (Jones and Silvestri 2010).

In addition to the aforementioned programmatic initiatives, quitlines are an evidence-based intervention that help people quit smoking by offering counseling; practical information on how to quit; referrals to other cessation resources; self-help materials; and, in some cases, cessation pharmacotherapy (USDHHS 2020). In 1992, California became the first state to launch a quitline, and other states—such as Arizona, Massachusetts, and Oregon—followed by the mid-1990s. (North American Quitline Consortium n.d.). In 2004, a single national quitline portal number (1-800-QUIT-NOW)—funded through a partnership between NCI and CDC—was launched to connect callers across the country to quitline services (USDHHS 2020; National Center for Chronic Disease Prevention and Health Promotion n.d.). Quitlines are currently available in all 50 states, Washington, D.C., and all U.S. territories. Quitlines have developed culturally tailored services to meet the needs of members of underserved groups, such as American Indian, Hispanic or Latino, and Asian American people, and provide services in multiple languages, including Spanish and languages spoken by Asian American people. In addition to quitlines, federal programs—such as federally funded health centers, which serve lower income patients, the uninsured, and Medicaid beneficiaries, among other patients—screen for tobacco use and offer cessation counseling.

Notwithstanding these important efforts, the allocation of limited public health resources involves prioritization, which often has not favored investment of time and resources to help understand and address disparities. The 1998 Surgeon General's report identified specific tobacco control and educational programs that targeted four racial and ethnic communities, but it acknowledged significant shortcomings in investments made by public health agencies and others for prevention and cessation initiatives in those communities (USDHHS 1998). These longstanding shortcomings in investments in research and programmatic efforts contribute to tobacco-related health disparities.

History of Advocacy to Address Menthol and Other Flavored Tobacco Products

Menthol cigarettes mask the harshness of cigarette smoke (The Roper Organization 1979; Creative Research Group Limited 1982; Yerger 2011; Center for Tobacco Products 2022), facilitate addiction (Ahijevych and Garrett 2010; Fagan et al. 2010; Hoffman and Simmons 2011; Yerger 2011; Center for Tobacco Products 2022), make quitting more difficult (Yerger 2011; Center for Tobacco Products 2022), and are disproportionately used by certain racial and ethnic groups, LGBTQI+ people, women, and young people (see Chapter 2). The *Family Smoking Prevention and Tobacco Control Act* (*Tobacco Control Act* [2009]) gave FDA the authority to regulate the manufacture, distribution, and marketing of tobacco products in the United States. The *Act* banned cigarettes with characterizing flavors, except those with menthol or tobacco flavors (FDA 2018, p. 3), and directed the Tobacco Products Scientific Advisory Committee (TPSAC) to study the impact of menthol on public health and make a recommendation to FDA. In a 2011 report, TPSAC concluded that "removal of menthol cigarettes from the marketplace would benefit public health in the United States" (TPSAC 2011, p. 225).

Prior to passage of the *Tobacco Control Act,* some tobacco control advocates—such as the National African American Tobacco Prevention Network—opposed menthol's exclusion from the legislation (Cheyne et al. 2014). After the *Act's* enactment, advocacy efforts continued to encourage a federal ban on menthol-flavored cigarettes. In 2013, advocates filed a formal petition, the "Citizen Petition Asking the Food and Drug Administration to Prohibit Menthol as a Characterizing Flavor in Cigarettes" and citing the TPSAC's 2011 conclusions (Tobacco Control Legal Consortium n.d.). In 2020, the African American Tobacco Control Leadership Council (2020) and Action on Smoking & Health (2020) filed a lawsuit seeking to compel FDA to respond to the 2013 citizen petition and to issue a product standard to prohibit menthol as a characterizing flavor in cigarettes (Public Health Law Center et al. 2013). In May 2022, FDA proposed such a product standard, to cover both cigarettes and cigarette components or parts, including those sold separately to consumers (*Federal Register* 2022a), and proposed a product standard to prohibit characterizing flavors, except tobacco flavor, in cigars (*Federal Register* 2022b).

While these important developments unfolded at the federal level, states and localities have helped to build momentum to protect their residents from flavored tobacco products. The *Tobacco Control Act* (2009) affirms state, territorial, tribal, and local authority to adopt and enforce requirements related to the sale, distribution, exposure to, access to, advertising and promotion of, or use of tobacco products by individuals of any age, among other actions.[3] As of 2023, two states (Massachusetts and California) and nearly 200 U.S. communities prohibit the sale of menthol cigarettes and other flavored tobacco products, protecting about one-sixth of the population (Campaign for Tobacco-Free Kids 2023b; Truth Initiative 2023). Prohibiting the

[3]The *Tobacco Control Act* (2009) expressly preempts state, territorial, and local requirements that differ from, or add to, any FDA requirements related to "tobacco product standards, premarket review, adulteration, misbranding, labeling, registration, good manufacturing standards, or modified risk tobacco products" (p. 1823), but the *Act* also clarifies that there is no preemption of any other measures. The *Tobacco Control Act* does not have relevance to state preemption of local action. See Chapter 7 for further discussion about preemption.

sale of flavored tobacco products in Massachusetts was associated with a statistically significant decrease in the sale of menthol cigarettes and all cigarettes (Asare et al. 2022). Local laws restricting the sale of flavored tobacco products are associated with a decrease in tobacco product sales and in the prevalence of tobacco use among youth (Rogers et al. 2022). Chapters 6 and 7 discuss more fully these and other studies that estimate the potential impact of a federal standard on menthol products. In addition to policies that prohibit the sale of menthol and other flavored tobacco products, the evaluation of these policies may help to foster a better understanding of their impact on reducing tobacco-related health disparities in the United States.

Conclusions

1. The complex and centuries-long historical context of tobacco commercialization is a foundational driver of present-day tobacco-related health disparities.

2. For decades, tobacco-related health disparities have not received the necessary investments of research, time, and resources.

3. Poverty, racism, and discrimination are important and long-standing social and structural determinants that marginalize minoritized racial, ethnic, gender identity, and sexual orientation groups and provide the context in which tobacco-related health disparities have occurred for many decades.

4. Not all vulnerable groups are disparate groups. A disparate group is not only vulnerable to tobacco use but may also face social determinants of poor health (e.g., poverty), cumulative indicators of social disadvantage across the lifespan, and historic injustices.

5. Tobacco industry marketing has historically targeted minoritized racial and ethnic groups and sexual orientation and gender identity groups.

6. States and localities have helped to build momentum to enact and implement policies that prohibit the sale of menthol cigarettes and other flavored tobacco products.

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Chapter 1 Appendices

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Appendix 1.1: Terminology Used in this Surgeon General's Report

Acculturation

The process in which a non-majority culture is exposed to a dominant culture and adapts to the cultural beliefs and practices of the dominant culture (Rothe et al. 2010).

Age-specific population groups

- Youth (12–17 years of age)
- Young adults (18–25 years of age)
- All adults (18 years of age and older) (Substance Abuse and Mental Health Services Administration 2020).

Commercial versus traditional or sacred tobacco

Commercial tobacco is manufactured tobacco sold by tobacco companies for personal use. Commercial tobacco use is the most prevalent form of tobacco use in the United States and is responsible for impacts on the health of historically disadvantaged groups, including among American Indian and Alaska Native populations (NCI 2017). Traditional or sacred tobacco is tobacco and/or other plant mixtures grown or harvested and used by some American Indian communities for ceremonial or religious purposes (Unger et al. 2006; Keep It Sacred n.d.).

Endgame approaches in tobacco control

Efforts to eliminate the burden of death and disease caused by commercial tobacco use (USDHHS 2014).

Equality versus equity

"Equality means each individual or group of people is given the same resources or opportunities. Equity recognizes that each person has different circumstances and allocates the exact resources and opportunities needed to reach an equal outcome" (The George Washington University, Milken Institute School of Public Health 2020).

Gender identity

A person's deeply felt, internal, and individual experience of gender, which may or may not correspond to the person's physiology or designated sex at birth (World Health Organization n.d.).

Health equity

The state in which everyone has a fair and just opportunity to attain their highest level of health and no one is "disadvantaged from achieving this potential because of their social position or other socially determined circumstance" (Brennan Ramirez et al. 2008, p. 6, citing Whitehead and Dahlgreen 2006; CDC n.d.). Achieving this requires focused and ongoing societal efforts to address historical and contemporary injustices; overcome economic, social, and other obstacles to health and healthcare; and eliminate preventable health disparities (Office of Disease Prevention and Health Promotion n.d.).

Indigenous

Refers to people with origins in the original or earliest known inhabitants of an area, in contrast to groups that have settled, occupied, or colonized the area more recently in human history (National Institutes of Health 2024).

Intersectionality

How social and cultural categories (such as race, class, and gender) are linked. Interconnected structures and systems create inequality among people and populations based on social categories of difference (such as race, class, and gender) (Crenshaw 1991).

Minoritized

Refers to socially constructed groups who have been historically marginalized in society based on their racial, ethnic, sexual orientation, gender identity, or other social identity membership (Flanagin et al. 2021; National Institutes of Health 2024).

Preemption

Occurs when the action of a lower level of government is blocked or overridden by the authority of a higher level of government (Legal Information Institute n.d.).

Race and ethnicity

"Race and ethnicity are social constructs, without scientific or biological meaning" (Flanagin et al. 2021, p. 621). The Office of Management and Budget defines minimum categories for Federal data and statistics on race and ethnicity.

Race

- "*American Indian or Alaska Native*. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.

- *Asian.* A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

- *Black or African American.* A person having origins in any of the Black groups of Africa. Terms such as 'Haitian' or 'Negro' [have been used] in addition to 'Black or African American.'

- *Native Hawaiian or Other Pacific Islander.* A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.

- *White.* A person having origins in any of the original peoples of Europe, the Middle East, or North Africa" (*Federal Register* 1997a, p. 58789).

"Respondents shall be offered the option of selecting one or more racial designations" (*Federal Register* 1997a, p. 58789) (i.e., multiple race).

Ethnicity

- "*Hispanic or Latino.* A person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. The term *Spanish origin* can be used in addition to Hispanic or Latino" (*Federal Register* 1997a, p. 58789).

Sexual orientation

The term *sexual orientation* refers to the community with which a person self-identifies, including lesbian, gay, or bisexual and those who may not self-identify as lesbian, gay, or bisexual (e.g., queer, questioning, two-spirit, asexual). This term does not refer to a person's sex assigned at birth or to their gender identity (Merriam-Webster n.d.).

Social justice

The theory of social justice, from bioethicists Powers and Faden, posits that "social justice is concerned with human well-being . . . [which] is best understood as involving plural, irreducible dimensions" (Powers and Faden 2006, p. 15). These dimensions of well-being include "health, personal security, reasoning, respect, attachment, and self-determination" (Powers and Faden 2006, p. 16). Justice focuses on "securing and maintaining the social conditions necessary for a sufficient level of well-being in all of its essential dimensions for everyone" (Powers and Faden 2006, p. 50).

Tobacco products

Commercially marketed products made, containing, or derived from tobacco or containing nicotine from any source, including but not limited to cigarettes (including menthol cigarettes), cigars (including premium cigars, little cigars, and cigarillos), waterpipe or hookah tobacco, pipe tobacco, electronic cigarettes (e-cigarettes), heated tobacco products, smokeless tobacco, and other tobacco or nicotine products without an approved therapeutic purpose (*Federal Register* 2023).

Tobacco-related health disparities

"Differences in the patterns, prevention, and treatment of tobacco use; the risk, incidence, morbidity, mortality, and burden of tobacco-related illness that exist among specific population groups in the United States; and related differences in capacity and infrastructure, access to resources, and [exposure to secondhand tobacco smoke]" (Fagan et al. 2004, p. 211). The lived experiences of disparate groups—involving both social determinants of health (such as persistent poverty) and social injustices (such as targeted marketing)—have cumulative effects across the lifespan.

Tobacco-related health equity

Fair, equitable, and just opportunities and conditions for all people to live a healthy life, free from tobacco-related disease, disability, and death (CDC 2015).

Appendix 1.2: Chronology of Key Events Related to Tobacco-Related Health Disparities

Table 1A.1 Chronology of key events related to tobacco-related health disparities

Year(s)	Events
1600s	Colonization of Indigenous lands and the repurposing of traditional or ceremonial tobacco into a commercial product begins, resulting in the disruption of cultural practices within Indigenous communities.
1600s	A substantial proportion of the wealth of the early colonies arises from the exportation of tobacco cultivated using labor of enslaved people of African descent (USDHHS 1998).
1850s	Tobacco factories in Virginia begin recruiting free African American and White women as workers. Black women worked as field laborers, and White women work in other parts of the industry (Janiewski 1985).
1850s	Black employees in the tobacco industry work in areas of production that are separate from White employees (Janiewski 1985).
1883	The Code of Indian Offenses outlaws many traditional American Indian religious practices that incorporate ceremonial tobacco, including ghost and sun dances, the use of medicine men, funeral practices, and ritualized gift-giving ceremonies (Nez Henderson et al. 2022; National Geographic n.d.).
1887	The *Dawes Act of 1887* reduces American Indian lands by 65% and allots the remainder to the head of each American Indian family in parcels for farming or grazing (National Park Service n.d.). The barren lands that were allotted to Indigenous people made it difficult for them to self-sufficiently grow tobacco (Keep It Sacred n.d.; National Archives n.d.).
1890	R.J. Reynolds helps to finance the establishment of Winston-Salem University, a historically Black university (Gardiner 2004).
1890–1930s	Tobacco advertisements feature racist and imperialist imagery to appeal to White consumers (Tobacco Tactics 2021; Stanford Research into the Impact of Tobacco Advertising 2022).
1920s	Tobacco advertising geared toward women begins with targeted messaging about smoking and slimness (USDHHS 2001).
1924	Lloyd “Spud” Hughes of Mingo Junction, OH is credited with adding menthol to cigarettes (*Fortune Magazine* 1932; Trinkets & Trash n.d.).
1929	American Tobacco Company organizes a group of women to march in an Easter parade in New York City while holding “torches of freedom” (i.e., cigarettes) (Brandt 1996; Truth Initiative 2016a).
1930s	About half of all persons in manufacturing positions in tobacco companies are African American (Yerger and Malone 2002).
1940s	Tobacco advertising geared toward Black people begins, as companies recognize African American people as potential consumers (Yerger and Malone 2002).
1940s	Tobacco companies place ads in Black newspapers with expectation of a “quid pro quo,” as disclosed in documents internal to the tobacco industry documents; newspapers run editorials that support the positions of tobacco companies (McCandless et al. 2012).
1943	Black women workers strike at R.J. Reynolds, initiating a change in wages and work conditions (American Postal Workers Union 2014).
1947	Black workers strike at R.J. Reynolds to protest wage inequities and working conditions (Encyclopedia Virginia 1947).
1950s	Tobacco companies establish relationships with organizations working to advance Black communities in exchange for economic support, marketing access, and political relations (Yerger and Malone 2002).
1953	Through the *Indian Termination Act* enacted in 1953, followed by other policies through 1968, Congress (a) sought to abolish tribes, relocate American Indian people, and sell their land, resulting in relocation to urban areas; and (b) terminated federal obligations to tribes, including federal aid, services, and protections (Native Voices 1953).

Table 1A.1 Continued

Year(s)	Events
1954	Hammond and Horn, epidemiologists from the ACS, launch the Hammond-Horn Study and identify differences in tobacco use and lung cancer by SES, occupation, and rural-urban geography (Hammond and Horn 1954).
1964	In January, the first Surgeon General's report, *Smoking and Health: Report of the Advisory Committee to the Surgeon General of the Public Health Service,* outlines the nation's major public health issues related to cigarette smoking. This report is the first major government report to assign a causal relationship between cigarette smoking and cancer (USDHEW 1964).
1978	Indigenous people formally regain their ability to exercise their traditional religious practices without penalty with the passage of the *American Indian Religious Freedom Act* (*American Indian Religious Freedom Act* 1978; *American Indian Religious Freedom Act Amendments of 1994* 1994; Nez Henderson et al. 2022). This *Act* extends protections to "preserve for American Indians their inherent right to freedom to believe, express, and exercise the traditional religions." Prior to enactment, Indigenous people could not perform public ceremonies with traditional tobacco (D'Silva et al. 2018; American Indian Health Service of Chicago n.d.).
1980s	Deloyd T. Parker, Jr., co-founder and executive director of SHAPE (Self-Help for African People through Education) Community Center in Houston, Texas, refuses to accept a $50,000 Kool Achiever Award (Center for the Study of Tobacco and Society n.d.b).
1980s	John Wiley Price, County Commissioner for District 3 of Dallas, Texas, is one of the first elected officials to denounce the cigarette companies and their advertising in neighborhoods with high concentrations of residents from minoritized population groups (Center for the Study of Tobacco and Society n.d.b).
1980s	Father Michael Pfleger, a Roman Catholic priest in Chicago, leads efforts with members of his church to deface tobacco and alcohol billboards. These efforts led the Chicago City Council to vote to remove such ads from the Auburn Gresham neighborhood, which is comprised largely of African American residents (McClory 2010; *Chicago Tribune* 2012; Center for the Study of Tobacco and Society n.d.b).
1980s–1990s	Robert C. Newberry (1990), a columnist for the *Houston Post,* writes several columns on the cigarette companies' exploitation of the black community.
1980s–2000s	James G. Muhammad, a reporter for *The Final Call* published in Chicago by the Nation of Islam, writes hard-hitting articles against the tobacco industry (Muhammed 2006; Center for the Study of Tobacco and Society n.d.b).
1980	Alberta Tinsley-Talabi seeks to ban tobacco and alcohol billboards in Detroit in 1989 when she serves on the City Council. She persuades Michigan Congressman John Conyers to introduce a measure in the U.S. House of Representatives to ban tobacco and alcohol billboards in neighborhoods with high concentrations of residents from minoritized population groups (Center for the Study of Tobacco and Society n.d.b; Michigan House Democrats n.d.).
1985	Virginia L. Ernster, Associate Professor in the School of Medicine at the University of California–San Francisco, publishes the first paper to systematically study the tobacco industry's targeted marketing to women (Ernster 1985).
1985	The Surgeon General's Report, *The Health Consequences of Smoking: Cancer and Chronic Lung Disease in the Workplace,* identifies differences in tobacco use based on occupational class (USDHHS 1985).
1988	NCI publishes the *Annotated Bibliography of Cancer-Related Literature on Black Populations,* which includes a focus on tobacco-caused lung cancer (NCI 1988).
1988	California is the first state to implement a comprehensive statewide tobacco control program (November 1988). The state passes Proposition 99, *California Tobacco Tax and Health Promotion Act,* which allows for a 25-cent tax on cigarettes and funding for tobacco control activities (Themba-Nixon et al. 2004). This initiative also launches the California Tobacco Control Program, which highlights pointed advocacy on priority populations as one key intervention to reduce tobacco-related health disparities (Roeseler and Burns 2010).
1989	The National LCAT is establishes as a 501(c)(3) organization, the only national organization dedicated solely to reducing the harm caused by alcohol use and tobacco use in the Latino community through research, policy analysis, community education, and training (LCAT n.d.). Dr. Jeannette Noltenius serves as LCAT's Executive Director for many years (Parker 2003; North American Quitline Consortium n.d.).
1989–1990	*Pathways to Freedom* is developed at the Fox Chase Cancer Center in Philadelphia with funding from NCI and under the leadership of Dr. Robert G. Robinson. It is based on principles of community competence, which makes explicit the importance of history, culture, context, geography, literacy, language, positive imagery, salient imagery, multigenerational content, and diversity (Robinson et al. 2006).

Table 1A.1 Continued

Year(s)	Events
1990s	Henry McNeil "Mandrake" Brown, Jr., a court reporter in Illinois, whitewashes billboards that promote tobacco and alcohol products in Chicago's African American community (Heise 1996).
1990s	Brenda Bell Caffee leads the California African American Tobacco Education Network in developing nationally recognized model community initiatives and is a founding Elder of the National African American Tobacco Prevention Network. She creates the "Not in Mama's Kitchen" Secondhand Smoke Eradication Program (Caffee, Caffee & Associates Public Health Foundation n.d.; Center for the Study of Tobacco and Society n.d.b).
1990s	Rev. Calvin Butts, pastor of the Abyssinian Baptist Church in Harlem, New York, leads efforts to whitewash tobacco and alcohol billboards located in Harlem and pickets the corporate headquarters of Philip Morris Companies in New York City (Associated Press 2022; Center for the Study of Tobacco and Society n.d.b; Encyclopedia.com n.d.).
1990s	Charyn D. Sutton, serves as media coordinator of the Uptown Coalition for Tobacco Control and Public Health, a contributing author to *Pathways to Freedom,* a founding member of the National Association of African Americans for Positive Imagery, and contributor to *Tobacco Use Among U.S. Racial/Ethnic Minority Groups: A Report of the Surgeon General,* which was published in 1998 (Sutton 2013; Center for the Study of Tobacco and Society n.d.b).
1990s	Sandra Headen, PhD, serves as teacher and researcher at the University of North Carolina Gillings School of Global Public Health where she develops pioneering, youth-led smoking cessation programs. She also serves as the first executive director of the National African American Tobacco Prevention Network (Center for the Study of Tobacco and Society n.d.b).
1990s	Yvonne Lewis works for the American Lung Association before joining the CDC in 1994. In addition to helping to develop national and international initiatives, she spearheads the policy that helps the Head Start program adopt systemwide smokefree policies (Center for the Study of Tobacco and Society n.d.b).
1990s	William S. Robinson is a founding member of the National African American Tobacco Prevention Network and serves as its Executive Director for many years (Center for the Study of Tobacco and Society n.d.b).
1990	USDHHS launches *Healthy People 2000,* a comprehensive, nationwide health promotion and disease prevention framework to improve the health of all people in the United States. One of the three broad goals of *Healthy People 2000* is to "reduce health disparities" (Office of Disease Prevention and Health Promotion 2021). This is the second iteration of the *Healthy People* objectives; *Healthy People 1990,* issued in 1979, did not have a specific goal to address health disparities.
1990	R.J. Reynolds plans to launch a campaign in February in Philadelphia, Pennsylvania, to promote Uptown menthol cigarettes to increase their appeal to Black or African American people. One month before the launch, the proposed campaign sparks protests by community activists and major community-based and national organizations, including representatives from the Uptown Coalition for Tobacco Control and Public Health, ACS, and the Philadelphia branch of the NAACP. In response, R.J. Reynolds ceases production of Uptown cigarettes, and the targeted ads are never released (Ramirez 1990a,b).
1990	The California Department of Health Services Tobacco Control Branch begins funding tobacco control organizations representing various minoritized racial and ethnic populations to enact tobacco control programs tailored to their stakeholders and populations of interest. The first organization funded is APITEN (Asian & Pacific Islander American Health Forum 1994; Asian and Pacific Islander Tobacco Education Network 2004).
1990	The California Department of Health Services, Tobacco Control Branch launches the longest running antitobacco program in the nation. The media campaign is the first to reach diverse populations with paid advertisements in six languages: Cantonese, English, Korean, Mandarin, Spanish, and Vietnamese (California Department of Public Health 2017).
1991	NCI (1991) publishes its first Smoking and Tobacco Control Monograph, *Strategies to Control Tobacco Use in the United States: A Blueprint for Public Health Action in the 1990s.* This volume reports differences in smoking prevalence and lung cancer mortality by race and gender.
1991	Rev. Jesse W. Brown Jr. and Henry McNeil "Mandrake" Brown, Jr., co-found the National Association of African Americans for Positive Imagery, which leads efforts to counter the promotion of unhealthy tobacco products targeted to African Americans (Heise 1996; Center for the Study of Tobacco and Society n.d.b).
1991	On May 20, APITEN convenes its first statewide conference with the main goal of mobilizing other tobacco control advocates to assist in passing tobacco tax legislation that would ensure sustained funding to address tobacco-related health disparities (Asian and Pacific Islander Tobacco Education Network 1991).

Table 1A.1 Continued

Year(s)	Events
1991; 2003	In 1991, CDC's Office on Smoking and Health adopts *Pathways to Freedom* as state-of-the-art material to help African American people successfully quit smoking. In 2003, the Office on Smoking and Health revises *Pathways to Freedom,* which undergoes an extensive qualitative evaluation based on a national sample of people who smoked, practitioners, and stakeholders (Robinson et al. 2006)
1997	CDC releases a funding announcement of $1 million in June to assist organizations in establishing programs that seek to reduce tobacco-related health disparities, as set forth in the *Healthy People 2000* initiative, for populations, including African American, Hispanic, Asian and Pacific Islander, and American Indian and Alaska Native people; youth; women; and lower wage workers (*Federal Register* 1997b). This marks the beginning of CDC's funding of what is now known as the Consortium of National Networks to Impact Populations Experiencing Tobacco-Related and Cancer Health Disparities. This initiative provided funding to establish the National African American Tobacco Prevention Network (Devex n.d.).
1997	In May, leaders in tobacco control issue the Communities of Color Statement to policymakers on behalf of minoritized racial and ethnic population groups to ensure that their needs will be met using MSA funds (see 1998 in this table) when they are allocated. The tobacco control leaders are concerned that lower income people who smoke in their respective communities will experience an increased financial burden because of the higher costs of cigarettes and will not reap the benefits from the settlement monies (Themba-Nixon et al. 2004).
1997	Dr. Gary King, sociologist, publishes the seminal paper titled, "The Concept of Race in Smoking: A Review of Research on African Americans" (King 1997). This paper discusses the race concept as used by researchers, uncritically, who have studied the smoking behavior of African American people but may not understand the dimension of race as a social construct (King 1997). Dr. King is the first to use the term *racially classified social groups* in the context of smoking (Fernander 2007).
1998	Surgeon General Dr. David Satcher releases *Tobacco Use Among U.S. Racial/Ethnic Minority Groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, Hispanics: A Report of the Surgeon General.* It is the first report in the series to specifically address tobacco-related health disparities in four racial and ethnic groups. The report details the prevalence of tobacco use among the different groups and identifies gaps in research concerning tobacco-related health disparities (USDHHS 1998).
1998	In *Brown v. Philip Morris,* civil rights activists file a class action lawsuit against major tobacco companies, citing the targeted advertising of mentholated products to Black or African American people as a violation of the *Civil Rights Act* and the 13th and 14th Amendments. The activists include the Uptown Coalition for Tobacco Control and Public Health, a community-based advocacy group; Rev. Jesse W. Brown Jr.; and the National Association of African Americans for Positive Imagery. The lawsuit calls for the end of the production, sale, and promotion of tobacco products containing menthol. It also seeks to establish tobacco education and cessation programs for Black or African American people (National Association of African Americans for Positive Imagery 1998). In September 1999, U.S. District Judge John R. Padova dismisses the lawsuit. On appeal, in a split decision announced on May 18, 2001, the 3rd Circuit Court of Appeals upholds the dismissal by the lower federal court (National Association of African Americans for Positive Imagery 2001).
1998	Four states (Florida, Minnesota, Mississippi, and Texas) reach settlements with the tobacco industry to recover healthcare costs associated with tobacco-related illnesses. Minnesota is the only state lawsuit to go to trial. In addition to a large monetary award and public health provisions, the Minnesota settlement requires defendant tobacco companies to publicly disclose enormous numbers of documents produced during the discovery process and create two publicly accessible document depositories, including documents revealing the industry's targeted marketing of disparate communities. This disclosure is credited as changing the tobacco control landscape (Hurt et al. 2009).
1998	In November, the remaining 46 states, 4 U.S. territories, the Commonwealth of Puerto Rico, and the District of Columbia enter into the MSA with the five largest tobacco companies in the nation: Philip Morris USA Inc., R.J. Reynolds Tobacco Company, Brown & Williamson Corporation, and Lorillard Tobacco Company (Public Health Law Center 1998, 2019; USDHHS 2000). This agreement is entered to recover billions in healthcare costs associated with tobacco-related illnesses, and particularly with Medicaid expenditures. The MSA restricts some of the tobacco industry's marketing strategies; requires tobacco companies to release thousands of internal documents and make them accessible to the public; and provides funds to create the American Legacy Foundation, a national tobacco education and prevention organization.

Table 1A.1 Continued

Year(s)	Events
1998	Dr. Alan Blum, Professor at the University of Alabama, directs the Center for the Study of Tobacco and Society, which has the largest collection of original documents, artifacts, images, and reports on the tobacco industry and the antismoking movements. He pioneers research on the tobacco industry's targeted marketing to women and minoritized groups (Center for the Study of Tobacco and Society n.d.a).
1999	In the summer, two lawsuits are filed against the tobacco companies settling in the MSA. The first lawsuit seeks reimbursement and payment of punitive damages to treat tobacco-related illnesses for 34 American Indian tribes since 1962. The second lawsuit lodges a complaint that tobacco companies are targeting American Indian people, causing a public health issue, and purposely excluding tribes from MSA negotiations. Both cases are dismissed because the court ruled that the tribes had no right to recover federal monies spent on healthcare (Brown & Williamson 2004; Themba-Nixon et al. 2004).
2000	U.S. Senate passes the *Minority Health and Health Disparities Research and Education Act of 2000* (2000). Title I of this *Act* ("Improving Minority Health and Reducing Health Disparities Through National Institutes of Health; Establishment of National Center") establishes the National Center on Minority Health and Health Disparities to conduct and support research, training, and the dissemination of information and other programs that focus on health conditions of minoritized racial and ethnic groups and other populations affected by health disparities (American Legacy Foundation n.d.; National Institute on Minority Health and Health Disparities n.d.).
2000	In January, USDHHS launches *Healthy People 2010,* a comprehensive, nationwide health promotion and disease prevention framework to improve the health of all people in the United States. The two overarching goals are to increase quality and years of healthy life and to eliminate health disparities (CDC 2015b). Subsequent initiatives, including *Healthy People 2020* (launched in 2010) and *Healthy People 2030* (launched in 2020) also include goals related to health equity, elimination of disparities, and social determinants of health (Office of Disease Prevention and Health Promotion 2021).
2000	In December, the Office of the Surgeon General releases its 26th report on tobacco, *Reducing Tobacco Use: A Report of the Surgeon General,* which concludes that there is a need to addresses tobacco-related health disparities and emphasizes the importance of reducing the negative effects of tobacco on the health of various populations (USDHHS 2000).
2000	Sharon Eubanks, JD, serves as lead counsel on behalf of the United States in *United States v. Philip Morris USA, et al.* This federal tobacco litigation is the largest civil Racketeer Influenced and Corrupt Organizations (RICO) enforcement action in history (Cornell Law School n.d.).
2001	NCI appoints Dr. Harold Freeman as the first Director of the Center to Reduce Cancer Health Disparities (Freeman 2003).
2001	The American Legacy Foundation (n.d.) launches its Priority Populations Initiative, which provides $25 million to 83 grantees to fund programs with the goal of reducing tobacco-related health disparities and preventing tobacco use among high-risk populations. The initiative funds cessation services and education programs on the harms of tobacco use (Healton et al. 2004).
2002	In February, LCAT holds the first National Hispanic/Latino Conference on Tobacco Prevention and Control (University of Southern California 2002).
2002	The Campaign for Tobacco-Free Kids grants funding to the Asian Pacific Partners for Empowerment, Advocacy, and Leadership to create the Mobilizing Asian American and Pacific Islander Communities on the Tobacco Settlement toolkit. The toolkit encourages states to increase their efforts to educate Asian American and Pacific Islander people about the risks of tobacco use (Themba-Nixon et al. 2004).
2002	The National Conference on Tobacco and Health Disparities convenes in December, marking the first gathering of experts in tobacco control to discuss research agendas to combat tobacco-related health disparities. The outcomes from this conference yield more than 100 recommendations for future research. These recommendations continue to inform tobacco-related health disparities research today (Fagan et al. 2004).
2002	On March 21–22, CDC and NCI host The First Conference on Menthol Cigarettes: Setting the Research Agenda, in Atlanta, GA. This meeting is co-chaired by Pamela Clark, PhD, and Phillip Gardiner, Dr.PH, who led efforts to evaluate the present state of the science about the health implications of adding menthol to cigarettes and about setting the priorities for future studies on the health effects of menthol cigarettes. The conference results in a report and the first supplement issue on menthol cigarettes, which is published in *Nicotine & Tobacco Research* (2004).

Table 1A.1 Continued

Year(s)	Events
2003	In October, the Tobacco-Related Disease Research Program and other California tobacco control leaders cosponsor the "Priority Populations Conference: Weaving Our Message—United Against Tobacco Abuse." The main goal of this conference is to plan for a future of protecting priority populations from tobacco-related health issues (University of California 2003; Themba-Nixon et al. 2004).
2003	NCI and the American Legacy Foundation partner to establish TReND, a network of 21 core members and scientists who work across various disciplines. The mission of this network is to "eliminate tobacco-related health disparities through transdisciplinary research . . . [that] informs public policy" (Clayton 2006, p. ii3; Okuyemi et al. 2015).
2003	A question that assesses menthol smoking status is added to TUS-CPS, an effort led by Dr. Deirdre Lawrence Kittner (NCI 2022b).
2003	The TUS-CPS is translated into Chinese, Khmer, Korean, and Vietnamese, an effort led by Dr. Deirdre Lawrence Kittner (NCI 2022a).
2004	Brown & Williamson launches the *Kool Mixx* marketing campaign. The campaign uses images of disc jockeys and rappers on product packaging. Community activists argue that the campaign and its imagery target menthol products to Black or African American people, specifically Black or African American youth. In May, attorneys general in 29 states send a letter to Brown & Williamson urging it to cease production and promotion of the product, citing a violation of the MSA. Kool Mixx cigarette packages are recalled after the New York Supreme Court issues a restraining order to halt the promotion of the campaign (New York State Attorney General 2004; Hafez and Ling 2006).
2004	Just 5 months after the Kool Mixx controversy, R.J. Reynolds is pressured by the state attorney general of Hawai'i, Governor of Hawai'i, and Mayor of the Island of Kaua'i to discontinue sales of Camel Exotic Blends, a product line targeting Native Hawaiian people. R.J. Reynolds ceases production of the cigarettes and the production of all Camel, Kool, and Salem cigarettes that contain characterizing flavors, except for menthol, in 2006 (American Lung Association 2006; Brnovich 2006).
2004	Members of TReND launch the Low Socioeconomic Status Women and Girls Project. The goal of the project is "to stimulate new research, review existing research, and, as a result of its findings, inform the development and implementation of policies and programs that may reduce tobacco use among low socioeconomic status women and girls." This project is the first to address the effects of tobacco policies on this population (NCI 2012).
2005	In September, TReND hosts "Tobacco Control Policies: Do They Make a Difference for Low SES Women and Girls?" Attendees at the meeting examine new data on the effects of tobacco control policies on women and girls from lower SES groups. After the meeting, TReND publishes two special journal issues to address disparities in these populations (Greaves et al. 2006; McLellan and Kaufman 2006; NCI 2012).
2005	NCI's Center to Reduce Cancer Health Disparities awards $95 million over a 5-year span to the Community Networks Program. The program funds 25 networks, whose goals include reducing cancer health disparities in minoritized racial and ethnic groups and other underserved communities. The funding permits networks to address tobacco-related health disparities in these communities through education, community outreach, and research efforts (Tong et al. 2015).
2005	The ATOD Section of the APHA awards its Lifetime Achievement Award to Charyn D. Sutton, president of the Onyx group; the award is presented posthumously to her mother for ". . . commitment to eliminate health disparities in minoritized communities" (University of North Carolina at Chapel Hill Program for Ethnicity n.d.).
2006	Drs. Pebbles Fagan and Donna Vallone, co-chairs of TReND, formally propose establishing a tobacco and health disparities committee to Dr. Ellen Gritz, president of SRNT. The researchers envision expanding the focus of SRNT's Special Populations Subcommittee to include the advancement of research on tobacco-related health disparities to bring it to the forefront of the scientific community. SRNT's Tobacco and Health Disparities Committee commences with inaugural chairs Drs. Fagan and Dennis Trinidad (Okuyemi et al. 2015).
2006	On August 17, a district court judge in *U.S. v. Philip Morris USA,* finds major U.S. tobacco companies liable for violating the *Racketeer Influenced and Corrupt Organizations Act.* The companies conspired to deceive the American public about the dangers of tobacco products and about their role in designing and marketing highly addictive products and distorting scientific evidence. Included in Judge Kessler's decision are findings about the industry's knowledge of consumer perceptions of menthol and how certain companies targeted their menthol marketing to better reach certain population groups. The court orders the companies to post corrective statements in newspapers, on TV, on cigarette packages, in retail stores, and online (*United States v. Philip Morris USA,* Inc. 2006; Tangari et al. 2010; Public Health Law Center n.d.e).

Table 1A.1 Continued

Year(s)	Events
2006	TReND holds the LGBT of Color Sampling Methodology meeting in Washington, D.C., on September 15. The effort seeks to identify gaps in tobacco control research and to conceptualize and plan future research related to the LGBT community and their disparate health outcomes (Buchting et al. 2009).
2007	In June, Maine becomes the first state to pass a law banning the sale of cigars with characterizing flavors other than tobacco, menthol, clove, coffee, nuts, or peppers, effective July 1, 2009 (Maine Legislature 2007). The law is amended in April 2010 so that tobacco flavor is the only allowable flavor in non-premium cigars. It allows the sale of flavored premium cigars and some preexisting flavored non-premium cigars (Maine Legislature 2010).
2008	In June, seven former secretaries of USDHHS, one former Surgeon General, and one tobacco control advocate write to urge Congress to ban menthol in the impending *Family Smoking Prevention and Tobacco Control Act of 2009* (*Tobacco Control Act*). The letter details the high prevalence of menthol cigarette use among Black or African American people compared with other racial and ethnic groups (*The New York Times* 2008).
2008	Carol McGruder, Dr. Phillip Gardiner, and Dr. Valerie Yerger help to found the AATCLC in California (African American Tobacco Control Leadership Council n.d.b).
2009	On June 22, President Barack Obama signs into law the *Family Smoking Prevention and Tobacco Control Act* of 2009. This seminal legislation grants FDA regulatory control of the manufacturing, distribution, and marketing and advertising of tobacco products. It prevents the sale of flavored cigarettes, excluding tobacco and menthol flavors, and gives FDA the authority to (a) require health warnings on smokeless tobacco products, (b) promulgate a regulation requiring pictorial health warnings on cigarette packages, (c) require a premarket review, and (d) issue product standards (which could be standards regarding ingredients or constituents). This legislation creates FDA's Center for Tobacco Products and the TPSAC, a 12-member scientific advisory committee representing diverse expertise (Tobacco Control Legal Consortium 2009; FDA 2020).
2010	On March 23, President Obama signs the *Patient Protection and Affordable Care Act* (ACA) into law. Among other achievements, this legislation establishes the Prevention and Public Health Fund, which provides funds to reduce and prevent tobacco use. The ACA also expands coverage for tobacco cessation that is aimed at decreasing the prevalence of tobacco use, especially among people of lower SES who use tobacco. The expansion of Medicaid also provides smoking cessation benefits to more citizens with lower incomes. The ACA allows tobacco dependence to be treated as a substance use disorder under some circumstances (Patient Protection and Affordable Care Act 2010; Tobacco Control Legal Consortium n.d.).
2010	As part of the ACA, the National Center on Minority Health and Health Disparities (n.d.) is designated as an NIH Institute and charged with leading scientific research to improve health among minoritized racial and ethnic groups and reduce health disparities.
2010	NCI, CDC's Office on Smoking and Health, American Legacy, and TReND collaborate to publish two special journal issues (*Addiction* [2010] and *Nicotine & Tobacco Research* [2010]) to inform the evidence base related to the Congressionally mandated report on the public health impact of menthol. The FDA TPSAC uses the results from the papers to inform the writing and conclusions of the report published in 2011 (Tobacco Products Scientific Advisory Committee 2011). FDA uses the research to inform the writing and conclusions of the report published in 2013 (FDA n.d.).
2011	In February, Lorillard and R.J. Reynolds file a lawsuit challenging the TPSAC, which was constituted to, among other things, examine menthol cigarettes under the *Tobacco Control Act of 2009*. The companies claim that three members of TPSAC had conflicts of interest and urge the court not to permit FDA to use the TPSAC's forthcoming report on menthol to inform decision making about menthol cigarettes. In 2014, the District Court for the District of Columbia ruled in favor of the tobacco companies but that decision was later reversed and vacated (Public Health Law Center n.d.b)
2011	The TPSAC releases its report on menthol concluding that the availability of menthol cigarettes has a negative impact on public health and that banning menthol cigarettes would benefit public health. At the TPSAC public meeting on January 11, Mark Stuart Clanton, MD, MPH, former Deputy Director of the NCI and past member of the first TPSAC and its Menthol Subcommittee, reads the final TPSAC conclusions on the public health impact of menthol in cigarettes (Center for Tobacco Products 2011; TPSAC 2011).
2011	SRNT and its Health Disparities Committee transform into a network. From this point on, the network meets annually during the larger SRNT conferences (Okuyemi et al. 2015).

Table 1A.1 Continued

Year(s)	Events
2011	NCI (2011) publishes *Guía: Viva de Forma más Saludable Para Usted y su Familia, Deje de Fumar hoy Mismo (Guide: Live Healthier for You and Your Family Quit Smoking Today),* the first nationally distributed evidence-based, self-help cessation-focused material tailored for Hispanic or Latino populations.
2011	Delmonte Jefferson becomes the director of the National African American Tobacco Prevention Network, a national organization whose mission is to "facilitate the development and implementation of comprehensive and community competent public health programs to benefit communities and people of African descent" (Center for the Study of Tobacco and Society n.d.b; National African American Tobacco Prevention Network n.d.).
2012	Campaign for Tobacco-Free Kids publishes *How Big Tobacco and Convenience Stores Partner to Market Tobacco Products and Fight Life-Saving Policies.* The report details the various ways in which tobacco companies continue to use convenience stores to help promote their products in the form of point-of-sale advertising. This form of advertising targets children and lower income communities among minoritized racial and ethnic groups, specifically where these types of stores are most prevalent (Campaign for Tobacco-Free Kids 2012).
2012	In March, the Surgeon General publishes *Preventing Tobacco Use Among Youth and Young Adults: A Report of the Surgeon General.* This report includes data and other information on disparities in tobacco use among young people of color and youth of lower SES, as well as geographical differences in health outcomes among youth. Because of limited data, findings on LGBT youth are not presented (USDHHS 2012).
2012	In March, CDC launches *Tips From Former Smokers,* the first national antitobacco campaign sponsored by a federal agency. The campaign is designed to reach people from multiple racial and ethnic, SES, sexual orientation and gender identity, and age groups who do not smoke and who used to smoke (CDC 2018).
2012	Through funding from CDC, California launches the Asian Smokers' Quitline, the first quitline to provide culturally appropriate smoking cessation services to Cantonese-, Mandarin-, Korean-, and Vietnamese-speaking populations nationwide (Kuiper et al. 2015).
2013	The NHIS adds a question to capture self-reported sexual orientation (National Center for Health Statistics n.d.). Scout, PhD, advocated for many years to add this question that would help quantitatively document the known disparities in smoking among LBGT communities (National LGBT Cancer Network n.d.).
2013	FDA issues an advanced notice of proposed rulemaking and request for comments on menthol in cigarettes and other tobacco products (*Federal Register* 2013).
2013	Delta Sigma Theta Sorority, Inc., becomes the first African American organization to adopt a national resolution urging FDA to ban menthol cigarettes (Delta Sigma Theta Sorority 2017).
2013	Eighteen organizations representing various populations at risk for tobacco-related morbidity and mortality collectively issue a citizen petition to FDA requesting a federal ban on the sale of menthol-flavored cigarettes (Tobacco Control Legal Consortium 2013).
2013	AACR and ASCO are among the first professional organizations focused on cancer research to submit a letter to FDA urging FDA to ban menthol in cigarettes (American Association for Cancer Research and American Society of Clinical Oncology 2013).
2013	In December, the Chicago City Council passes an ordinance banning the sale of menthol cigarettes within 500 feet of schools, making Chicago the first U.S. city to regulate the sale of menthol cigarettes (Freiberg 2015; Tobacco Control Legal Consortium 2016).
2014	In *Cynthia Robinson v. R.J. Reynolds Tobacco Company,* private citizen Cynthia Robinson sues R.J. Reynolds for the death of her husband, who developed lung cancer from smoking menthol cigarettes. Ms. Robinson asserts that R.J. Reynolds did not adequately warn customers about the addictiveness of nicotine and the significant risk of lung cancer. The court rules in favor of Ms. Robinson, awarding her $23 billion in damages, which were later reduced to $16.9 million (Robles 2014; The National Trial Lawyers n.d.).
2015	In May, FDA launches the *Fresh Empire* campaign. The campaign is tailored to attract Black or African American, Hispanic, and Asian American and Pacific Islander youth who identify with hip-hop culture. The campaign promotes the healthy connections between the hip-hop lifestyle and living tobacco-free (FDA 2022a).
2015	In August, National Jewish Health launches the AICTP to provide American Indian people from several states with remote counseling on tobacco cessation. The program features American Indian smoking cessation coaches and aims to reduce the prevalence of commercial tobacco use in this underserved population (National Jewish Health 2015).

Table 1A.1 Continued

Year(s)	Events
2015	The AICTP quitline, 1-855-5AI-QUIT (1-855-524-7848), is established in Minnesota and serves 14 states (AICTP n.d.).
2015	CDC publishes the *Best Practices User Guide: Health Equity in Tobacco Prevention and Control* (CDC 2015a).
2016	On January 15, the U.S. Court of Appeals for the District of Columbia rules against Lorillard and R.J. Reynolds in their 2011 lawsuit challenging the TPSAC menthol report. The appellate court finds that the companies' allegations of harm were speculative and overturned a lower court's order that had dissolved TPSAC and had mandated that FDA could not use the report. The court ordered the reconstitution of TPSAC (Public Health Law Center n.d.c).
2016	On July 19, the NAACP adopts, at its national conference in Cincinnati, Ohio, a national resolution to urge FDA to ban menthol cigarettes. The resolution, which was ratified on October 15 by the NAACP National Board of Directors, calls on NAACP chapters to support local policy efforts to restrict the sale of menthol cigarettes and other flavored tobacco products, such as little cigars, cigarillos, and the flavored juices used in electronic nicotine devices (NAACP n.d.).
2016	The Truth Initiative joins the AATCLC in an open letter to former President Barack Obama urging FDA to ban menthol in combusted cigarettes (African American Tobacco Control Leadership Council 2016; Truth Initiative 2016b).
2016	On May 10, FDA announces its final deeming rule, which extends FDA's regulatory authority to all tobacco products, including future tobacco products. FDA now has the power to restrict the sale of tobacco products, including cigars and e-cigarettes and their parts and components, to youth and to issue product standards to newly deemed products (*Federal Register* 2016a).
2016	In December 2016, the U.S. Department of Housing and Urban Development issues a final rule that requires all PHAs that provide lower income, conventional public housing to implement smokefree policies in their facilities by July 30, 2018. Policies must prohibit residents from smoking indoors on any PHA properties or within 25 feet of a PHA building (*Federal Register* 2016b; U.S. Department of Housing and Urban Development 2016).
2016	FDA's *The Real Cost* campaign is expanded to include boys living in rural areas. The goal of the expanded campaign is to educate young people on the dangers of smokeless tobacco use (FDA 2019).
2016	FDA launches the *This Free Life* campaign. The campaign is designed to prevent and reduce tobacco use among LGBTQI+ young adults who occasionally smoke cigarettes (FDA 2022b).
2017	In June, the board of supervisors in San Francisco, California, bans the sale of all flavored tobacco products, including mentholated cigarettes. R.J. Reynolds petitions against this ban and requests a public vote (Swan 2017). On June 5, 2018, nearly 70% of San Francisco residents vote in favor of upholding the ban (City and County of San Francisco 2018). San Francisco begins enforcing these sales restrictions in April 2019.
2017	In July, the city council in Oakland, California, restricts the sale of mentholated tobacco products, except in specialty stores (Oakland City Council 2017; Tadayon 2017). This exemption was later removed.
2017	NCI publishes Tobacco Control Monograph 22, *A Socioecological Approach to Addressing Tobacco-Related Health Disparities,* which calls for individual- to systems-level interventions and policies to be key components of comprehensive tobacco control, prevention, and treatment. This is the first monograph to focus specifically on tobacco-related health disparities (NCI 2017).
2017	Truth Initiative issues a report called *Tobacco Nation: An Ongoing Crisis,* which highlights states where the prevalence of tobacco use exceeds 20%, where residents are relatively poor, and where healthcare infrastructure is poor (Truth Initiative 2019).
2018	On March 21, FDA publishes an advanced notice of proposed rulemaking, with a call for data, research, and comments regarding the role of flavors in tobacco products. FDA plans to use the information gained from the call to inform its decisions on regulating flavored tobacco products in the future (*Federal Register* 2018).
2018	Rev. Jesse W. Brown, Jr., outlines cigar manufacturer Swisher International, Inc.'s aggressive marketing to African American people in the form of concerts and in-store entertainment (Center for the Study of Tobacco and Society n.d.b).
2018	In May, ClearWay Minnesota funds the American Indian Quitline Program, a tobacco cessation quitline dedicated to serving American Indian people who live in Minnesota (North American Quitline Consortium 2018).
2018	In July, the City Council in Richmond, California, votes to prohibit the retail sale of menthol and flavored tobacco products within city limits, following actions in other California cities (e.g., Berkeley) and counties (Contra Costa and Alameda) (Tadayon 2018).

Table 1A.1 Continued

Year(s)	Events
2018	The San Francisco Board of Supervisors bans the sale of flavored tobacco products (Center for the Study of Tobacco and Society n.d.b).
2019	Rod Lew receives the Andre Stanley Memorial Health Equity Award from the APHA. The award honors an individual who has contributed to public health efforts to build health equity and reduce health disparities in the area of substance use. Lew is recognized for his leadership in addressing the disproportionate impact of commercial tobacco on Asian American and Native Hawaiian and Pacific Islander communities and other priority populations. Andre Stanley, who died in 2017, worked with the ASSIST study, the APHA, and FDA to advocate for tobacco prevention and control among diverse population groups (North American Quitline Consortium 2019).
2020	Massachusetts becomes the first state to prohibit the sale of all flavored tobacco products, including menthol cigarettes, effective on June 1 (Campaign for Tobacco-Free Kids 2023).
2020	California enacts a statewide law prohibiting the sale of all flavored tobacco products (Campaign for Tobacco-Free Kids 2023). Tobacco companies delay implementation until a referendum vote in 2022 (*New York Times* 2022).
2020	Policies of AMA—under the leadership of Dr. Patrice Harris, first African American president of AMA—recognize race as a social, not biological, construct (American Medical Association 2020; American Medical Women's Association n.d.).
2020	On June 17, the AATCLC and ASH file a lawsuit against FDA in the Northern District of California alleging an unreasonable delay on the part of the agency in banning menthol in cigarettes. The two groups request several forms of relief from the court, including an order requiring FDA to respond to the citizen petition and an order requiring FDA to reevaluate the tobacco product standards. AMA joined the lawsuit as a plaintiff on September 3; and NMA joined AATCLC, ASH, and AMA as plaintiffs on December 3 (Action on Smoking & Health 2020).
2021	CDC Director Dr. Rochelle Walensky declares racism to be a serious public health threat and announces efforts to advance science, invest in communities, foster diversity and inclusion, catalyze public and scientific discourse around racism and health, and be accountable for progress (CDC 2021).
2021	The University of Illinois Chicago School of Public Health names the Andre Gilmore Stanley DrPH Scholarship in honor of Stanley and his legacy of fighting racism, inequities, and advocating for tobacco control in communities. In 2019, APHA also named the Andre Stanley Memorial Health Equity Award to honor his legacy and years served in APHA ATOD (University of Illinois Chicago School of Public Health 2021).
2021	The Public Health Law Center and AATCLC, among other groups, file on January 14 a supplement to the citizen petition to FDA to prompt FDA to take action related to menthol in cigarettes (Public Health Law Center n.d.a).
2021	On January 20, President Biden signs Executive Order 13985, *Advancing Racial Equity and Support for Underserved Communities Through the Federal Government,* which charged the government to address inequities in policies and programs by "[pursuing] a comprehensive approach to advancing equity for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality" (*Federal Register* 2021).
2021	On April 29, FDA responds to the citizen petition in a letter, which indicates that the agency plans to grant the petition and issue a proposed rule prohibiting menthol in cigarettes (Action on Smoking & Health 2021; Nelson 2021).
2022	FDA issues two proposed rules on April 28, indicating that the agency plans to remove menthol from cigarettes (*Federal Register* 2022a) and all flavors (except tobacco flavor) from cigars (*Federal Register* 2022b), but those rules have not been finalized.
2022	Navajo Nation casinos and public places become smokefree on February 5. The legislation was signed by Navajo Nation President Jonathan Nez in November 2021 (Smokefree Casinos 2021).
2022	Dr. Pebbles Fagan receives the President's Award from SRNT (n.d.), recognizing her lifetime work to advance research on tobacco-related health disparities.
2022	Dr. Patricia Nez Henderson is the first Indigenous woman elected President of SRNT. Dr. Nez Henderson is a member of the Diné (Navajo) tribe and has worked for years to conduct participatory research and advocate for policies that protect Indigenous communities (*Navajo-Hopi Observer* 2022).
2022	On September 28–30, the third meeting on menthol cigarettes is organized by the AATCLC and convenes in Washington, DC (African American Tobacco Control Leadership Council n.d.a).
2022	On November 8, 2022, California voters overwhelmingly approve Proposition 31, a ballot measure on a 2020 law prohibiting the sale of all flavored tobacco products, including menthol cigarettes (*New York Times* 2022).

Table 1A.1 Continued

Year(s)	Events
2023	On February 16, President Biden signs Executive Order 14091, *Further Advancing Racial Equity and Support for Underserved Communities Through the Federal Government,* reaffirming the government's commitment to take additional action to "combat discrimination and advance equal opportunity, including by redressing unfair disparities and removing barriers to Government programs and services" (*Federal Register* 2023).
2023	CDC announces a new five-year, $15 million initiative to help increase adoption, implementation, and enforcement of policies prohibiting the sale of menthol and other flavored tobacco products and increase awareness of cessation services and coverage options among populations experiencing tobacco-related disparities in order to accelerate smoking cessation (CDC 2023).
2024	On January 8, the Supreme Court declines to hear challenges from tobacco companies and retailers to California's restrictions on the sales of flavored tobacco products, in which the companies and retailers argued that the *Tobacco Control Act* preempted the state law (Public Health Law Center n.d.d).

Notes: **AACR =** American Association for Cancer Research; **AATCLC =** African American Tobacco Control Leadership Council; **ACA =** *Patient Protection and Affordable Care Act;* **ACS =** American Cancer Society; **AICTP =** American Indian Commercial Tobacco Program; **AMA =** American Medical Association; **APHA =** American Public Health Association; **APITEN =** Asian & Pacific Islander Tobacco Control Education Network; **ASCO =** American Society of Clinical Oncology; **ASH =** Action on Smoking & Health; **ASSIST =** American Stop Smoking Intervention Study; **ATOD =** Alcohol, Tobacco, and Other Drugs; **CDC =** Centers for Disease Control and Prevention; **FDA =** U.S. Food and Drug Administration; **LCAT =** National Latino Council on Alcohol and Tobacco Prevention; **LGBTQI+ =** lesbian, gay, bisexual, transgender, queer, and intersex; **MSA =** Master Settlement Agreement; **NAACP =** National Association for the Advancement of Colored People; **NCI =** National Cancer Institute; **NHIS =** National Health Interview Survey; **NIDA =** National Institute on Drug Abuse; **NIH =** National Institutes of Health; **NMA =** National Medical Association; **NUL =** National Urban League; **PHA =** Public Housing Agency; **SES =** socioeconomic status; **SRNT =** Society for Research on Nicotine & Tobacco; **TPSAC =** Tobacco Products Scientific Advisory committee; **TReND =** Tobacco Research Network on Disparities; **TUS-CPS =** Tobacco Use Supplement to the Current Population Survey; **UNCF =** United Negro College Fund; **USDHEW =** U.S. Department of Health, Education, and Welfare; **USDHHS =** U.S. Department of Health and Human Services.

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Introduction

Despite the considerable progress made in reducing the toll of tobacco-related disease since the release of the 1964 Surgeon General's report, tobacco-related health disparities and disparities in the patterns of tobacco use persist in the United States. Disparities in tobacco use have multifaceted influences that go beyond individual and intrapersonal factors, including the tobacco industry's aggressive marketing and promotion of flavored and fragranced products, such as mentholated products. Chapters 1, 3, 4, and 5 of the current report describe these and other factors that have influenced tobacco-related health disparities.

Health disparities may be understood as differences in health outcomes between two populations, between a specific population and the general population, or as former Surgeon General Dr. David Satcher stated in 1999, between a minority and a majority population—although it is not always clear how to define these populations (Satcher 1999; Harper and Lynch 2005).

In 2021, Centers for Disease Control and Prevention (CDC) published *Identifying and Eliminating Tobacco-Related Health Disparities: Key Outcome Indicators for Evaluating Comprehensive Tobacco Control Programs* (CDC 2022). This guide presents an overview of concepts and considerations when measuring tobacco-related disparities. In addition to identifying a reference group and choosing to use absolute scales based on differences or relative scales based on ratios, other important considerations include accounting for differences in group sizes, using differential weighting, using pairwise or summary approaches to compare differences across groups, and more. The choice of disparity measure (absolute or relative), the choice of a specific reference group, and the magnitude or statistical significance of the difference may lead to conflicting conclusions about whether a disparity exists. Thus, measuring disparities on both absolute and relative scales may provide a more complete understanding of disparities and the magnitude of differences between populations (CDC 2022).

Various conceptual, ethical, and methodological issues should be considered when deciding how to measure and communicate tobacco-related health disparities (Harper and Lynch 2005). Throughout this chapter, disparities in patterns of tobacco use are discussed in multiple ways. Differences in outcomes between populations are highlighted where 95% confidence intervals (CIs) do not overlap.

This chapter presents patterns and trends in commercial tobacco use and exposure to secondhand tobacco smoke among the groups of people that are more affected by tobacco use than others, including people from populations defined by racial and ethnic identity, sexual orientation, and gender identity; people of lower socioeconomic status (SES); people with mental health conditions or substance use disorders; members of certain occupational groups; and people who reside in rural or other selected geographic settings. In this chapter, data are presented on youth and adults, including information on different adult populations by age. Analyses focus on the persistence of specific patterns of tobacco product use, such as frequency of use or polytobacco use, among certain populations and differences in exposure among them to secondhand tobacco smoke. The analyses have also been informed by the theory of intersectionality, as introduced in Chapter 1, which holds that being in two or more groups that may have a higher risk for health disparities may worsen disparities in tobacco use, exposure to secondhand tobacco smoke, and tobacco-related health outcomes (Cole 2009).

Patterns of tobacco product use focus on cigarettes, other combustible products (such as cigars and little cigars), noncombustible products (such as smokeless tobacco), and electronic cigarette (e-cigarette) products that deliver nicotine. Having comprehensive information about these products and the key patterns and trends in their use, with a focus on disparities, is critical to the development and maintenance of health promotion programs to reduce tobacco-related illness and death.

Methods

In the United States, a variety of national surveillance systems collect tobacco-specific data for youth and adults. These systems conduct surveys that typically assess behaviors related to cigarette smoking and, sometimes, the use of other tobacco products; some surveys also collect information about important aspects of tobacco use, such as quit attempts. The surveys use different methods and provide comparable, but not identical, measures of tobacco product use. Appendix 2.1 and Table 2.1 describe the seven principal national surveys that inform this chapter. Although other national surveys exist that assess behaviors related to tobacco product use, these seven surveys were selected to serve as primary data sources based on the strength of their methodologies, salience of content, recency of data, and completeness with which they cover populations of interest. Appendix 2.2 describes the various measures of tobacco product use reported in this chapter.

The data from these principal national surveys may be limited based on the measures they include and the populations they sample to estimate tobacco product use across multiple populations. For example, various factors may influence the content of the surveys. Some of the surveys cover a broad range of public health topics with only limited tobacco-specific content. Additionally, the Office of Management and Budget requires accounting for respondent burden in determining survey content. Proposing new questions often calls for the deletion of existing survey items. Furthermore, some surveys require voting by states before including any newly proposed questions in the final survey instrument. In the past, few national surveillance systems met certain practice recommendations for measuring sexual orientation and gender identity, including assessing transgender-inclusive gender identity (Patterson et al. 2017). While most of the national surveillance systems used in this chapter ask questions about sexual orientation, fewer ask questions about gender identity. Moreover, when collected, data are often presented in aggregate, which may mask important differences between groups (National Academies of Sciences, Engineering, and Medicine 2022; National Science and Technology Council 2023). Results from these systems are also limited to the languages in which the surveys are offered and may not capture small or hard-to-reach populations that are examined in state- or community-level assessments (Friis et al. 2006; Tong et al. 2010; Mukherjea et al. 2018). Methodologic limitations are further discussed in Appendix 2.1.

Cross-sectional data presented in this chapter are from the following seven national surveillance systems: the Youth Risk Behavior Surveillance System (YRBSS), the National Youth Tobacco Survey (NYTS), the National Survey on Drug Use and Health (NSDUH), the National Health Interview Survey (NHIS), the Tobacco Use Supplement to the Current Population Survey (TUS-CPS), the Behavioral Risk Factor Surveillance System (BRFSS), and the National Health and Nutrition Examination Survey (NHANES). Each of these population-based surveys gather anonymous or confidentially obtained self-reported data. Generally, self-reported data are accurate enough for tracking general patterns of tobacco use in populations (Brener et al. 2003; U.S. Department of Health and Human Services [USDHHS] 2004).

The YRBSS conducts both state and local surveys as well as a national survey. Its national Youth Risk Behavior Survey (YRBS) uses probability samples of public and private high school students in Grades 9–12 who anonymously fill out questionnaires that are administered in schools. The findings from this survey are representative of the U.S. high school population. National YRBS data from 1991 to 2019 are used in this report to illustrate trends over time.

The NYTS provides national data on long-term, intermediate, and short-term indicators key to the design, implementation, and evaluation of comprehensive tobacco prevention and control programs. The NYTS uses probability samples of public and private middle school students (Grades 6–8) and high school students (Grades 9–12) who anonymously fill out questionnaires that are administered in schools. The findings of the NYTS are representative of the U.S. middle school and high school population. The NYTS also serves as a baseline for comparing progress toward meeting selected *Healthy People 2030* goals for reducing tobacco use among youth (CDC n.d.i). Items measured as part of the NYTS survey include ever and past-30-day use of a range of tobacco products and correlates of tobacco use such as demographics, minors' access to tobacco, and exposure to secondhand tobacco smoke. This chapter presents data from the 2011–2021 NYTS.

The NSDUH is conducted under the direction of the federal Substance Abuse and Mental Health Services Administration (SAMHSA). Using household-based sampling, the NSDUH is designed to represent the entire civilian, noninstitutionalized population 12 years of age and older in the United States. A major strength of the NSDUH is that its national sample is allocated strategically across age-specific populations. Starting in 2014 and continuing through 2019, the allocation of the NSDUH sample was 25% for adolescents (12–17 years of age), 25% for young adults (18–25 years of age), and 50% for adults (26 years of age and older). The sample of adults was further divided into three subgroups: 26–34 years of age (15%), 35–49 years of age (20%), and 50 years of age and older (15%) (SAMHSA 2019). The NSDUH includes youth who have dropped out of school or who are frequently absent and who are more likely to smoke than youth who stay in school or are not frequently absent (Tice et al. 2017). The NSDUH is the only national survey that has a wide range of tobacco use measures that can be compared across the three priority populations (youth, young adults, and all adults). Unless otherwise indicated, past-month use refers to use on 1 or more days during the past 30 days. In-person questionnaires for the NSDUH are completed

Table 2.1 Sources of national survey data on tobacco use used for this report, United States

Characteristic	BRFSS	NHIS	TUS-CPS	YRBS	NYTS	NSDUH	NHANES
Sponsoring agency or organization	CDC, HRSA, AoA, VA, and SAMHSA	CDC	NCI (2018–2019 wave co-sponsored by FDA)	CDC	CDC and FDA since 2011	SAMHSA	CDC
Type of survey	Cross-sectional	Cross-sectional	Cross-sectional and longitudinal	Cross-sectional	Cross-sectional	Cross-sectional	Cross-sectional
Years	2020	• 2019–2021 • Cancer Control Supplements 1992–1993, 2005, 2010, 2011–2013, and 2015–2018 • Some longitudinal analyses dating back to 1964[a]	• 2018–2019 • Reference years: 2001–2002, 2003, 2006–2007, 2010–2011, and 2014–2015	1991–2019	2020, 2021	2019	1988–2018
Mode of survey administration	Telephone-based questionnaire that state health departments conduct monthly over landline and cellular telephones using a standardized questionnaire and technical and methodologic assistance provided by CDC	Computer-assisted, personal interview	Questionnaire via telephone and in-person interviews	School-based, self-administered, paper-based questionnaire	School-based, self-administered questionnaire	Audio, computer-assisted, self-interview	Home interview and health examination in a mobile examination center

Table 2.1 Continued

Characteristic	BRFSS	NHIS	TUS-CPS	YRBS	NYTS	NSDUH	NHANES
Response rate	• 2020: 34.5–67.2% • The median survey response rate for all states, territories, and Washington, DC, in 2020 was 47.9%	• 2019: – Sample adults: 59.1% • 2020: – Sample adults: 48.9% • 2021: – Sample adults: 50.9%	• 2018–2019: Average self-response rate (for all waves combined) 57.6%	• 2019: – School: 75.1% – Student: 80.3% • Overall: 60.3%	• 2020: – School: 49.9% – Student: 87.4% – Overall: 43.6% • 2021: – School: 54.9% – Student: 81.2% – Overall: 44.6%	• 2019 weighted screening response rate: – 70.5% (original data) • 2019 weighted interview response rate for computer-assisted interview: – 64.9% (original data)	• 2017–2018: – Interviewed sample: 51.9% – Examined sample: 48.8%
Sample size	• 2020: 401,958 adults ≥18 years of age	• Adults ≥18 years of age: – 2019: 31,997 – 2020: 31,568 – 2021: 29,482	• 2018–2019: 137,471	• 2019: 13,677 students in grades 9–12	• 2020: 14,531 students in grades 6–12 • 2021: 20,413 students in grades 6–12	• 2019 restricted-use dataset: 67,625 • Public use dataset: 56,136	• 2017–2018: – Interviewed sample: 9,254 – Examined sample: 8,704
Type of tobacco use examined	Cigarettes, smokeless tobacco, and e-cigarettes	Cigarettes, cigars, pipes, smokeless tobacco, and e-cigarettes	Cigarettes, cigars, smokeless tobacco, and e-cigarettes	Cigarettes, cigars, smokeless tobacco, and electronic vapor products (i.e., e-cigarettes)	Cigarettes, smokeless tobacco, snus, cigars, e-cigarettes, hookah, pipes, dissolvable tobacco products, heated tobacco products, nicotine pouches, and bidis	Cigarettes, cigars, pipes, and smokeless (snuff, dip, and chewing tobacco or snus)	Self-reported tobacco use and serum cotinine levels

Notes: **AoA =** Administration on Aging; **BRFSS =** Behavioral Risk Factor Surveillance System; **CDC =** Centers for Disease Control and Prevention; **FDA =** U.S. Food and Drug Administration; **HRSA =** Health Resources and Services Administration; **N/A =** not applicable; **NCHS =** National Center for Health Statistics; **NCI =** National Cancer Institute; **NHANES =** National Health and Nutrition Examination Survey; **NHIS =** National Health Interview Survey; **NSDUH =** National Survey on Drug Use and Health; **SAMHSA =** Substance Abuse and Mental Health Services Administration; **TUS-CPS =** Tobacco Use Supplement—Current Population Survey; **VA =** U.S. Department of Veterans Affairs; **YRBS =** Youth Risk Behavior Survey.

[a]The content and structure of the NHIS questionnaire and interview were redesigned in 2019. One adult is randomly selected from each household for the sample. Updates were made to the weighting process for the 2019 sample of adults, limiting comparisons with previous years.

confidentially in the home with audio computer-assisted self-interviewing so that only the respondent is aware of the questions being asked. Unless otherwise indicated, all NSDUH data presented in this chapter are from the 2019 survey.

The NHIS is an annual cross-sectional household interview survey of civilian, noninstitutionalized adults 18 years of age and older. The NHIS has been a primary source of health data on the adult population in the United States since 1957. NHIS data on tobacco product use, which are available from 1965 to 2021, are used in this report to illustrate trends over time. In 2019, the content and structure of the NHIS were updated. Estimates of tobacco product use before and after 2019 may not be directly comparable; thus, figures portraying these data include a break in the trend line in 2019. In addition, data from the 2019–2021 NHIS were pooled when available into a combined dataset and analyzed to obtain estimates of patterns of tobacco product use.

The TUS-CPS is a nationally representative survey that has been sponsored by the National Cancer Institute (NCI) since 1992. The TUS-CPS is a key source of data, including data on health disparities, at the national and state levels and, to some degree, at the local level. The survey collects data from civilian, noninstitutionalized adults 18 years of age and older. The most recent data related to cigarette smoking, other tobacco product use, and cessation attempts were collected in July 2018, January 2019, and May 2019.

The BRFSS collects data on U.S. adults 18 years of age and older regarding risk behaviors and preventive health practices that can affect their health status. The BRFSS is conducted using random-digit dialing techniques on both landlines and mobile phones. The survey collects data from all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, and Palau. The BRFSS data presented in this chapter are from the 2019 survey.

The NHANES is a cross-sectional survey designed to assess the health and nutritional status of the civilian, noninstitutionalized population in the United States. The NHANES includes a home interview; health examinations at a mobile examination center where biologic specimens are collected; and laboratory specimen testing, including serum cotinine (a metabolite of nicotine that is widely used as a biomarker of nicotine exposure), for participants 3 years of age and older. Data from this survey are used to estimate the prevalence of major diseases, health conditions, environmental exposures, and risk factors for diseases. The NHANES data presented in this chapter are from 1988 to 2018 and explore the prevalence of exposure to secondhand tobacco smoke among the populations discussed in this report.

This chapter presents weighted prevalence estimates and 95% CIs. Because of the focus on patterns of tobacco use across populations, differences between groups are reported where CIs do not overlap, without formal statistical testing. Most data presented in this chapter are based on primary analyses conducted on these seven national surveillance systems. However, secondary analyses from the existing published literature are also included when available.

Tobacco Use Among Racial and Ethnic Groups

Disparities in tobacco use by race and ethnicity have been present for decades (Table 2.2) and were the focus of the 1998 Surgeon General's report (USDHHS 1998). Many of the disparities described in the 1998 report are still present today, with new disparities emerging or gaining notice.

The categorization of people by race and ethnicity has expanded since the 1998 report, which examined five groups of people: African American, American Indian and Alaska Native, Asian American and Pacific Islander, Hispanic, and White. This report analyzes seven broad racial and ethnic categories established by the Office of Management and Budget: American Indian and Alaska Native, Asian American, Black or African American, White, Hispanic or Latino, Native Hawaiian and Other Pacific Islander, and non-Hispanic multiple race (Federal Register 1997).

Throughout this chapter, all categories presented other than Hispanic or Latino are non-Hispanic. However, Hispanic or Latino people can be of any race. Although disaggregated data are needed to reflect the heterogeneity within each of these groups (e.g., "Asian American" includes Chinese, Japanese, Vietnamese, Korean, and South Asian people), the presentation of estimates for different populations is limited both by the measures used to assess racial and ethnic identity and the number of participants in each group that was sampled for inclusion in the surveys. In addition to racial and ethnic groups, this report assesses the role that immigration to the United States and assimilation in this country may play in determining the likelihood of some tobacco product use outcomes.

Table 2.2 Prevalence of adults, 18 years of age and older, who currently smoked cigarettes,[a] overall and by race and ethnicity;[b,c] National Health Interview Survey (NHIS) 1965–2021,[d] United States

	Percent that currently smoked cigarettes (95% CI)						
Year	Overall	White, non-Hispanic	Black, non-Hispanic	Hispanic	American Indian and Alaska Native	Asian American and Pacific Islander	Other
1965	42.4 (42.0–42.8)	42.1 (41.6–42.5)	45.8 (44.4–47.2)	40.2 (32.1–48.2)[b]	N/A	N/A	N/A
1970	37.4 (36.6–38.1)	37.0 (36.3–37.8)	41.4 (39.5–43.4)	27.2 (23.3–31.2)[b]	N/A	N/A	N/A
1974	37.1 (36.4–37.7)	36.4 (35.7–37.1)	44.0 (41.8–46.1)	31.2 (25.5–36.9)[b]	N/A	N/A	N/A
1978	34.1 (33.2–35.1)	34.0 (33.0–35.0)	37.5 (34.4–40.5)	31.6 (27.8–35.4)	45.2 (32.0–58.4)	24.2 (17.1–31.3)	27.4 (18.2–36.6)
1980	33.2 (32.3–34.2)	33.0 (31.9–34.0)	37.1 (33.9–40.2)	29.8 (25.9–33.7)	—[e]	24.1 (16.7–31.6)	29.9 (16.9–42.9)
1983	32.1 (31.5–32.8)	32.3 (31.5–33.0)	35.9 (33.7–38.0)	25.3 (22.9–27.6)	41.3 (30.9–51.7)	20.5 (15.9–25.1)	37.4 (29.3–45.4)
1985	30.1 (29.5–30.7)	29.9 (29.2–30.6)	35.0 (33.1–36.9)	25.9 (23.6–28.2)	33.5 (22.5–44.4)	21.8 (17.3–26.2)	31.0 (21.7–40.3)
1987	28.8 (28.2–29.3)	29.0 (28.4–29.6)	33.0 (31.4–34.6)	23.6 (21.8–25.3)	37.2 (26.9–47.4)	14.3 (12.0–16.7)	25.4 (18.1–32.8)
1990	25.5 (25.0–26.0)	25.8 (25.3–26.4)	26.2 (24.9–27.4)	23.0 (21.0–25.0)	39.0 (30.1–47.8)	16.4 (13.3–19.4)	19.8 (14.9–24.7)
1991	25.7 (25.2–26.2)	26.2 (25.6–26.7)	28.9 (27.4–30.4)	20.0 (18.3–21.8)	31.7 (24.4–38.9)	16.0 (12.9–19.0)	23.5 (17.0–29.9)
1992	26.5 (25.8–27.2)	27.2 (26.3–28.0)	27.8 (25.8–29.8)	20.7 (19.0–22.4)	39.1 (32.4–45.8)	15.4 (12.3–18.4)	25.2 (18.1–32.4)
1993	25.0 (24.3–25.6)	25.4 (24.6–26.2)	26.2 (24.5–27.9)	20.4 (17.7–23.1)	38.7 (30.2–47.3)	18.1 (13.7–22.4)	23.5 (15.3–31.7)
1994	25.5 (24.8–26.3)	26.3 (25.5–27.2)	27.2 (25.1–29.3)	19.5 (17.0–22.1)	42.0 (32.9–51.1)	14.0 (10.6–17.3)	22.6 (15.9–29.4)
1995	24.7 (24.2–25.2)	25.5 (24.9–26.1)	25.9 (24.9–26.8)	18.3 (17.6–19.1)	36.2 (27.7–44.8)	16.6 (15.3–17.9)	28.5 (24.1–32.8)
1997	24.7 (24.2–25.3)	25.2 (24.5–25.9)	26.8 (25.3–28.4)	20.4 (19.1–21.6)	32.1 (23.3–40.8)	16.5 (13.9–19.2)	34.0 (28.0–40.0)
1998	24.1 (23.5–24.7)	24.9 (24.2–25.7)	24.5 (22.8–26.2)	19.1 (17.6–20.6)	40.6 (28.4–52.9)	13.6 (10.5–16.7)	31.8 (25.7–37.9)
1999	23.5 (22.9–24.1)	24.3 (23.5–25.0)	24.1 (22.0–26.3)	18.1 (16.8–19.4)	41.2 (32.6–49.9)	15.0 (11.8–18.2)	30.0 (24.4–35.5)
2000	23.3 (22.6–23.9)	24.1 (23.3–24.8)	23.2 (22.0–24.5)	18.6 (17.2–19.9)	36.0 (26.4–45.6)	14.6 (11.7–17.5)	35.4 (28.7–42.1)
2001	22.8 (22.2–23.4)	24.0 (23.3–24.8)	22.3 (20.7–23.8)	16.7 (15.3–18.0)	32.7 (24.8–40.6)	12.1 (9.4–14.8)	34.3 (29.3–39.3)
2002	22.5 (21.9–23.1)	23.6 (22.8–24.4)	22.4 (20.9–24.0)	16.7 (15.4–17.9)	40.8 (30.9–50.6)	13.4 (11.0–15.8)	30.2 (24.6–35.8)
2003	21.6 (21.0–22.2)	22.7 (22.0–23.4)	21.5 (19.9–23.0)	16.4 (15.2–17.6)	39.7 (27.8–51.6)	11.7 (9.2–14.3)	30.2 (24.2–36.2)
2004	20.9 (20.3–21.5)	22.2 (21.4–22.9)	20.2 (18.5–21.9)	15.0 (13.8–16.2)	33.4 (25.1–41.8)	11.3 (8.9–13.8)	36.7 (29.7–43.6)
2005	20.9 (20.3–21.5)	21.9 (21.1–22.7)	21.5 (19.8–23.1)	16.2 (15.1–17.4)	32.0 (22.2–41.7)	13.3 (10.4–16.3)	23.9 (18.0–29.8)
2006	20.8 (20.1–21.5)	21.9 (21.1–22.8)	23.0 (21.1–24.8)	15.2 (13.7–16.7)	32.4 (19.6–45.2)	10.4 (8.4–12.5)	30.6 (24.2–37.0)
2007	19.8 (19.0–20.6)	21.4 (20.4–22.4)	19.8 (18.2–21.5)	13.3 (11.7–14.9)	36.4 (22.8–49.9)	9.6 (7.9–11.2)	25.7 (18.2–33.2)
2008	20.6 (19.9–21.4)	22.0 (21.1–23.0)	21.2 (19.4–23.1)	15.8 (14.2–17.4)	32.4 (23.7–41.1)	9.8 (7.5–12.1)	25.2 (19.1–31.4)

Table 2.2 Continued

Year	Percent that currently smoked cigarettes (95% CI)						
	Overall	**White, non-Hispanic**	**Black, non-Hispanic**	**Hispanic**	**American Indian and Alaska Native**	**Asian American and Pacific Islander**	**Other**
2009	20.6 (19.9–21.3)	22.1 (21.2–23.0)	21.3 (19.6–22.9)	14.5 (13.2–15.9)	23.2 (12.8–33.5)	12.0 (10.0–14.0)	27.7 (21.9–33.5)
2010	19.3 (18.8–19.9)	21.0 (20.3–21.8)	20.6 (19.1–22.1)	12.5 (11.4–13.6)	31.4 (22.3–40.5)	9.2 (7.6–10.8)	25.9 (20.4–31.4)
2011	19.0 (18.4–19.6)	20.6 (19.8–21.4)	19.4 (18.1–20.8)	12.9 (11.8–14.1)	31.5 (21.4–41.7)	9.9 (8.4–11.4)	25.5 (20.7–30.3)
2012	18.1 (17.5–18.7)	19.7 (18.9–20.4)	18.1 (16.7–19.4)	12.5 (11.3–13.7)	21.8 (15.0–28.6)	10.7 (9.1–12.3)	25.9 (21.2–30.5)
2013	17.8 (17.2–18.4)	19.4 (18.6–20.3)	18.3 (16.8–19.7)	12.1 (11.0–13.2)	26.1 (18.5–33.7)	9.6 (7.9–11.4)	27.7 (22.8–32.6)
2014	16.8 (16.1–17.4)	18.2 (17.3–19.1)	17.5 (16.1–18.8)	11.2 (10.2–12.2)	29.2 (19.6–38.8)	9.5 (7.7–11.2)	26.8 (20.9–32.7)
2015	15.1 (14.5–15.7)	16.6 (15.8–17.3)	16.7 (15.2–18.2)	10.1 (9.1–11.0)	21.9 (16.6–27.1)	7.0 (5.6–8.5)	18.7 (14.9–22.5)
2016	15.5 (14.8–16.1)	16.6 (15.9–17.4)	16.5 (14.7–18.3)	10.7 (9.2–12.3)	31.8 (24.1–39.5)	9.0 (7.1–10.9)	23.8 (19.4–28.3)
2017	14.0 (13.4–14.6)	15.2 (14.4–15.9)	14.9 (13.1–16.6)	9.9 (8.6–11.1)	24.0 (14.4–33.6)	7.1 (5.5–8.8)	19.5 (15.1–23.8)
2018	13.7 (13.1–14.3)	15.0 (14.3–15.7)	14.6 (12.8–16.3)	9.8 (8.4–11.2)	22.6 (12.0–33.3)	7.1 (5.2–8.9)	19.1 (14.7–23.5)
2019	14.0 (13.4–14.5)	15.5 (14.9–16.2)	14.9 (13.3–16.4)	8.8 (7.8–9.9)	20.9 (9.8–31.9)	7.2 (5.4–9.0)	19.7 (15.7–23.8)
2020	12.5 (11.9–13.0)	13.3 (12.7–14.0)	14.4 (12.6–16.3)	8.0 (7.0–9.2)	27.1 (17.4–38.6)	8.0 (6.4–9.9)	19.5 (14.9–24.7)
2021	11.5 (11.1–12.0)	12.9 (12.3–13.6)	11.7 (10.4–13.2)	7.7 (6.8–8.7)	—[e]	5.4 (4.2–6.9)	14.9 (11.6–19.0)

Source: NHIS, National Center for Health Statistics, public use data, 2021.

Notes: **CI =** confidence interval; **N/A =** not available.

[a]For NHIS survey years 1965–1991, people who currently smoked included adults who reported having smoked more than 100 cigarettes in their lifetimes and specified that they currently smoked. Since 1992, people who currently smoked included adults who reported having smoked at least 100 cigarettes in their lifetimes and specified that they currently smoked “every day” or “some days.”

[b]All other categories, not necessarily Hispanic (NHIS did not code for Hispanic as a separate demographic from 1965 to 1974).

[c]Beginning with the 1999 NHIS, “Asian American and Pacific Islander” was assessed separately as “Asian” and “Native Hawaiian and Other Pacific Islander.” For purposes of trends, these categories are combined here.

[d]The NHIS underwent a redesign in 2019. Because of the changes in weighting and design methodology, direct comparisons between estimates beginning in 2019 and earlier years should be made with caution because the effects of these changes have not been fully evaluated yet.

[e]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

Patterns of Ever and Current Use of Cigarettes

Youth

Table 2.3 presents YRBS data from 2019 on the prevalence of cigarette use among high school students by race and ethnicity. Ever use of cigarettes was lowest among Asian students (8.9%; 95% CI: 6.7–11.8), followed by Black students (14.2%; 95% CI, 10.7–18.7), Native Hawaiian and Other Pacific Islander students (23.7%; 95% CI, 13.4–38.4), White students (25.6%; 95% CI, 22.2–29.4), Hispanic students (26.1%; 95% CI, 21.0–32.0), non-Hispanic multiple race students (30.6%; 95% CI, 25.9–35.6), and American Indian and Alaska Native students (37.9%; 95% CI, 25.0–52.8).

Past-30-day (current) use was highest among American Indian and Alaska Native students (20.6%; 95% CI, 10.8–35.9), followed by non-Hispanic multiple race students (8.0%; 95% CI, 5.5–11.3), White students (6.7%; 95% CI, 5.3–8.4), Hispanic students (6.0%; 95% CI, 4.3–8.4), Native Hawaiian and Other Pacific Islander students (4.5%; 95% CI, 1.2–15.2), Black students (3.3%; 95% CI, 2.3–4.6), and Asian students (2.3%; 95% CI, 1.2–4.3).

Among youth (12–17 years of age), the incidence of the onset of cigarette smoking, defined as having moved from never smoking to daily smoking during the year, was highest among White youth. According to an analysis of NSDUH data from 2006 to 2013, the annual rate of smoking onset from multivariate regression models was significantly higher among White youth (boys: 0.026; girls: 0.026) compared with Black (boys: 0.009; girls: 0.009), Hispanic (boys: 0.015; girls: 0.012), and Asian/Pacific Islander (boys: 0.011; girls: 0.009) youth (Thompson et al. 2018). However, during this period, the rate of decline in the onset of cigarette smoking was faster for White youth than for youth in other racial and ethnic groups (Thompson et al. 2018). For example, White boys experienced a 0.2 percentage point decline in smoking onset for each successive annual cohort during 2006–2013, while the annual decline in smoking onset was 0.1 percentage points each year among Black boys. Among White girls, there was a 0.3 percentage point decline in smoking onset per year, while both Black and Hispanic girls experienced a decline in smoking onset of 0.1 percentage points per year (Thompson et al. 2018).

Adults

Among young adults (18–25 years of age), trends in the incidence of the onset of cigarette smoking were similar to that observed among youth (12–17 years of age). Specifically, declines in the onset of cigarette smoking (becoming a new smoker) were slower among Black and Hispanic young women than White young women. In addition, the onset of smoking increased among successive cohorts of Black and Hispanic young men compared with White and Asian young men (Thompson et al. 2018). Despite faster declines in the rate of smoking onset among White young adults compared with other racial and ethnic groups, the overall rate of smoking onset was higher during 2006–2013 among White young adults than it was among all other racial and ethnic groups (Thompson et al. 2018).

The prevalence of cigarette use among adults who identify with specific racial and ethnic groups has changed over time, according to data from NHIS (Figure 2.1). Table 2.4 provides NSDUH data from 2019 on the prevalence of cigarette use among adults across the seven racial and ethnic groups described previously in this chapter. The highest prevalence of ever use of cigarettes was among American Indian and Alaska Native adults (68.6%; 95% CI, 59.7–77.5), followed by White (68.1%; 95% CI, 67.1–69.0), multiple race (64.5%; 95% CI, 60.7–68.2), Hispanic (46.4%; 95% CI, 44.6–48.1), Black (45.2%; 95% CI, 43.1–47.3), Native Hawaiian and Pacific Islander (41.8%; 95% CI, 32.8–50.7), and Asian (32.3%; 95% CI, 28.9–35.8) adults.

Estimates by race and ethnicity from the 2019 NSDUH indicate that past-month use of cigarettes, defined as having smoked part or all of a cigarette during the 30 days prior to the interview, was generally lowest among adults 65 years of age and older (Table 2.5). Among Asian, Black, Hispanic, multiple race, or White adults, the prevalence of ever cigarette use increased between ages 18–25 and 26–49. Among Black, multiple race, and White adults, the prevalence of past-month cigarette use also increased significantly between ages 18–25 and 26–49.

The highest prevalence of past-month cigarette use was observed among American Indian and Alaska Native adults (30.7%; 95% CI, 23.7–37.7) and multiple race adults (30.6%; 95% CI, 26.7–34.5), followed by Black (20.6%; 95% CI, 18.8–22.3), White (19.4%; 95% CI, 18.6–20.1), Native Hawaiian and Pacific Islander (14.1%; 95% CI, 8.6–19.7), Hispanic (13.4%; 95% CI, 12.2–14.7), and Asian adults (8.0%; 95% CI, 6.3–9.7) (Table 2.4).

Menthol Cigarette Use

Evidence reviews have concluded that, compared with nonmenthol cigarette use, menthol cigarette use is associated with a greater likelihood of dependence among young people who are experimenting with smoking and with decreased likelihood of cessation success among adults who are trying to quit (Tobacco Products Scientific Advisory Committee 2011; U.S. Food and Drug

Table 2.3 Prevalence of ever use of cigarettes[a] and electronic vapor products, current use[b] of tobacco products, and quit attempts[c] among high school students, by race, ethnicity,[d] and sex; national Youth Risk Behavior Survey (YRBS) 2019, United States

A. By race and ethnicity

			Current use of tobacco products: % (95% CI)					
Race and ethnicity	**Ever use of cigarettes: % (95% CI)**	**Ever use of electronic vapor products: % (95% CI)**	**Cigarettes**	**Cigars[e]**	**Smokeless tobacco[f]**	**Electronic vapor products[g]**	**≥2 tobacco products[h]**	**Ever quit attempt: % (95% CI)**
Total	24.1 (21.3–27.0)	50.1 (48.1–52.2)	6.0 (5.0–7.2)	5.7 (4.8–6.7)	3.8 (3.2–4.6)	32.7 (30.7–34.8)	8.2 (7.0–9.5)	47.6 (45.1–50.1)
American Indian and Alaska Native	37.9 (25.0–52.8)	57.9 (44.7–70.0)	20.6 (10.8–35.9)	14.9 (7.4–27.9)	16.2 (7.0–33.2)	47.3 (34.7–60.4)	23.8 (13.4–38.5)	48.5 (27.1–70.5)
Asian	8.9 (6.7–11.8)	24.9 (21.5–28.6)	2.3 (1.2–4.3)	1.0 (0.4–3.0)	0.8 (0.3–1.9)	13.0 (9.5–17.5)	2.5 (1.3–4.8)	43.1 (33.4–53.3)
Black	14.2 (10.7–18.7)	40.0 (37.2–42.7)	3.3 (2.3–4.6)	5.3 (4.1–6.8)	2.8 (1.8–4.4)	19.7 (16.9–22.8)	4.8 (3.7–6.2)	33.8 (26.2–42.4)
Hispanic	26.1 (21.0–32.0)	49.5 (47.0–52.1)	6.0 (4.3–8.4)	6.1 (4.7–8.0)	3.1 (2.3–4.3)	31.2 (28.6–33.8)	7.9 (6.2–10.0)	51.5 (46.0–56.9)
Multiple race	30.6 (25.9–35.6)	55.3 (48.6–61.8)	8.0 (5.5–11.3)	6.5 (4.4–9.6)	3.8 (2.1–6.8)	33.5 (28.1–39.4)	9.2 (6.6–12.7)	48.0 (38.2–57.9)
Native Hawaiian and Other Pacific Islander	23.7 (13.4–38.4)	58.7 (46.6–69.8)	4.5 (1.2–15.2)	8.6 (2.9–22.6)	13.8 (5.0–32.9)	38.8 (28.2–50.5)	15.7 (6.4–33.9)	—[i]
White	25.6 (22.2–29.4)	54.7 (52.2–57.2)	6.7 (5.3–8.4)	5.9 (4.7–7.4)	4.4 (3.3–5.7)	38.3 (36.0–40.7)	9.5 (7.8–11.5)	48.4 (45.1–51.7)

B. By race, ethnicity, and sex[j]

			Current use of tobacco products: % (95% CI)					
Race, ethnicity, and sex	**Ever use of cigarettes: % (95% CI)**	**Ever use of electronic vapor products: % (95% CI)**	**Cigarettes**	**Cigars[e]**	**Smokeless tobacco[f]**	**Electronic vapor products[g]**	**≥2 tobacco products[h]**	**Ever quit attempt: % (95% CI)**
Total								
Male	25.3 (22.1–28.8)	49.6 (47.3–51.9)	6.9 (5.7–8.4)	7.4 (6.4–8.6)	5.8 (4.7–7.1)	32.0 (29.7–34.3)	10.4 (9.0–11.9)	45.6 (42.8–48.6)
Female	22.9 (20.1–26.1)	50.7 (48.2–53.2)	4.9 (3.8–6.4)	3.8 (2.8–5.1)	1.6 (1.2–2.1)	33.5 (30.9–36.1)	5.8 (4.5–7.5)	50.0 (45.7–54.3)
American Indian and Alaska Native								
Male	39.6 (23.8–57.9)	54.2 (38.5–69.1)	22.3 (10.5–41.3)	20.5 (9.2–39.5)	23.3 (10.3–44.5)	48.7 (35.0–62.5)	26.7 (14.0–44.8)	—[i]
Female	37.2 (19.1–59.8)	63.7 (43.4–80.1)	15.7 (5.1–39.2)	7.8 (2.4–22.9)	3.4 (0.6–17.8)	47.3 (28.5–66.8)	17.4 (6.4–39.5	—[i]

Table 2.3 Continued

Race, ethnicity, and sex	Ever use of cigarettes: % (95% CI)	Ever use of electronic vapor products: % (95% CI)	Current use of tobacco products: % (95% CI) Cigarettes	Cigars[e]	Smokeless tobacco[f]	Electronic vapor products[g]	≥2 tobacco products[h]	Ever quit attempt: % (95% CI)
Asian								
Male	10.4 (7.6–14.3)	25.1 (19.3–32.0)	3.6 (1.5–8.2)	1.9 (0.6–6.0)	0.9 (0.3–2.3)	13.8 (9.4–20.0)	3.8 (1.8–8.2)	48.3 (34.7–62.2)
Female	7.4 (3.7–14.0)	24.7 (20.2–29.7)	1.0 (0.3–3.3)	0.2 (0.0–1.0)	0.7 (0.2–1.9)	12.1 (8.4–17.2)	1.2 (0.6–2.4)	36.7 (21.1–55.7)
Black								
Male	15.8 (11.1–22.1)	40.8 (36.4–45.2)	4.2 (2.7–6.6)	6.4 (4.6–8.9)	3.7 (2.2–6.2)	21.5 (18.2–25.1)	6.0 (4.3–8.4)	39.9 (31.4–49.1)
Female	12.3 (9.2–16.3)	39.0 (34.6–43.5)	2.0 (1.0–4.0)	3.8 (2.3–6.1)	1.7 (0.8–3.8)	17.7 (14.4–21.4)	3.2 (1.9–5.2)	25.6 (15.3–39.5)
Hispanic								
Male	28.1 (20.4–37.4)	48.5 (45.2–51.8)	7.8 (4.8–12.5)	7.3 (5.4–9.9)	3.4 (2.2–5.1)	29.2 (25.9–32.9)	9.7 (7.0–13.4)	49.3 (43.6–55.1)
Female	24.4 (20.7–28.4)	50.5 (46.3–54.8)	4.3 (3.1–6.0)	4.9 (3.3–6.9)	2.9 (1.9–4.3)	33.0 (29.1–37.1)	6.1 (4.5–8.1)	53.4 (45.1–61.6)
Multiple race								
Male	29.3 (22.3–37.3)	52.9 (44.3–61.4)	8.6 (5.6–13.1)	8.5 (4.8–14.5)	6.2 (3.2–11.7)	32.4 (25.6–40.1)	11.9 (8.2–17.0)	49.9 (34.8–64.9)
Female	31.8 (24.6–40.0)	57.6 (48.7–66.1)	7.3 (4.2–12.4)	4.8 (2.5–9.1)	1.7 (0.7–4.4)	34.7 (28.3–41.7)	6.8 (3.9–11.5)	46.5 (30.1–63.8)
White								
Male	26.9 (23.8–30.3)	54.4 (51.5–57.3)	7.4 (6.1–8.9)	8.1 (6.6–10.0)	7.6 (5.7–10.0)	37.7 (34.9–40.6)	12.3 (10.4–14.4)	45.1 (41.4–48.9)
Female	24.4 (20.1–29.2)	55.1 (52.0–58.1)	6.0 (4.1–8.6)	3.5 (2.3–5.2)	0.9 (0.6–1.5)	38.9 (35.9–42.0)	6.6 (4.6–9.4)	52.3 (46.9–57.7)

Source: YRBS, Centers for Disease Control and Prevention, public use data, 2019; CDC (n.d.a).
Notes: **CI** = confidence interval.
[a]At least one or two puffs.
[b]On at least 1 day during the 30 days before the survey.
[c]Includes ever quit attempt of cigarettes, cigars, smokeless tobacco, shisha or hookah tobacco, and electronic vapor products during the 12 months before the survey among high school students who used any tobacco products during the 12 months before the survey.
[d]All categories except Hispanic are considered non-Hispanic or Latino.
[e]Includes use of cigars, cigarillos, or little cigars on at least 1 day during the 30 days before the survey.
[f]Includes use of chewing tobacco, snuff, dip, snus, or dissolvable tobacco products—such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, Copenhagen, Camel Snus, Marlboro Snus, General Snus, Ariva, Stonewall, or Camel Orbs—not counting any electronic vapor products on at least 1 day during the 30 days before the survey.
[g]Includes use of e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods (e.g., JUUL, Vuse, MarkTen, and blu) on at least 1 day during the 30 days before the survey.
[h]Percentage of students who used two or more of the following tobacco products: cigarettes, cigars (cigars, cigarillos, or little cigars), electronic vapor products, or smokeless tobacco on 1 or more days during the 30 days before the survey.
[i]Data are suppressed.
[j]Data for Native Hawaiian and Other Pacific Islander by sex are suppressed due to small sample sizes.

Table 2.4 Prevalence of ever use of cigarettes, past-month use of tobacco products, and cigarette smoking cessation among adults, 18 years of age and older, by race and ethnicity; National Survey on Drug Use and Health (NSDUH) 2019, United States

		Past-month use of tobacco products: % (95% CI)						Cigarette smoking cessation:[a] % (95% CI)		
Race and ethnicity	**Ever use of cigarettes: % (95% CI)**	**Any tobacco product**	**Cigarettes**	**Cigars**	**Smokeless tobacco**	**Pipes**	**≥2 tobacco products[b]**	**Never quit or quit for ≤30 days[c]**	**Quit for >30 days but <1 year[d]**	**Quit for 1 year or more[e]**
American Indian and Alaska Native	68.6 (59.7–77.5)	36.4 (29.0–43.8)	30.7 (23.7–37.7)	4.6 (2.8–6.4)	7.1 (3.5–10.6)	—[f]	6.6 (4.3–9.0)	45.0 (34.6–55.3)	—[f]	42.8 (31.6–54.1)
Asian	32.3 (28.9–35.8)	10.2 (8.2–12.2)	8.0 (6.3–9.7)	1.4 (0.8–2.0)	1.2 (0.5–2.0)	—[f]	0.6 (0.3–0.9)	24.9 (20.5–29.4)	10.3 (6.9–13.6)	64.8 (59.3–70.3)
Black	45.2 (43.1–47.3)	25.8 (23.9–27.6)	20.6 (18.8–22.3)	8.6 (7.6–9.6)	1.3 (0.9–1.8)	0.7 (0.4–1.0)	4.8 (4.0–5.6)	46.0 (42.7–49.2)	5.3 (4.1–6.5)	48.7 (45.6–51.9)
Native Hawaiian and Pacific Islander	41.8 (32.8–50.7)	21.8 (14.6–29.0)	14.1 (8.6–19.7)	—[f]	—[f]	—[f]	—[f]	33.9 (21.7–46.0)	12.7 (5.8–19.6)	53.5 (39.1–67.9)
Hispanic	46.4 (44.6–48.1)	15.6 (14.3–17.0)	13.4 (12.2–14.7)	3.2 (2.7–3.8)	0.9 (0.6–1.1)	0.5 (0.3–0.7)	2.2 (1.8–2.6)	29.2 (26.5–31.9)	9.0 (7.7–10.3)	61.8 (58.9–64.6)
Multiple race	64.5 (60.7–68.2)	34.6 (30.5–38.6)	30.6 (26.7–34.5)	6.9 (4.6–9.2)	3.9 (2.0–5.8)	3.1 (1.7–4.6)	7.7 (5.1–10.3)	47.5 (42.5–52.5)	6.6 (3.9–9.3)	45.9 (40.5–51.2)
White	68.1 (67.1–69.0)	24.8 (24.0–25.6)	19.4 (18.6–20.1)	4.3 (4.0–4.7)	4.5 (4.1–4.8)	0.8 (0.6–1.0)	3.6 (3.3–3.9)	28.6 (27.5–29.7)	5.4 (5.0–5.8)	66.0 (64.8–67.2)

Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.

Notes: **CI =** confidence interval.

[a]Cigarette smoking cessation estimates were calculated among people who had ever smoked cigarettes.

[b]Any combination of more than one tobacco product (cigarettes, cigars, smokeless tobacco, or pipes).

[c]Among people who had ever smoked cigarettes, respondent answered “Within the past 30 days” to the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[d]Among people who had ever smoked cigarettes, respondent answered “More than 30 days ago but within the past 12 months.” To the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[e]Among people who had ever smoked cigarettes, respondent answered “More than 12 months ago but within the past 3 years” or “More than 3 years ago” to the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[f]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

Table 2.5 Prevalence of ever use of cigarettes, past-month use of tobacco products, and smoking cessation among adults, 18 years of age and older, by race and ethnicity and age (in years); National Survey on Drug Use and Health (NSDUH) 2019, United States

		Past-month use of tobacco products: % (95% CI)					Smoking cessation:[a] % (95% CI)		
Race, ethnicity, and age (in years)	Ever use of cigarettes: % (95% CI)	Cigarettes	Cigars	Smokeless tobacco	Pipes	≥2 tobacco products[b]	Never quit or quit for ≤30 days[c]	Quit for >30 days but <1 year[d]	Quit for 1 year or more[e]
American Indian and Alaska Native									
18–25	65.0 (56.1–74.0)	29.1 (19.3–39.0)	—[f]	10.9 (6.0–15.8)	—[f]	9.6 (4.3–14.9)	44.8 (32.8–56.7)	20.6 (8.3–32.8)	34.6 (24.1–45.2)
26–49	79.6 (71.8–87.5)	43.3 (34.3–52.2)	7.4 (4.3–10.5)	9.5 (4.0–15.0)	—[f]	11.1 (6.3–16.0)	54.8 (45.2–64.4)	—[f]	42.6 (33.2–52.1)
50–64	67.0 (50.2–83.8)	32.9 (17.5–48.4)	—[f]	—[f]	—[f]	—[f]	49.2 (28.5–69.8)	—[f]	—[f]
≥65	—[f]	—[f]	N/A	N/A	N/A	N/A	—[f]	—[f]	—[f]
Asian									
18–25	27.3 (23.0–31.5)	9.3 (7.2–11.4)	2.2 (0.9–3.6)	—[f]	—[f]	—[f]	35.2 (29.1–41.3)	22.6 (15.6–29.6)	42.2 (33.5–51.0)
26–49	37.1 (32.4–41.7)	9.4 (7.4–11.4)	1.5 (0.6–2.3)	—[f]	—[f]	—[f]	25.4 (20.8–29.9)	11.2 (7.3–15.1)	63.4 (58.1–68.7)
50–64	29.9 (19.5–40.3)	—[f]	—[f]	—[f]	—[f]	N/A	—[f]	—[f]	—[f]
≥65	25.0 (14.8–35.1)	—[f]	—[f]	N/A	N/A	N/A	—[f]	N/A	—[f]
Black									
18–25	27.2 (24.9–29.4)	12.3 (10.5–14.0)	12.2 (10.2–14.2)	1.5 (0.7–2.2)	—[f]	4.7 (3.3–6.1)	46.5 (41.0–52.0)	13.0 (9.2–16.9)	40.5 (35.0–45.9)
26–49	47.4 (45.3–49.6)	24.4 (22.7–26.0)	11.1 (9.5–12.8)	1.1 (0.6–1.6)	0.7 (0.4–1.1)	6.0 (4.8–7.1)	51.6 (48.3–55.0)	5.7 (4.1–7.4)	42.6 (39.6–45.6)
50–64	49.5 (43.8–55.2)	25.1 (20.5–29.6)	5.3 (3.0–7.6)	—[f]	—[f]	4.5 (2.4–6.6)	51.2 (45.1–57.3)	—[f]	45.3 (38.9–51.7)
≥65	49.6 (44.3–54.9)	11.5 (7.8–15.2)	3.2 (1.3–5.1)	—[f]	—[f]	—[f]	23.2 (16.1–30.2)	—[f]	74.0 (66.7–81.3)

Table 2.5 Continued

Race, ethnicity, and age (in years)	Ever use of cigarettes: % (95% CI)	Past-month use of tobacco products: % (95% CI)					Smoking cessation:[a] % (95% CI)		
		Cigarettes	Cigars	Smokeless tobacco	Pipes	≥2 tobacco products[b]	Never quit or quit for ≤30 days[c]	Quit for >30 days but <1 year[d]	Quit for 1 year or more[e]
Native Hawaiian and Pacific Islander									
18–25	34.9 (20.3–49.5)	—[f]	—[f]	—[f]	—[f]	—[f]	—[f]	—[f]	—[f]
26–49	50.3 (38.2–62.4)	13.7 (6.0–21.3)	—[f]	—[f]	—[f]	—[f]	27.2 (12.6–41.8)	—[f]	62.4 (46.7–78.2)
50–64	—[f]	—[f]	N/A	N/A	—[f]	—[f]	—[f]	—[f]	—[f]
≥65	—[f]	—[f]	N/A	N/A	N/A	N/A	—[f]	N/A	—[f]
Hispanic									
18–25	38.8 (36.5–41.1)	13.8 (12.0–15.7)	5.2 (4.2–6.2)	1.8 (1.1–2.4)	0.8 (0.4–1.3)	3.9 (3.0–4.8)	36.3 (31.6–41.1)	18.6 (14.8–22.4)	45.1 (40.4–49.7)
26–49	50.3 (48.0–52.6)	16.1 (14.5–17.7)	3.8 (3.1–4.6)	1.0 (0.6–1.3)	0.7 (0.3–1.1)	2.5 (1.9–3.0)	32.3 (29.6–34.9)	8.4 (6.7–10.2)	59.3 (56.1–62.5)
50–64	47.1 (42.6–51.7)	11.1 (7.4–14.7)	—[f]	—[f]	—[f]	—[f]	23.5 (15.6–31.4)	—[f]	71.5 (63.4–79.7)
≥65	40.0 (33.4–46.7)	5.4 (2.5–8.2)	N/A	—[f]	—[f]	—[f]	13.4 (5.5–21.3)	—[f]	80.7 (71.0–90.4)
Multiple race									
18–25	43.6 (38.4–48.8)	20.1 (15.5–24.6)	8.6 (6.0–11.3)	5.4 (2.7–8.0)	—[f]	8.9 (6.0–11.8)	46.6 (38.5–54.7)	13.7 (7.6–19.8)	39.7 (29.6–49.8)
26–49	71.0 (66.1–75.8)	32.6 (27.4–37.7)	6.6 (4.0–9.2)	—[f]	2.4 (1.4–3.5)	6.2 (4.0–8.4)	45.8 (39.9–51.7)	5.9 (2.6–9.2)	48.3 (42.1–54.4)
50–64	72.5 (62.1–82.9)	41.3 (30.7–51.8)	—[f]	—[f]	—[f]	—[f]	56.9 (43.3–70.6)	—[f]	39.7 (26.4–52.9)
≥65	64.4 (51.0–77.8)	25.6 (11.8–39.5)	—[f]	—[f]	—[f]	—[f]	—[f]	—[f]	53.3 (33.4–73.3)

Table 2.5 Continued

Race, ethnicity, and age (in years)	Ever use of cigarettes: % (95% CI)	Past-month use of tobacco products: % (95% CI)					Smoking cessation:[a] % (95% CI)		
		Cigarettes	Cigars	Smokeless tobacco	Pipes	≥2 tobacco products[b]	Never quit or quit for ≤30 days[c]	Quit for >30 days but <1 year[d]	Quit for 1 year or more[e]
White									
18–25	51.1 (49.4–52.8)	21.4 (20.1–22.6)	8.0 (7.3–8.8)	7.5 (6.6–8.3)	1.6 (1.3–2.0)	7.7 (6.8–8.5)	42.4 (40.3–44.5)	19.6 (18.0–21.3)	38.0 (35.9–40.0)
26–49	71.4 (70.3–72.5)	25.3 (24.3–26.2)	4.8 (4.4–5.3)	6.5 (6.0–7.0)	0.7 (0.5–0.9)	4.6 (4.1–5.1)	35.5 (34.1–36.9)	6.5 (6.0–7.1)	58.0 (56.7–59.3)
50–64	71.7 (70.1–73.4)	20.7 (19.2–22.3)	4.3 (3.4–5.2)	3.6 (2.7–4.4)	0.8 (0.3–1.2)	2.7 (2.1–3.3)	29.1 (26.9–31.3)	2.8 (2.0–3.6)	68.1 (65.7–70.5)
≥65	67.1 (64.5–69.6)	8.5 (7.3–9.7)	2.0 (1.4–2.6)	1.2 (0.8–1.5)	0.5 (0.2–0.8)	1.1 (0.6–1.6)	12.8 (11.0–14.6)	1.8 (1.2–2.4)	85.4 (83.5–87.2)

Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.

Notes: **CI =** confidence interval; **N/A =** not available.

[a]Cigarette smoking cessation estimates were calculated among those who responded “Yes” to “Have you ever smoked part or all of a cigarette?”

[b]Any combination of more than one tobacco product (cigarettes, cigars, smokeless tobacco, or pipes).

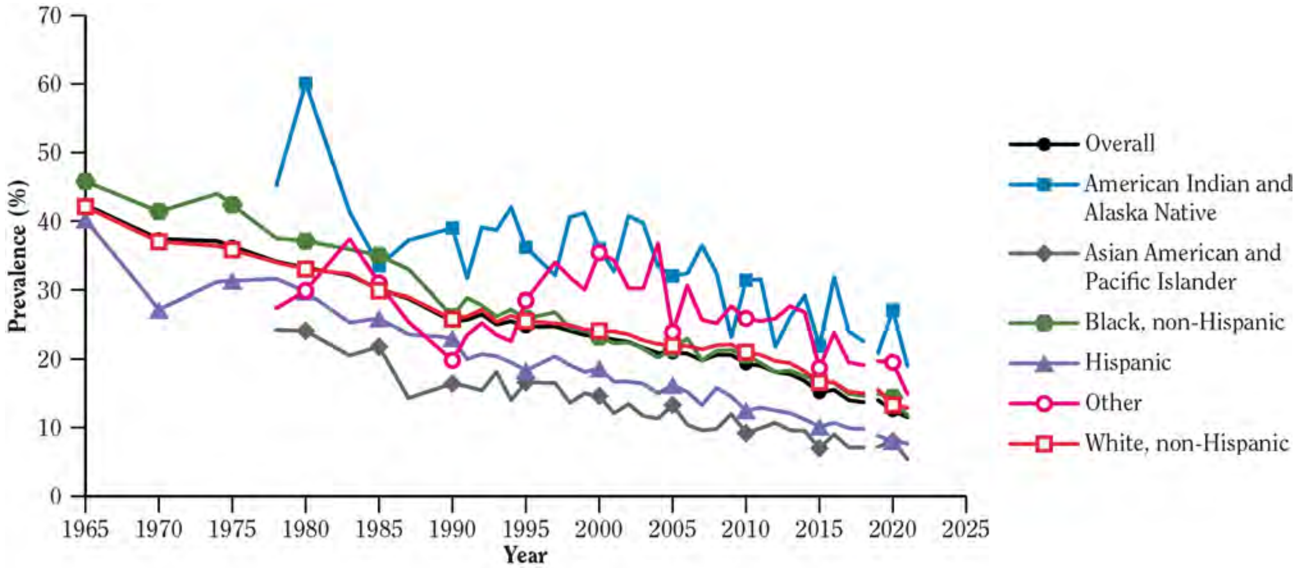
[c]Among people who had ever smoked cigarettes, respondent answered “Within the past 30 days” to the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[d]Among people who had ever smoked cigarettes, respondent answered “More than 30 days ago but within the past 12 months.” To the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[e]Among people who had ever smoked cigarettes, respondent answered “More than 12 months ago but within the past 3 years” or “More than 3 years ago” to the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[f]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

Figure 2.1 Trends in the prevalence of current cigarette smoking[a] among adults, 18 years of age and older, by race and ethnicity;[b,c] National Health Interview Survey (NHIS) 1965–2021,[d,e] United States



Source: NHIS, National Center for Health Statistics, public use data, 1965–2021.

[a]For NHIS survey years 1965–1991, people who currently smoked included adults who reported having smoked 100 or more cigarettes in their lifetimes and specified that they currently smoked. Since 1992, people who currently smoked included adults who reported having smoked at least 100 cigarettes in their lifetimes and specified that they currently smoked "every day" or "some days."

[b]All other categories, not necessarily Hispanic (NHIS Survey did not code for Hispanic as a separate demographic from 1965 to 1974).

[c]Beginning with the 1999 NHIS, "Asian American and Pacific Islander" was assessed separately as "Asian" and "Native Hawaiian and Other Pacific Islander." For purposes of trends, these categories are combined here.

[d]For the "Overall" category, data for White, non-Hispanic; Black, non-Hispanic, and Hispanic people were not reported for 1966–1969, 1971–1973, 1975–1977, 1979, 1981, 1982, 1984, 1986, 1988, 1989, and 1996. For the specific races/ethnicities, data were not reported for people who were American Indian and Alaska Native and Asian American and Pacific Islander for 1965–1977, 1979, 1981, 1982, 1984, 1986, 1988, 1989, and 1996.

[e]The NHIS underwent a redesign in 2019. Because of the changes in weighting and design methodology, direct comparisons between estimates beginning in 2019 and earlier years should be made with caution because the effects of these changes have not been fully evaluated yet. This change is represented by a break in the trend lines between 2018 and 2019.

Administration [FDA] 2013a,b; Villanti et al. 2017; Federal Register 2022).

Several studies published since 2009 have also documented the higher prevalence of menthol cigarette use among Black people who smoke compared with White or Hispanic people who smoke (Cubbin et al. 2010; Lawrence et al. 2010; Rock et al. 2010; Jones et al. 2013; Giovino et al. 2015; Villanti et al. 2016; Seaman et al. 2022). Table 2.6 presents the prevalence of menthol cigarette use among people who had smoked cigarettes during the past month by racial and ethnic group. Estimates from 2017–2019 NSDUH data show that the prevalence of menthol cigarette use was highest among Black people who smoke cigarettes (88.1%; 95% CI, 86.4–89.6), followed by Native Hawaiian and Pacific Islander (73.5%; 95% CI, 59.4–89.6), Hispanic (50.0%; 95% CI, 47.6–52.4), multiple race (48.2%; 95% CI, 43.3–53.1), Asian (45.0%; 95% CI, 39.0–51.0), American Indian and Alaska Native (34.2%; 95% CI, 29.3–39.5), and White people who smoke (31.4%; 95% CI, 30.4–32.3).

The prevalence of menthol cigarette use was also higher among women (46.2%; 95% CI, 44.9–47.6) versus men (38.7%; 95% CI, 37.5–39.8); among people who identify as lesbian or gay (50.8%; 95% CI, 45.2–56.5) or bisexual (51.8%; 95% CI, 49.1–54.5) versus those who identify as heterosexual (41.0%; 95% CI, 40.0–42.0); among people with household incomes less than \$75,000 (<\$10,000–\$29,999: 48.4%; 95% CI, 46.4–50.4; \$30,000–\$74,999: 43.4%; 95% CI, 42.1–44.7) versus people with household incomes of \$75,000 or more (39.0%; 95% CI, 36.8–41.2); and among people reporting symptoms of past-month serious psychological distress (50.5%; 95% CI, 47.9–53.0) versus people not reporting such symptoms (40.8%; 95% CI, 39.8–41.7). These patterns were generally consistent across young adults (18–25 years of age) and older adults (26 years of age and older).

Table 2.6 Prevalence of menthol cigarette use[a] among people who smoked during the past month, by age group, gender, sexual orientation, race and ethnicity, household income, and past-month serious psychological distress; National Survey on Drug Use and Health (NSDUH) 2017–2019, United States

Characteristics	Total: % (95% CI)	Youth (12–17 years of age): % (95% CI)	Young adults (18–25 years of age): % (95% CI)	Adults (26 years of age and older): % (95% CI)
Overall	42.1 (41.2–43.0)	54.3 (50.3–58.3)	52.4 (51.1–53.8)	40.2 (39.2–41.2)
Gender				
Male	38.7 (37.5–39.8)	52.4 (46.6–58.2)	47.4 (45.5–49.2)	36.9 (35.6–38.2)
Female	46.2 (44.9–47.6)	56.6 (50.9–62.1)	59.4 (57.4–61.5)	44.1 (42.5–45.7)
Sexual orientation				
Heterosexual	41.0 (40.0–42.0)	N/A	51.3 (49.8–52.9)	39.4 (38.4–40.5)
Lesbian/gay	50.8 (45.2–56.5)	N/A	58.1 (49.8–65.9)	49.1 (42.7–55.5)
Bisexual	51.8 (49.1–54.5)	N/A	57.9 (54.0–61.7)	48.7 (45.3–52.2)
Race and ethnicity				
American Indian and Alaska Native	34.2 (29.3–39.5)	—[b]	43.7 (31.6–56.5)	32.2 (26.7–38.3)
Asian	45.0 (39.0–51.0)	—[b]	51.8 (43.0–60.5)	43.6 (36.8–50.6)
Black	88.1 (86.4–89.6)	—[b]	88.8 (86.2–90.9)	88.1 (86.2–89.7)
Native Hawaiian and Pacific Islander	73.5 (59.4–84.1)	—[b]	76.0 (55.1–89.0)	73.5 (56.9–85.4)
Hispanic	50.0 (47.6–52.4)	60.6 (50.4–69.8)	60.5 (56.7–64.2)	47.3 (44.4–50.2)
Multiple race	48.2 (43.3–53.1)	38.3 (25.4–53.1)	47.1 (40.8–53.5)	48.7 (42.9–54.5)
White	31.4 (30.4–32.3)	52.7 (48.1–57.2)	44.6 (43.0–46.2)	28.9 (27.8–30.1)
Household income				
<$10,000–$29,999	48.4 (46.4–50.4)	63.0 (54.3–70.9)	51.3 (48.9–53.7)	47.6 (45.3–49.9)
$30,000–$74,999	43.4 (42.1–44.7)	52.6 (45.4–59.8)	56.1 (53.9–58.3)	41.3 (39.8–42.8)
$75,000 or more	39.0 (36.8–41.2)	44.2 (35.4–53.5)	52.2 (47.9–56.5)	37.0 (34.6–39.5)
Past-month serious psychological distress[c]				
Yes	50.5 (47.9–53.0)	N/A	56.5 (53.4–59.5)	48.5 (45.3–51.7)
No	40.8 (39.8–41.7)	N/A	51.3 (49.8–52.8)	39.2 (38.2–40.2)

Source: NSDUH, National Survey on Drug Use and Health, 2017–2019.

Notes: **CI =** confidence intervals. **N/A =** Data unavailable.

[a]Includes people who smoked cigarettes during the past month and who indicated having smoked a menthol cigarette or a brand of Kool or menthol.

[b]Data were statistically unreliable because of an unweighted denominator <50 or a relative standard error >30%.

[c]Serious psychological distress was defined using the Kessler-6 measure. Respondents were rated on a Likert scale for how frequently they experienced the following symptoms of psychological distress during the past 30 days: (1) nervousness, (2) hopelessness, (3) feeling restless or fidgety, (4) feeling so depressed that nothing could cheer them up, (5) feeling that everything was an effort, and (6) feeling worthless. Responses were coded as follows: "all of the time" was coded as 4; "most of the time" as 3; "some of the time" as 2; "a little of the time" as 1; and "none of the time" as 0. Response codes 0–4 were summed to yield a score range of 0–24. Serious psychological distress was defined as a value of 13 or more.

The higher prevalence of menthol cigarette use among certain populations has implications for health disparities for two primary reasons. First, menthol in tobacco products is positively associated with increased tobacco product initiation and progression to regular tobacco use (Nonnemaker et al. 2013; Villanti et al. 2019, 2021), which could increase exposure to cigarette smoking and its harms (USDHHS 2014). Second, among some minoritized racial and ethnic populations, tobacco cessation is lower among people who smoke menthol cigarettes than among people who smoke nonmenthol cigarettes (Stahre et al. 2010; Delnevo et al. 2011b; Smith et al. 2020a).

Greater progression to regular cigarette use and reduced successful quitting means that group differences in menthol cigarette use could serve to maintain or worsen disparities in current cigarette use overall. Chapter 3 of this report details the factors that may influence the use of flavored tobacco products, including menthol, by certain groups of people and how this use influences tobacco-related health disparities along the tobacco use continuum.

Patterns of Frequency and Quantity of Cigarette Use

Understanding racial and ethnic differences in cigarette use is complicated by differences in the frequency and quantity of use by populations. Historically, nondaily cigarette use has been more common among some racial and ethnic groups (NCI 2017; Wang et al. 2018) compared with White people. In particular, Black, Asian and Pacific Islander, and Hispanic people who smoke were found to be more likely to smoke intermittently and to consume fewer cigarettes on days in which they smoked than White people (Trinidad et al. 2011). Compared with never using cigarettes, nondaily cigarette use is associated with a higher risk of death, including death from cancer, heart disease, and respiratory disease (Inoue-Choi et al. 2019, 2020).

NSDUH data from 2019 on adults 18 years of age and older indicate that, among American Indian and Alaska Native people, 13.6% of men and 11.2% of women smoked cigarettes nondaily in the past month. The prevalence of nondaily cigarette use was next highest among Black (13.3% of men, 9.0% of women), multiple race (10.9% of men, 10.5% of women), Hispanic (10.7% of men, 5.8% of women), Asian (7.9% of men, 2.5% of women), White (7.2% of men, 6.0% of women), and Native Hawaiian and Pacific Islander (4.8% of men, 6.9% of women) people (NSDUH, public use data, 2019).

Patterns of Smoking Cessation

Investigations into racial and ethnic differences in cessation suggest that, compared with White people, Black people who smoke make more quit attempts but are less successful at long-term quitting (Kulak et al. 2016). Data from the NSDUH in 2019 (Table 2.4) align with this pattern. The prevalence of long-term quitting (1 year or more) among adults who had ever smoked cigarettes was lower among American Indian and Alaska Native (42.8%; 95% CI, 31.6–54.1), Black (48.7%; 95% CI, 45.6–51.9), and multiple race (45.9%; 95% CI, 40.5–51.2) adults than Hispanic (61.8%; 95% CI, 58.9–64.6), Asian (64.8%; 95% CI, 59.3–70.3), and White (66.0%; 95% CI, 64.8–67.2) adults, as indicated by nonoverlapping confidence intervals. This finding may be related, in part, to the higher prevalence of nondaily smoking among some racial and ethnic groups compared with White people (Wang et al. 2018). Additionally, some studies have reported a lower likelihood of Black and Hispanic people who smoke cigarettes being asked about tobacco use in a healthcare visit, being advised to quit, or having used tobacco cessation aids in a past-year quit attempt compared with White people who smoke (Cokkinides et al. 2008; Babb et al. 2020).

Further, the use of menthol cigarettes can decrease the likelihood of cessation success among adults who are trying to quit. Evidence suggests that menthol in cigarettes is associated with a reduced likelihood of successful quitting overall and particularly among people in minoritized racial and ethnic populations who smoke cigarettes (Gundersen et al. 2009; Stahre et al. 2010; Delnevo et al. 2011b; Levy et al. 2011; Smith et al. 2020a; Mills et al. 2021). Additionally, Smith and colleagues (2014b) found that Black women who smoke menthol cigarettes may have significantly lower cessation outcomes than White women who smoke menthol cigarettes.

Patterns of Any Tobacco Product Use

Youth

Based on data from the 2020 NYTS, an estimated 23.6% (95% CI, 21.1–26.4) of U.S. high school students reported current use of any tobacco product, defined as having used e-cigarettes, cigarettes, cigars (cigars, cigarillos, and little cigars), smokeless tobacco (chewing tobacco, snuff, dip, snus, and dissolvable tobacco products), hookahs, pipe tobacco, bidis (small brown cigarettes wrapped in a leaf), or heated tobacco products on at least 1 day during the past 30 days (Gentzke et al. 2020). Figure 2.2 (Part A) presents trends in the current use of any tobacco product during 2011–2020 among U.S. high school students by race and ethnicity. In 2020, current use of any tobacco product was higher among White high school students (25.9%; 95% CI, 23.0–29.2) than Black students (18.4%; 95% CI, 15.5–21.8) and students of other races (15.7%; 95% CI, 12.1–20.2), while Hispanic students (23.3%; 95% CI, 19.4–27.7) had a similar prevalence of current use of any tobacco product as all other racial and ethnic groups.

Adults

Tables 2.4, 2.6, and 2.7 provide NSDUH data on the past-month prevalence of use of cigarettes, cigars, smokeless tobacco, pipes, and any tobacco product among adults (18 years and older) for 2019. Use of any tobacco product, defined as use of cigarettes, cigars, smokeless tobacco, and

Table 2.7 Prevalence of ever use of cigarettes, past-month use of tobacco products, and smoking cessation among adults, 18 years of age and older, by race and ethnicity and sex; National Survey on Drug Use and Health (NSDUH) 2019, United States

Race and ethnicity and sex	Ever use of cigarettes: % (95% CI)	Past-month use of tobacco products: % (95% CI)					Smoking cessation: % (95% CI)[a]		
		Cigarettes	Cigars	Smokeless tobacco	Pipes	≥2 tobacco products[b]	Never quit or quit for ≤30 days[c]	Quit for >30 days but <1 year[d]	Quit for 1 year or more[e]
American Indian and Alaska Native									
Female	62.3 (49.4–-75.1)	30.9 (21.0–40.8)	—[f]	—[f]	—[f]	—[f]	49.6 (34.7–64.5)	—[f]	44.6 (29.2–60.1)
Male	76.4 (66.5–86.4)	30.4 (20.8–40.0)	7.5 (4.1–10.8)	13.4 (5.7–21.2)	—[f]	9.6 (5.6–13.6)	40.3 (25.7–54.9)	—[f]	41.0 (24.7–57.2)
Asian									
Female	18.9 (14.5–23.3)	4.6 (3.0–6.2)	—[f]	—[f]	—[f]	—[f]	24.4 (17.4–31.3)	12.8 (7.0–18.7)	62.8 (54.0–71.6)
Male	47.8 (43.0–52.6)	12.0 (9.3–14.7)	2.7 (1.4–4.0)	—[f]	—[f]	—[f]	25.2 (19.9–30.5)	9.1 (5.0–13.1)	65.7 (59.8–71.7)
Black									
Female	41.3 (38.5–44.0)	17.1 (15.2–19.0)	5.4 (4.5–6.4)	0.7 (0.3–1.1)	—[f]	2.6 (2.0–3.1)	41.9 (37.8–46.0)	3.9 (2.7–5.2)	54.2 (49.7–58.6)
Male	49.9 (46.8–53.0)	24.7 (22.1–27.3)	12.4 (10.7–14.0)	2.1 (1.2–3.0)	1.1 (0.6–1.6)	7.5 (6.1–9.0)	50.1 (45.8–54.3)	6.6 (4.7–8.6)	43.3 (39.2–47.4)
Native Hawaiian and Pacific Islander									
Female	40.7 (28.0–53.3)	11.5 (4.9–18.1)	—[f]	—[f]	—[f]	—[f]	—[f]	—[f]	—[f]
Male	42.6 (30.0–55.2)	16.2 (6.7–25.6)	—[f]	—[f]	—[f]	—[f]	37.9 (19.2–56.6)	—[f]	—[f]
Hispanic									
Female	37.8 (35.3–40.2)	9.3 (7.8–10.8)	1.3 (0.9–1.7)	—[f]	—[f]	1.0 (0.6–1.4)	24.6 (20.9–28.3)	9.3 (7.2–11.3)	66.1 (61.8–70.4)
Male	55.0 (52.7–57.4)	17.6 (15.8–19.5)	5.2 (4.1–6.3)	1.4 (0.9–1.8)	0.8 (0.5–1.1)	3.4 (2.7–4.2)	32.4 (29.1–35.8)	8.9 (6.9–10.8)	58.7 (55.1–62.3)

Table 2.7 Continued

Race and ethnicity and sex	Ever use of cigarettes: % (95% CI)	Past-month use of tobacco products: % (95% CI) Cigarettes	Cigars	Smokeless tobacco	Pipes	≥2 tobacco products[b]	Smoking cessation: % (95% CI)[a] Never quit or quit for ≤30 days[c]	Quit for >30 days but <1 year[d]	Quit for 1 year or more[e]
Multiple race									
Female	62.4 (56.7–68.1)	26.8 (21.2–32.3)	4.1 (2.2–6.0)	—[f]	—[f]	—[f]	43.0 (35.2–50.7)	—[f]	50.1 (42.4–57.8)
Male	66.7 (61.0–72.4)	34.8 (29.1–40.4)	10.0 (5.9–14.1)	7.5 (3.9–11.1)	4.7 (2.7–6.6)	12.3 (7.9–16.7)	52.1 (45.0–59.2)	6.3 (3.3–9.3)	41.6 (33.9–49.2)
White									
Female	65.2 (63.7–66.7)	18.6 (17.5–19.7)	1.6 (1.3–1.9)	0.7 (0.5–0.8)	0.3 (0.2–0.5)	1.4 (1.2–1.7)	28.6 (27.1–30.1)	4.8 (4.3–5.4)	66.6 (65.0–68.1)
Male	71.1 (70.1–72.2)	20.2 (19.3–21.1)	7.2 (6.6–7.8)	8.5 (7.8–9.2)	1.3 (1.0–1.6)	5.8 (5.2–6.4)	28.7 (27.3–30.0)	5.9 (5.3–6.6)	65.4 (64.0–66.8)

Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.

Notes: **CI** = confidence interval.

[a]Cigarette smoking cessation estimates were calculated among those who responded “Yes” to “Have you ever smoked part or all of a cigarette?”

[b]Any combination of more than one tobacco product (cigarettes, cigars, smokeless tobacco, or pipes).

[c]Among people who had ever smoked cigarettes, respondent answered “Within the past 30 days” to the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

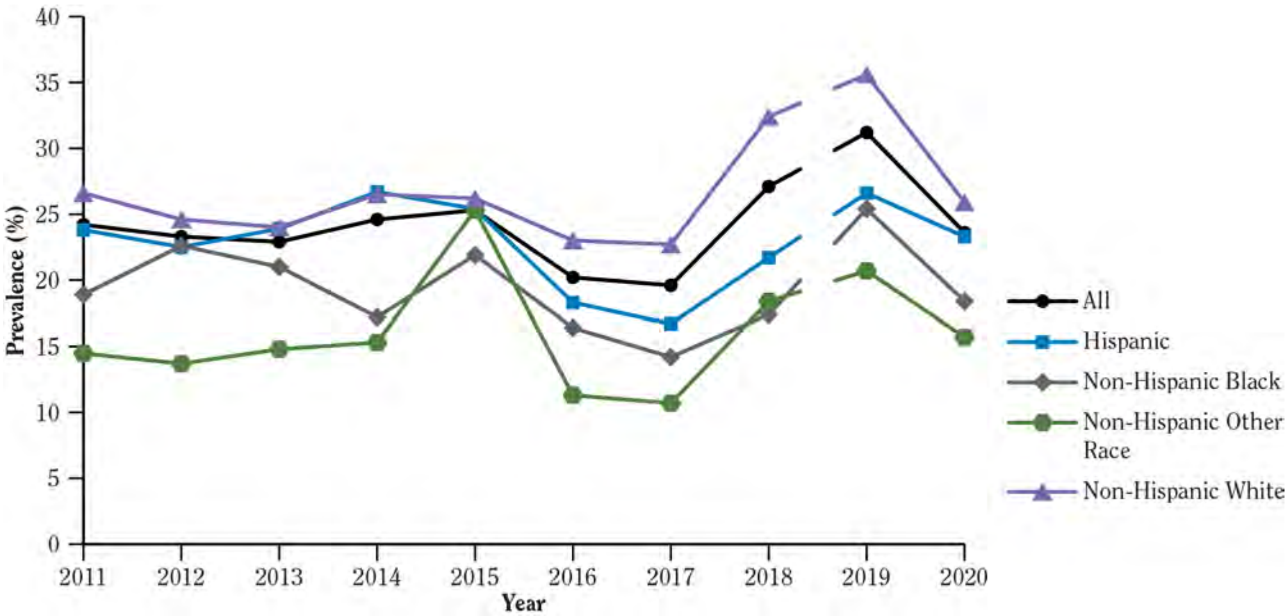
[d]Among people who had ever smoked cigarettes, respondent answered “More than 30 days ago but within the past 12 months.” To the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

[e]Among people who had ever smoked cigarettes, respondent answered “More than 12 months ago but within the past 3 years” or “More than 3 years ago” to the question, “Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?”

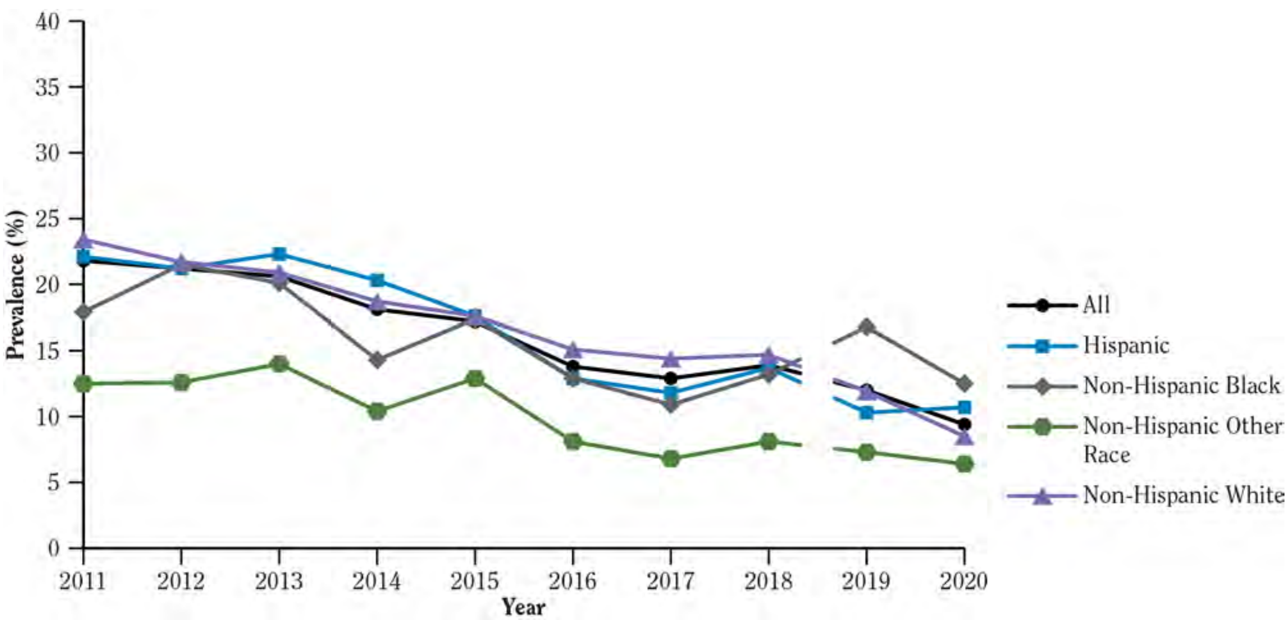
[f]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

Figure 2.2 Trends in the prevalence of current use of any tobacco product[a] and any combustible tobacco product[b] among high school students,[c] by race and ethnicity; National Youth Tobacco Survey (NYTS) 2011–2020,[d] United States

A. Any tobacco product



B. Any combustible tobacco product



Source: NYTS, CDC, public use data, 2011–2020.
[a]For 2011–2019, any tobacco product use was defined as use of e-cigarettes, cigarettes, cigars, hookahs, smokeless tobacco, pipe tobacco, and/or bidis (small brown cigarettes wrapped in a leaf) on 1 or more days during the past 30 days. For 2020, any tobacco product use was defined as use of e-cigarettes, cigarettes, cigars, smokeless tobacco, hookahs, pipe tobacco, bidis, or heated tobacco products on 1 or more days during the past 30 days.

Figure 2.2 Continued

[b]Any combustible tobacco product use was defined as use of cigarettes, cigars, hookahs, pipe tobacco, and/or bidis (small brown cigarettes wrapped in a leaf) on 1 or more days during the past 30 days.
[c]Data were self-reported by students in grades 9–12.
[d]Beginning in 2019, the NYTS was administered as an electronic survey, which included skip patterns and images of tobacco products. Thus, estimates may not be directly comparable to previous years. This change is represented by a break in the trend lines between 2018 and 2019.

pipe tobacco during the past 30 days, was higher among American Indian and Alaska Native (36.4%; 95% CI, 29.0–43.8) and multiple race (34.6%; 95% CI, 30.5–38.6) adults than Black (25.8%; 95% CI, 23.9–27.6), White (24.8%; 95% CI, 24.0–25.6), Native Hawaiian and Pacific Islander (21.8%; 95% CI, 14.6–29.0), Hispanic (15.6%; 95% CI, 14.3–17.0), and Asian (10.2%; 95% CI, 8.2–12.2) adults (Table 2.4).

Patterns of Use of Combustible Tobacco Products

Youth

Based on data from the 2020 NYTS, about 9.4% (95% CI, 8.0–11.0) of U.S. high school students reported current use of a combustible tobacco product, defined as having used cigarettes, cigars (cigars, cigarillos, and little cigars), hookahs, pipe tobacco, or bidis on at least 1 day during the past 30 days (Gentzke et al. 2020). Figure 2.2 (Part B) presents trends in the current use of any combustible tobacco product from 2011 to 2020 among U.S. high school students by race and ethnicity. During this period, use of combustible tobacco products had generally declined among all racial and ethnic groups. As noted in Figure 2.2 Part B, beginning in 2019, current use of any combustible tobacco product was higher among Black high school students (16.8%; 95% CI, 14.4–19.5) than it was among high school students of all other races and ethnicities (White: 11.9%; 95% CI, 10.0–14.2; Hispanic: 10.3%; 95% CI, 8.9–11.9; non-Hispanic, Other Race: 7.3%; 95% CI, 4.8–11.0) (Wang et al. 2019). In 2020, current use of any combustible tobacco product remained higher among Black high school students (12.5%; 95% CI, 10.3–15.1) compared with high school students of other races (6.4%; 95% CI, 4.1–9.9); however, Hispanic (10.7%; 95% CI, 8.2–14.0) and White (8.5%; 95% CI, 6.8–10.6) high school students had a similar prevalence of current use of a combustible tobacco product as Black high school students and students of other races.

Adults

Data from the NHIS in 2020 revealed differences in use of combustible tobacco products overall by racial and ethnic group. Every-day or some-day use of any combustible tobacco product, including cigarettes, cigars, or pipes (including pipes, water pipes, or hookah), was lower among Asian (8.7%; 95% CI, 7.0–10.7) and Hispanic (9.8%; 95% CI, 8.6–11.0) adults than it was among American Indian and Alaska Native (29.3%; 95% CI, 18.8–41.7), Black (18.0%; 95% CI: 16.2–19.9), and White (16.3%, 95% CI, 15.6–17.0) adults and non-Hispanic adults of other races (21.0%; 95% CI, 16.3–26.4) (Cornelius et al. 2022).

Patterns of Use of Other Tobacco Products

E-Cigarettes

Youth

Since 2014, e-cigarettes have been the most commonly used tobacco product among U.S. adolescents (Gentzke et al. 2019). Table 2.3 provides YRBS data from 2019 on the prevalence of ever and current (during the past 30 days) e-cigarette use (known as *electronic vapor products* in the YRBS) among high school students. For all races and ethnicities assessed, current use of e-cigarettes among adolescents surpassed current use of all other tobacco products—including conventional cigarettes. Current use of e-cigarettes was highest among American Indian and Alaska Native students (47.3%; 95% CI, 34.7–60.4), followed by students who were Native Hawaiian and Other Pacific Islander (38.8%; 95% CI, 28.2–50.5), White (38.3%; 95% CI, 36.0–40.7), multiple race (33.5%; 95% CI, 28.1–39.4), Hispanic (31.2%; 95% CI, 28.6–33.8), Black (19.7%; 95% CI, 16.9–22.8), and Asian (13.0%; 95% CI, 9.5–17.5) (Table 2.3, Part A).

Adults

The use of e-cigarettes among adults varied somewhat across racial and ethnic groups. Based on data from the 2020 NHIS, among adults 18 years of age and older, use of e-cigarettes "every day" or "some days" was higher among adults who were of other races (7.8%; 95% CI, 5.1–11.2) than it was among adults who were White (4.2%; 95% CI, 3.8–4.7), Asian (3.4%; 95% CI, 2.3–4.7), Hispanic (2.8%; 95% CI, 2.2–3.5), and Black (1.6%; 95% CI, 1.0–2.3) (Cornelius et al. 2022).

Smokeless Tobacco

Youth

Based on data from the 2019 YRBS, the prevalence of past-30-day use of smokeless tobacco among youth was higher among American Indian and Alaska Native high school students (16.2%; 95% CI, 7.0–33.2) than it was among White (4.4%; 95% CI, 3.3–5.7), multiple race (3.8%; 95% CI, 2.1–6.8), Hispanic (3.1%; 95% CI, 2.3–4.3), Black (2.8%; 95% CI, 1.8–4.4), and Asian (0.8%; 95% CI, 0.3–1.9) high school students (Table 2.3, Part A). The prevalence of past-30-day smokeless tobacco use also was lower among Asian students than it was among White, multiple race, and Hispanic high school students.

Adults

Based on data from the 2019 NSDUH, the prevalence of past-30-day use of smokeless tobacco was higher among (a) adults of multiple races (3.9%; 95% CI, 2.0–5.8), White (4.5%; 95% CI, 4.1–4.8), or American Indian and Alaska Native (7.1%; 95% CI, 3.5–10.6) adults than it was among Black (1.3%; 95% CI, 0.9–1.8) and Hispanic (0.9%; 95% CI, 0.6–1.1) adults; and (b) among White (4.5%; 95% CI, 4.1–4.8) or American Indian and Alaska Native (7.1%; 95% CI, 3.5–10.6) adults than among Asian adults (1.2%; 95% CI, 0.5–2.0) (Table 2.4).

Cigars

Youth

Based on data from the 2019 YRBS, which treats cigars as a single category that includes large cigars, little/filtered cigars, and cigarillos, the prevalence of past-30-day cigar use was higher among American Indian and Alaska Native high school students (14.9%; 95% CI, 7.4–27.9) than it was among Black (5.3%; 95% CI, 4.1–6.8) and Asian (1.0%; 95% CI, 0.4–3.0) students. The prevalence of past-30-day cigar use was similar among Native Hawaiian and Other Pacific Islander (8.6%; 95% CI, 2.9–22.6), multiple race (6.5%; 95% CI, 4.4–9.6), White (5.9%; 95% CI, 4.7–7.4), Hispanic (6.1%; 95% CI, 4.7–8.0), and Black (5.3%; 95% CI, 4.1–6.8) high school students (Table 2.3, Part A). However, data from the 2020 NYTS show that the prevalence of past-30-day cigar use was higher among Black (9.2%; 95% CI, 7.0–12.1) high school students compared with White (4.2%; 95% CI, 3.2–5.5) high school students (Gentzke et al. 2020).

Adults

Data from the 2019 NSDUH show the prevalence of past-30-day cigar use was (a) higher among Black (8.6%; 95% CI, 7.6–9.6) and multiple race (6.9%; 95% CI, 4.6–9.2) adults than it was among Hispanic (3.2%; 95% CI, 2.7–3.8) and Asian (1.4%; 95% CI, 0.8–2.0) adults; and (b) higher among Black adults (8.6%; 95% CI, 7.6–9.6) than it was among American Indian and Alaska Native (4.6%; 95% CI, 2.8–6.4) and White (4.3%; 95% CI, 4.0–4.7) adults (Table 2.4).

Pipes, Including Hookahs and Water Pipes

Youth

Use of pipe tobacco and hookah or water pipes was not assessed in the 2019 YRBS. However, the NYTS assesses use of pipe tobacco and hookah or water pipes. Data from the 2020 NYTS show that past-30-day hookah use was higher among Hispanic (4.45%; 95% CI, 2.8–6.9) and Black (3.9%; 95% CI, 2.5–6.0) high school students than it was among White high school students (1.8%; 95% CI, 1.3–2.3) (Gentzke et al. 2020). The prevalence of past-30-day use of pipe tobacco was low among high school students overall (0.7%; 95% CI, 0.5–1.1), making it difficult to obtain stable estimates of pipe tobacco use for all races and ethnicities (Gentzke et al. 2020).

Adults

Data from the 2019 NSDUH show the prevalence of past-30-day pipe use was higher among multiple race adults (3.1%; 95% CI, 1.7–4.6) than it was among Black (0.7%; 95% CI, 0.4–1.0), Hispanic (0.5%; 95% CI, 0.3–0.7), and White (0.8%; 95% CI, 0.6–1.0) adults (Table 2.4).

According to the 2019 NHIS, about 1% of adults, overall, report current use (every day or some days) of regular pipes, hookah, or waterpipes (Cornelius et al. 2020). By race and ethnicity, current use of pipes, hookah, or waterpipes did not differ between White (1.0%; 95% CI, 0.8–1.2), Black (1.1%; 95% CI, 0.7–1.5), and Hispanic (0.8%; 95% CI, 0.5–1.1) adults; estimates were unstable and not reported among Asian adults, American Indian and Alaska Native adults, and non-Hispanic adults of other races.

Patterns of Use of Emerging Tobacco Products

The availability of tobacco products continues to evolve as emerging and modified tobacco products are introduced into the U.S. marketplace. For example, various heated tobacco products were unsuccessfully market-tested in the United States in the late 1980s (Simonavicius et al. 2019). Currently, the only heated tobacco product authorized for sale in the United States is IQOS (Philip Morris Products S.A.), which gained such authorization in April 2019 through FDA's Premarket Tobacco Product Application (PMTA) pathway (FDA 2019). Sales were stopped in November 2021 due to a patent lawsuit (United States International Trade Commission 2022). Nicotine pouches entered the U.S. market in 2016. These prefilled, microfiber pouches contain nicotine powder that dissolves in the mouth without spitting (Marynak et al. 2021).

Youth

According to data from the 2021 NYTS, 1.8% (95% CI, 1.5–2.0) of U.S. middle and high school students reported ever using heated tobacco products; this finding was similar across racial and ethnic groups (Gentzke et al. 2022).

Overall, 1.9% (95% CI, 1.5–2.4) of U.S. middle and high school students in 2021 reported they had ever used nicotine pouches. Reported ever use of nicotine pouches was higher among White students (2.6%; 95% CI, 2.1–3.3) than it was among students who were Hispanic (1.3%; 95% CI, 0.9–1.3) or Black (0.7%; 95% CI, 0.4–1.3). Current (during the past 30 days) use of heated tobacco products and nicotine pouches was low among middle and high school students (0.7%; 95% CI, 0.5–0.8 and 0.8; 95% CI, 0.6–1.0, respectively), making it difficult to obtain stable estimates of such use among middle and high school students of all races and ethnicities (Gentzke et al. 2022).

Adults

According to data from the 2019 TUS-CPS, 8.6% (95% CI, 8.3–8.9) of adults were aware of heated tobacco products, among whom 5.8% (95% CI, 4.9-6.6) reported having ever used these products (Azagba and Shan 2021). However, the prevalence of ever use of heated tobacco products among all adults was low (0.5%; 95% CI, 0.4–0.6). No statistically significant differences in awareness or use of heated tobacco products were observed by race and ethnicity.

Nationally representative data on nicotine pouch use among adults are unavailable.

Patterns of Polytobacco Use

Attention to dual use and polyuse of tobacco products is gaining momentum, but relatively few studies are available that assess differences in dual use and polyuse across racial and ethnic populations.

Youth

Among high school students in the 2019 YRBS, polytobacco use was defined as having used two or more tobacco products during the past 30 days. Polytobacco use was higher among American Indian and Alaska Native students (23.8%; 95% CI, 13.4–38.5) than it was among White students (9.5%; 95% CI, 7.8–11.5). Polytobacco use was also higher among Native Hawaiian and Other Pacific Islander (15.7%; 95% CI, 6.4–12.7), White (9.5%; 95% CI, 7.8–11.5), and multiple race (9.2%; 95% CI, 6.6–12.7) students than it was among Black (4.8%; 95% CI, 3.7–6.2) and Asian (2.5%; 95% CI, 1.3–4.8) students; and was higher among Hispanic students (7.9%; 95% CI, 6.2–10.0) than it was among Asian students (2.5%; 95% CI, 1.3–4.8) (Table 2.3, Part A).

Adults

According to data from the 2019 NSDUH, the prevalence of polytobacco use (defined as having used two or more of the following tobacco products during the past month: cigarettes, cigars, smokeless tobacco, or pipes) was higher among multiple race (7.7%; 95% CI, 5.1–10.3), American Indian and Alaska Native, (6.6%; 95% CI, 4.3–9.0), and Black (4.8%; 95% CI, 4.0–5.6) adults than it was among White (3.6%; 95% CI, 3.3–3.9), Hispanic (2.2%; 95% CI, 1.8–2.6) and Asian adults (0.6%; 95% CI, 0.3–0.9) (Table 2.4).

E-cigarettes were not assessed in the 2019 NSDUH and are not included in the estimate of polytobacco use presented in Table 2.4. However, estimates of polytobacco use including e-cigarettes can be obtained from other sources. For example, the NHIS defines polytobacco use as having used two or more of the following tobacco products "every day" or "some days": cigarettes; cigars; pipes, water pipes, or hookah; smokeless tobacco; or e-cigarettes. In the 2019 NHIS, the prevalence of polytobacco use was higher among non-Hispanic adults of other races (7.5%; 95% CI, 4.7–10.3) than it was among Black (3.3%; 95% CI, 2.5–4.1), Hispanic (2.2%; 95% CI, 1.7–2.7), and Asian (1.4%; 95% CI, 0.8–2.0) adults (Cornelius et al. 2020). Additionally, the prevalence of polytobacco use was higher among White adults (4.5%; 95% CI, 4.1–4.9) than it was among Hispanic (2.2%; 95% CI, 1.7–2.7) and Asian (1.4%; 95% CI, 0.8–2.0) adults. The prevalence of polytobacco use from the 2019 NHIS was not available for American Indian and Alaska Native adults (Cornelius et al. 2020).

Patterns of Co-Use with Other Substances

Among adolescents and adults, the co-occurring use of tobacco with alcohol and other substances has been reported across racial and ethnic groups (Falk et al. 2006; Johnson et al. 2009; Luczak et al. 2017). The extent of this co-occurrence differs materially by racial and ethnic groups. For example, Falk and colleagues (2006) found that co-use of tobacco and alcohol was highest among American Indian men (34.0%) and lowest among Asian, Native Hawaiian, and Pacific Islander women (6.6%).

The intersection between race and ethnicity and polysubstance use has received a lot of attention, particularly in the case of tobacco and marijuana use (hereafter described as "cannabis use") among Black adults compared with White and Hispanic adults (Ramo et al. 2012; Schauer et al. 2015, 2017; Montgomery and Oluwoye 2016; Montgomery and Mantey 2017; Montgomery and Ramo 2017; Trapl et al. 2018; Montgomery et al. 2020; Mantey et al. 2021). Although tobacco and cannabis co-use (assessed as using both products during the past month) increased from 2003 to 2012 among adults overall, there was a faster increase among Black and Hispanic adults compared with White adults (Schauer et al. 2015).

Many studies have also assessed tobacco and cannabis co-use as *blunt use*—in which cannabis is wrapped inside the shell of a cigar or cigarillo. An analysis of the 2014 NSDUH found that an estimated 8.3% of Black, 3.3% of Hispanic, and 2.5% of White adults currently (during the past 30 days) used blunts (Montgomery and Mantey 2017, 2018). Additionally, in the NSDUH study, the prevalence of current blunt use was 5.3% among Black, 4.3% among Hispanic, and 3.8% among White adolescents (Montgomery and Mantey 2018). Some evidence indicates that people who use blunts may not consider themselves to use cigars or cigarillos, which may result in underestimates of the use of cigars and cigarillos (Yerger et al. 2001; Delnevo et al. 2011a).

Patterns of Tobacco Use During the Life Course

A growing body of research indicates the importance of examining racial and ethnic differences in tobacco use during the life course to complement the findings available for various age categories of interest, such as adolescence or late adulthood. Such research has uncovered different patterns of smoking across the age continuum.

Among adolescents, understanding the patterns of racial and ethnic differences in tobacco use is made more complex by racial and ethnic differences in average age of tobacco initiation (Caraballo et al. 2006; Lawrence et al. 2014) and differences in the products that are most commonly tried first (Ross et al. 2018). For example, compared with White people, many Asian and Black people start smoking cigarettes at older ages (Trinidad et al. 2004; Chen and Jacobson 2012; Roberts et al. 2016a; NCI 2017), and Hispanic people are more likely than people in other racial and ethnic groups to try cigarettes as their first tobacco product (Ross et al. 2018). Although the prevalence of tobacco product use was generally lower among Black and Asian groups than other racial and ethnic groups during early adolescence, an older study that joined data from the 1992–1993, 1995–1996, and 1998–1999 TUS-CPS found that Black and Asian people were the most likely groups to begin tobacco product use during adulthood (Trinidad et al. 2004).

Data on trends from 2006 to 2013 support increases in the onset of cigarette smoking (moving from never having smoked to having smoked cigarettes every day for at least 30 days during the past 12 months) among Black and Hispanic young men with slower declines in smoking onset among Black and Hispanic young women compared with their respective White counterparts (Thompson et al. 2018). Regarding rates of cessation, three studies found that they were higher for White adults compared with Black adults (Pampel 2008; Kandel et al. 2011; Trinidad et al. 2011). Although the prevalence of smoking declines with advancing age for all racial and ethnic groups, the prevalence of cigarette use among adults 65 years of age and older is higher among Black people than it is among White people (Table 2.5).

This pattern, in which the prevalence of smoking among Black people is lower than that of White people during adolescence but later equals or exceeds that of White people during adulthood, is known as *crossover* or *convergence* (Arnett and Brody 2008; Pampel 2008; Keyes et al. 2015; Giovino and Gardiner 2016). Two earlier studies assessing the crossover effect between non-Hispanic Black and non-Hispanic White people found evidence that the age crossover effect occurred by age 30 (Geronimus et al. 1993; Kandel et al. 2011). The findings align with other research examining lifetime smoking, which indicates that American Indian people have the longest median duration of smoking (32 years), followed by Black and "Other" race (30 years), White (28 years), and Hispanic people (24 years) (Siahpush et al. 2010). Some evidence indicates that the racial crossover may be more pronounced in women than men (Caraballo et al. 2016).

According to data from the Monitoring the Future Study, in the late 1970s, the prevalence of smoking among adolescents and young adults of different racial and ethnic groups was similar (Nelson et al. 2008; Oredein and Foulds 2011). However, between the late 1970s and early 1990s, the prevalence of cigarette smoking declined significantly among Black and Hispanic adolescents and young adults, leading to a substantial gap in the prevalence of smoking, especially between Black and White adolescents (Nelson et al. 2008). By the early 1990s, smoking was two to four times higher among Hispanic and White adolescents compared with Black adolescents. Since 1991, trends in cigarette smoking among adolescents have been similar across racial and ethnic groups, although the prevalence remained lower among Black adolescents. Additionally, since about 1990, overall trends in cigarette smoking among young adults were similar to trends among adolescents but lagged by a couple of years. This pattern suggests a cohort effect, with previous adolescent smoking behavior affecting subsequent smoking behavior among young adults (Nelson et al. 2008). Further research on this topic is needed, using cross-sectional and prospective studies, as well as studies of age cohorts to document differences in behavior over calendar time.

Patterns of Tobacco Use by Race and Ethnicity and Sex

Among adults, NSDUH data from 2019 (Table 2.7) show differences in the prevalence of tobacco product use by sex within racial and ethnic groups. The prevalence of ever cigarette use was higher among Asian (47.8%; 95% CI, 43.0–52.6 vs. 18.9%; 95% CI, 14.5–23.3), Black (49.9%; 95% CI, 46.8–53.0 vs. 41.3%; 95% CI, 38.5–44.0), Hispanic (55.0%; 95% CI, 52.7–57.4 vs. 37.8%; 95% CI, 35.3–40.2), and White (71.1%; 95% CI, 70.1–72.2 vs. 65.2%; 95% CI, 63.7–66.7) men than it was among women. Similarly, the prevalence of past-month cigarette use was higher among Asian (12.0%; 95% CI, 9.3–14.7 vs. 4.6%; 95% CI, 3.0–6.2), Black (24.7%; 95% CI, 22.1–27.3 vs. 17.1%; 95% CI, 15.2–19.0) and Hispanic (17.6%; 95% CI, 15.8–19.5 vs. 9.3%; 95% CI, 7.8–10.8) men than it was among women.

The prevalence of past-month cigar use was higher among men than it was among women who were Black (male: 12.4%; 95% CI, 10.7–14.0 vs. female: 5.4%; 95% CI, 4.5–6.4), Hispanic (5.2%; 95% CI, 4.1–6.3 vs. 1.3%; 95% CI, 0.9–1.7), or White (7.2%; 95% CI, 6.6–7.8 vs. 1.6%; 95% CI, 1.3–1.9). The prevalence of past-month smokeless tobacco product use was higher among men than it was among women who were Black (2.1%; 95% CI, 1.2–3.0 vs. 0.7%; 95% CI, 0.3–1.1) or White (8.5%; 95% CI, 7.8–9.2 vs. 0.7%; 95% CI, 0.5–0.8). The prevalence of past-month pipe use was higher among White men (1.3%; 95% CI, 1.0–1.6) than it was among White women (0.3%; 95% CI, 0.2–0.5). The prevalence of the use of two or more tobacco products during the past month was higher among men than it was among women who were Black (7.5%; 95% CI, 6.1–9.0 vs. 2.6%; 95% CI, 2.0–3.1), Hispanic (3.4%; 95% CI, 2.7–4.2 vs. 1.0%; 95% CI, 0.6–1.4), or White (5.8%; 95% CI, 5.2–6.4 vs. 1.4%; 95% CI, 1.2–1.7).

Among high school students, data from the 2019 YRBS indicate that current use of cigars (8.1%; 95% CI, 6.6–10.0 vs. 3.5%; 95% CI, 2.3–5.2), smokeless tobacco (7.6%; 95% CI, 5.7–10.0 vs. 0.9%; 95% CI, 0.6–1.5), and use of two or more tobacco products (12.3%; 95% CI, 10.4–14.4 vs. 6.6%; 95% CI, 4.6–9.4) was higher among White adolescent males than it was among White adolescent females. No other differences in use of other tobacco products were observed by sex among other racial and ethnic groups (Table 2.3, Part B).

Variation Within Aggregate Racial and Ethnic Groups

Within aggregate racial and ethnic groups, the prevalence of tobacco use often varies by population. This variation may not be captured in national surveillance studies. For example, although the prevalence of current cigarette use is relatively low among Asian people who speak English in the United States when reported in aggregate, prevalence varies considerably by sex and country of ancestry within this population (Chae et al. 2006; Mukherjea et al. 2014). One analysis of national data found that current cigarette use was highest among Korean (26.6%; 95% CI, 21.3–32.7), Vietnamese (21.5%; 95% CI, 16.4–27.7), and Filipino (16.7%; 95% CI, 13.7–20.2) adults and lowest among Japanese (12.1%; 95% CI, 9.2–15.8), Asian Indian (11.8%; 95% CI 8.9–15.4), and Chinese adults (8.8%; 95% CI, 6.9–11.3) (Martell et al. 2016). In another study (Mukherjea et al. 2014) of Asian American and Native Hawaiian and Pacific Islander adults, current cigarette smoking was highest among Native Hawaiian and Pacific Islander adults (20%), and preference for menthol-flavored cigarettes was highest among Filipino (45%) and Native Hawaiian and Pacific Islander (46%) adults who smoked cigarettes.

Further, although the prevalence of tobacco use is relatively high among American Indian and Alaska Native people (Odani et al. 2017), prevalence varies widely across the country (Nez Henderson et al. 2005; Eichner et al. 2010; Redwood et al. 2010). For example, one study found that current cigarette use was much higher among American Indian and Alaska Native people in Alaska (31.6%) than among those in the Southwest (8.3%) (Redwood et al. 2010).

Research also indicates substantial variation within the Hispanic population (Kaplan et al. 2014; Dominguez et al. 2015). For example, a study by Martell and colleagues (2016) found that the prevalence of current cigarette smoking during 2010–2013 was highest among Puerto Rican adults (28.5%; 95% CI, 25.8–31.4), followed by Cuban (19.8%; 95% CI, 16.5–23.6), Mexican (19.1%; 95% CI, 18.2–20.1), and Central or South American adults (15.6%; 95% CI, 13.5–18.0).

However, knowledge of differences within racial and ethnic populations is limited to the groups assessed. Thus, additional disparities may emerge with changes to U.S. Census measures and other classifications (U.S. Census Bureau 2021). For example, Arab American people and other people from the Middle East are currently classified as "White" (Kayyali 2013), which may mask differences in the use of tobacco products as they relate to country of ancestry and common products used in the Arabian Gulf region (Maziak et al. 2015; Vupputuri et al. 2016). Data collected during 2004–2005 suggest that hookah use was higher among Arab American youth than among non-Arab American youth (Weglicki et al. 2008). Arab American men also have a higher prevalence of ever and current cigarette smoking than White men; however, the prevalence of ever and current smoking is lower among Arab American women than it is among White women (Abuelezam et al. 2021).

Nativity and Acculturation

In 2019, more than 44.9 million people in the United States were foreign born; this equated to 13.7% of the total U.S. population (U.S. Census Bureau n.d.c). Although immigrants to the United States come from all over the world, estimates indicate that most foreign-born people in the United States come from Latin America (50.3%), Asia (31.4%), and Europe (10.4%) (U.S. Census Bureau n.d.c). In terms of specific countries, the largest proportions of foreign-born people in the United States originated from Mexico (25%), India (6%), China (6%, excluding Hong Kong and Taiwan), and the Philippines (4%) (Budiman 2020).

Immigrants enter the United States with their own cultural backgrounds regarding tobacco use. According to a review performed by NCI (2017), a small but growing body of research demonstrates how these backgrounds—as well as the processes of acculturation in and assimilation to the United States—create a complex network of factors that influence tobacco use outcomes for youth and adults. Data from the TUS-CPS found that participants who took the survey in a language other than English (a proxy for English language proficiency) and earlier immigrant generation status (first and second generation compared with third generation) were associated with higher prevalence of a past-year quit attempt among Hispanic adults (Gundersen et al. 2012). Whether acculturation is a risk or a protective factor for tobacco use may depend on the interplay of ethnicity, sex, and SES (Zhu et al. 2007; Tong et al. 2012; NCI 2017).

Pooled data from the 2019–2021 NHIS found that the prevalence of ever cigarette use, current cigarette use (defined as having smoked at least 100 cigarettes in one's lifetime and smoking cigarettes every day or some days), and current use of cigars, smokeless tobacco, e-cigarettes, and multiple tobacco products (defined as having used such products every day or some days) was lower among foreign-born people than among their U.S.-born counterparts (Table 2.8). Of note, pooling data for foreign-born people of various races and ethnicities may mask differences in tobacco product use behaviors by country of origin. For example, although aggregate Hispanic or Latino and Asian populations have a lower-than-average prevalence of smoking overall (Figure 2.1), both groups represent diverse populations and variations in the patterns of tobacco use have been observed by country of origin (Blanco et al. 2014; Gorman et al. 2014) (also see Chapter 6).

Current cigarette use overall was nearly two times higher among U.S.-born people (13.8%; 95% CI, 13.5–14.2) than it was among foreign-born people (7.4%; 95% CI, 6.9–8.0) and this pattern was consistent for use of cigars (3.9%; 95% CI, 3.8–4.1 vs. 1.7%; 95% CI, 1.4–1.9), smokeless tobacco (2.7%; 95% CI, 2.6–2.9 vs. 0.3%; 95% CI, 0.2–0.4), e-cigarettes (4.8%; 95% CI, 4.6–5.0 vs. 1.6%; 95% CI, 1.4–1.9), and multiple tobacco products (4.0%; 95% CI, 3.8–4.2 vs. 1.5%; 95% CI, 1.3–1.8) (Table 2.8). Smoking cessation outcomes, in contrast, were comparable between foreign- and U.S.-born people.

Pooled NHIS data from 2019 to 2021 reveal that the prevalence of ever using cigarettes was higher among men than it was among women for each of the nativity groups (Table 2.9). The disparity by sex was wider among foreign-born people. Among U.S.-born people, men and women were separated by an absolute difference of 8 percentage points in prevalence of ever using cigarettes (men: 42.4%; 95% CI, 41.7–43.1 vs. women: 34.4%; 95% CI, 33.6–34.9), but among foreign-born people, the difference in the prevalence of ever use was 20.4 percentage points (men: 33.8%; 95% CI, 32.3–35.2 vs. women: 13.4%; 95% CI, 12.6–14.3). When examining current use of tobacco in its various forms by sex, foreign-born women reported the lowest prevalence of using all products compared with foreign-born men, U.S.-born women, and U.S.-born men (Table 2.9).

When examining differences in tobacco use by nativity and age, ever use of cigarettes and current use of smokeless tobacco products and e-cigarettes were consistently and significantly lower among foreign-born people than among U.S.-born people across all specific age groups: 18–24 years of age, 25–44 years of age, 45–64 years of age, and 65 years of age and older (Table 2.9). For other tobacco products, use was consistently, though not always statistically, lower among foreign-born adults than it was among U.S.-born adults across all age groups.

Table 2.8 Prevalence of ever use of cigarettes, current use of tobacco products, and smoking cessation among adults, 18 years of age and older, by nativity and sex; National Health Interview Survey (NHIS) 2019–2021, United States

		Current use of tobacco products:[a] % (95% CI)						Smoking cessation: % (95% CI)	
Nativity	Ever use of cigarettes:[b] % (95% CI)	Cigarettes	Cigars	Smokeless tobacco	Pipes[c]	E-cigarettes	≥2 tobacco products[d]	Attempt in past year[e]	Quit for ≥6 months[f]
U.S. born	38.2 (37.7–38.7)	13.8 (13.5–14.2)	3.9 (3.8–4.1)	2.7 (2.6–2.9)	1.1 (0.9–1.2)	4.8 (4.6–5.0)	4.0 (3.8–4.2)	54.9 (52.6–57.1)	8.4 (7.2–9.6)
Female	34.3 (33.6–34.9)	13.0 (12.5–13.4)	1.1 (1.0–1.2)	0.3 (0.2–0.4)	0.7 (0.5–0.8)	4.0 (3.8–4.3)	2.2 (2.0–2.4)	54.8 (51.7–57.8)	8.1 (6.4–9.9)
Male	42.4 (41.7–43.1)	14.7 (14.2–15.2)	7.0 (6.6–7.3)	5.3 (5.0–5.6)	1.5 (1.3–1.6)	5.6 (5.3–6.0)	5.8 (5.5–6.1)	55.0 (51.9–58.1)	8.6 (7.0–10.3)
Foreign born	23.1 (22.3–23.9)	7.4 (6.9–8.0)	1.7 (1.4–1.9)	0.3 (0.2–0.4)	0.8 (0.6–1.0)	1.6 (1.4–1.9)	1.5 (1.3–1.8)	59.7 (53.6–65.7)	6.1 (3.4–8.7)
Female	13.4 (12.5–14.3)	3.9 (3.4–4.4)	0.4 (0.2–0.6)	—[g]	0.5 (0.3–0.6)	0.8 (0.6–1.0)	0.6 (0.4–0.8)	59.9 (49.9–69.8)	7.6 (2.1–13.1)
Male	33.8 (32.3–35.2)	11.4 (10.4–12.4)	3.0 (2.5–3.6)	0.6 (0.4–0.8)	1.1 (0.8–1.4)	2.5 (2.1–3.0)	2.5 (2.1–3.0)	59.6 (52.3–66.8)	5.4 (2.4–8.4)

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021; ever use of cigarettes and current use of tobacco are based on 2019–2021 data; and smoking cessation outcomes are based on 2020 data.

Notes: **CI =** confidence interval.

[a]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days.

[b]People who had ever smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes.

[c]Pipes included the use of regular pipes, water pipes, or hookah.

[d]Any combination of more than one tobacco product.

[e]Attempt in past year was defined as the percentage of people who (a) currently smoked cigarettes and reported having stopped smoking for more than 1 day during the past 12 months because they were trying to quit smoking and (b) quit smoking during the past year.

[f]Quit for at least 6 months was defined as the percentage of people who used to smoke cigarettes and reported having quit smoking for at least 6 months during the past year, among people who currently smoked cigarettes for at least 2 years and people who had quit smoking during the past year.

[g]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

Table 2.9 Prevalence of ever use of cigarettes and current use of tobacco products among adults, 18 years of age and older, by nativity, sex, and age group; National Health Interview Survey (NHIS) 2019–2021, United States

Nativity, sex, and age group	Ever use of cigarettes:[b] % (95% CI)	Current use of tobacco products:[a] % (95% CI)					
		Cigarettes	Cigars	Smokeless tobacco	Pipes[c]	E-cigarettes	≥2 tobacco products[d]
By sex							
U.S. born							
Male	42.4 (41.7–43.1)	14.7 (14.2–15.2)	7.0 (6.6–7.3)	5.3 (5.0–5.6)	1.5 (1.3–1.7)	5.6 (5.3–6.0)	5.8 (5.5–6.2)
Female	34.3 (33.6–34.9)	13.0 (12.5–13.4)	1.1 (1.0–1.2)	0.3 (0.2–0.4)	0.7 (0.5–0.8)	4.0 (3.8–4.3)	2.2 (2.0–2.4)
Foreign born							
Male	33.8 (32.3–35.2)	11.4 (10.4–12.4)	3.0 (2.6–3.6)	0.6 (0.4–0.8)	1.1 (0.8–1.5)	2.5 (2.1–3.1)	2.5 (2.1–3.0)
Female	13.4 (12.6–14.3)	3.9 (3.4–4.4)	0.4 (0.3–0.7)	—[e]	0.5 (0.3–0.7)	0.8 (0.6–1.1)	0.6 (0.4–0.8)
By age group							
U.S. born							
18–24	12.7 (11.7–13.9)	7.2 (6.4–8.1)	3.8 (3.2–4.5)	2.2 (1.8–2.8)	1.8 (1.4–2.2)	10.2 (9.3–11.3)	5.2 (4.5–6.0)
25–44	35.4 (34.6–36.2)	16.1 (15.5–16.8)	5.4 (5.1–5.8)	3.5 (3.2–3.8)	1.6 (1.4–1.8)	7.1 (6.6–7.5)	6.0 (5.6–6.4)
45–64	43.8 (42.9–44.6)	17.6 (17.0–18.2)	3.9 (3.6–4.2)	3.2 (3.0–3.5)	0.6 (0.5–0.7)	3.1 (2.9–3.4)	3.3 (3.1–3.6)
≥65	49.0 (48.2–49.8)	8.9 (8.5–9.4)	2.0 (1.8–2.2)	1.3 (1.1–1.5)	0.4 (0.4–0.5)	0.9 (0.7–1.0)	1.2 (1.0–1.4)
Foreign born							
18–24	7.6 (5.6–10.3)	4.6 (3.1–6.8)	2.7 (1.6–4.7)	—[e]	—[e]	6.0 (4.2–8.6)	3.7 (2.4–5.6)
25–44	19.9 (18.7–21.3)	8.1 (7.2–9.0)	2.3 (1.8–2.9)	0.5 (0.3–0.8)	1.3 (1.0–1.7)	2.2 (1.8–2.7)	2.1 (1.7–2.6)
45–64	25.4 (24.0–26.9)	8.1 (7.3–9.1)	1.3 (1.0–1.7)	—[e]	0.3 (0.2–0.5)	0.8 (0.6–1.2)	1.0 (0.8–1.4)
≥65	31.7 (29.7–33.8)	5.7 (4.7–6.9)	0.8 (0.5–1.2)	—[e]	—[e]	—[e]	0.5 (0.3–0.9)

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.
Notes: **CI =** confidence interval; **N/A =** not available.
[a]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days at the time of the survey.
[b]People who had ever smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes.
[c]Pipes included the use of regular pipes, water pipes, or hookah.
[d]Any combination of more than one tobacco product.
[e]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

Tobacco Use by Sexual Orientation and Gender Identity

Patterns of Ever and Current Use of Cigarettes

Disparities in tobacco use by sexual orientation and gender identity are evident; however, data are limited because of the lack of standard measurements across data collection instruments and surveillance systems. Recommendations from scientific organizations—including USDHHS; the National Institutes of Health; and the National Academies of Science, Engineering, and Medicine—have encouraged defining and measuring sexual orientation and gender identity across studies to fill this evidence gap (Dermody et al. 2020; National Academies of Sciences, Engineering, and Medicine 2022; National Institutes of Health n.d.; USDHHS n.d.).

This section focuses on patterns of tobacco use by sexual orientation. Among adults, combined data from the 2019 to 2021 NHIS are presented to report the prevalence of tobacco use behaviors among (a) heterosexual adults compared with adults who identify with a minoritized sexual orientation group (includes responses from those who reported identifying as "gay," "lesbian," or "bisexual" or who reported "something else" as their sexual orientation) and (b) gay, lesbian, or bisexual adults compared with heterosexual adults. Among youth, patterns of tobacco use by sexual orientation (heterosexual compared to gay, lesbian, or bisexual) are presented from the 2019 YRBS.

The NHIS and the YRBS did not collect data on gender identity during these years, which reflects a limited amount of research in the gender identity research domain. However, the NHIS and YRBS began assessing gender identity in 2022 and 2023, respectively.[1] Disparities in tobacco use by gender identity have been assessed using other surveys of adults (Buchting et al. 2017; Wheldon and Wiseman 2019) and youth, including recent administrations of the NYTS (Gentzke et al. 2022).

Youth

In 2019, the YRBS estimated that 22.7% (95% CI, 19.9–25.8) of heterosexual high school students had ever tried a cigarette compared with 32.9% (95% CI, 28.1–38.0) of gay, lesbian, or bisexual high school students (Table 2.10). The prevalence of ever cigarette use among students who were unsure about their sexual orientation (19.9%; 95% CI, 15.2–25.6) was lower compared with gay, lesbian, or bisexual high school students. As a group, gay, lesbian, and bisexual high school students had the highest prevalence of past-30-day use of cigarettes (10.4%; 95% CI, 7.8–13.7) compared with 5.2% (95% CI, 4.3–6.3) of heterosexual students (Table 2.10). Based on data from the 2019 YRBS, an estimated 6.9% (95% CI, 5.8–8.2) of heterosexual high school students first used a cigarette before 13 years of age; estimates of such use were higher for gay, lesbian, and bisexual students combined (12.1%; 95% CI, 9.9–14.7) and specifically for gay, lesbian, and bisexual students who were female (12.3%; 95% CI, 9.5–15.7) compared with heterosexual students who were female (5.5%; 95% CI, 4.5–6.6) (CDC n.d.h).

Adults

Combined data from the NHIS from 2019 to 2021 reveal that ever use of cigarettes by adults was higher among adults who identified with a minoritized sexual orientation group (including individuals who identified as gay, lesbian, bisexual, or who reported "something else") (38.0%; 95% CI, 36.0–40.0) than it was among heterosexual adults (35.4%; 95% CI, 34.9–35.9) (Table 2.11). Similarly, current use of cigarettes was greater among adults who identified with a minoritized sexual orientation group (16.3%; 95% CI, 14.8–17.9)—specifically, bisexual (18.0%; 95% CI, 15.7–20.6) and gay (16.3%; 95% CI, 13.2–19.9) adults—than it was among adults who identified as heterosexual (12.5%, 95% CI, 12.2–12.8) (Table 2.11). Among young adults (18–24 years of age), the prevalence of ever and current cigarette use was higher among bisexual people (22.2%; 95% CI, 17.5–27.7, and 11.9%; 95% CI, 8.5–16.3, respectively) compared with heterosexual people (11.6%; 95% CI, 10.6–12.7 and 6.6%; 95% CI, 5.8–7.4, respectively) (Table 2.11).

Patterns of Frequency and Quantity of Cigarette Use

Youth

According to the 2019 YRBS, the prevalence of frequent cigarette use (use on 20 or more days during the past 30 days) was higher among gay and lesbian high school

[1]Most federal surveillance systems that measure gender identity do not currently measure nonbinary as an identity (Federal Interagency Working Group on Improving Measurement of Sexual Orientation and Gender Identity in Federal Surveys 2016). Beginning in 2023, the NHIS will include a gender identity measure with the following responses: "male," "female," "transgender," "nonbinary," and "another gender." Respondents may select more than one response (CDC 2023a).

Table 2.10 Prevalence of ever use of cigarettes and electronic vapor products, current use of tobacco products, and ever making an attempt to quit all tobacco products among high school students by sexual orientation; national Youth Risk Behavior Survey (YRBS) 2019, United States

			Current use of tobacco products:[a] % (95% CI)					
Sexual orientation	Ever use of cigarettes:[b] % (95% CI)	Ever use of electronic vapor products:[c] % (95% CI)	Cigarettes	Cigars[d]	Smokeless tobacco[e]	Electronic vapor products[f]	≥2 tobacco products[g]	Ever quit attempt:[h] % (95% CI)
Heterosexual	22.7 (19.9–25.8)	49.8 (47.7–52.0)	5.2 (4.3–6.3)	5.2 (4.4–6.1)	3.7 (3.1–4.4)	32.8 (30.5–35.2)	7.8 (6.7–9.0)	47.4 (44.6–50.2)
Gay, lesbian, or bisexual	32.9 (28.1–38.0)	56.0 (52.2–59.7)	10.4 (7.8–13.7)	8.1 (5.9–11.1)	3.2 (2.0–5.2)	34.1 (30.8–37.6)	10.4 (8.0–13.5)	50.8 (42.5–59.0)
Not sure	19.9 (15.2–25.6)	37.2 (30.9–43.9)	7.4 (4.8–11.3)	7.2 (4.3–12.0)	5.5 (3.1–9.4)	24.9 (19.8–30.7)	8.1 (5.4–11.9)	40.5 (25.5–57.5)

Source: CDC (n.d.a).
Notes: **CI =** confidence interval.
[a]On at least 1 day during the 30 days before the survey.
[b]Even one or two puffs.
[c]Even one or two puffs; includes use of e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods (e.g., JUUL, Vuse, MarkTen, and blu).
[d]Includes use of cigars, cigarillos, or little cigars on at least 1 day during the 30 days before the survey.
[e]Includes use of chewing tobacco, snuff, dip, snus, or dissolvable tobacco products—such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, Copenhagen, Camel Snus, Marlboro Snus, General Snus, Ariva, Stonewall, or Camel Orbs—not counting any electronic vapor products, on at least 1 day during the 30 days before the survey,
[f]Includes use of e-cigarettes, vapes, vape pens, e-cigars, e-hookahs, hookah pens, and mods (e.g., JUUL, Vuse, MarkTen, and blu) on at least 1 day during the 30 days before the survey.
[g]Percentage of students who used two or more of the following tobacco products: cigarettes, cigars (cigars, cigarillos, or little cigars), an electronic vapor product, or smokeless tobacco, on 1 or more days during the 30 days before the survey.
[h]Includes ever quit attempt of cigarettes, cigars, smokeless tobacco, shisha or hookah tobacco, and electronic vapor products during the 12 months before the survey, among high school students who used any tobacco products during the 12 months before the survey.

Table 2.11 Prevalence of ever use of cigarettes, current use of tobacco products, and smoking cessation among adults (≥18 years of age and older) and young adults (18–24 years of age), by sexual orientation; National Health Interview Survey (NHIS) 2019–2021 combined data, United States

		Current use of tobacco products:[a] % (95% CI)						Smoking cessation (2020): % (95% CI)	
Age group and sexual orientation	**Ever use of cigarettes:[b] % (95% CI)**	**Cigarettes**	**Cigars**	**Smokeless tobacco**	**Pipes[c]**	**E-cigarettes**	**≥2 tobacco products[d]**	**Attempt in past year[e]**	**Quit for ≥6 months[f]**
Adults (≥18 years of age)	35.4 (34.9–35.9)	12.7 (12.4–13.0)	3.5 (3.4–3.7)	2.3 (2.2–2.4)	1.0 (0.9–1.1)	4.2 (4.1–4.4)	3.5 (3.4–3.7)	55.4 (53.2–57.5)	8.1 (7.1–9.3)
Heterosexual	35.4 (34.9–35.9)	12.5 (12.2–12.8)	3.5 (3.3–3.7)	2.4 (2.2–2.5)	1.0 (0.9–1.0)	4.0 (3.8–4.1)	3.4 (3.2–3.6)	54.4 (52.2–56.6)	8.0 (6.9–9.2)
Not heterosexual (all)[g]	38.0 (36.0–40.0)	16.3 (14.8–17.9)	4.3 (3.4–5.4)	1.0 (0.7–1.5)	2.3 (1.7–3.1)	11.2 (9.8–12.8)	6.5 (5.5–7.8)	67.3 (57.9–75.5)	13.1 (8.0–20.9)
Gay	40.7 (36.7–44.7)	16.3 (13.2–19.9)	—[h]	—[h]	—[h]	7.8 (6.0–10.2)	6.2 (4.0–9.4)	64.1 (46.4–78.6)	—[h]
Lesbian	34.5 (30.2–39.0)	13.4 (10.5–16.9)	3.3 (1.9–5.7)	—[h]	—[h]	5.9 (4.0–8.5)	3.9 (2.5–5.9)	—[h]	—[h]
Bisexual	39.6 (36.4–42.9)	18.0 (15.7–20.6)	5.4 (4.1–7.1)	1.0 (0.6–1.8)	2.8 (1.9–4.1)	15.4 (13.0–18.0)	8.3 (6.7–10.2)	71.1 (57.1–82.0)	—[h]
Young adults (18–24 years of age)	12.2 (11.2–13.3)	6.9 (6.2–7.7)	3.7 (3.1–4.3)	2.0 (1.6–2.5)	1.8 (1.4–2.2)	9.9 (9.0–10.8)	5.1 (4.4–5.8)	68.5 (58.4–77.1)	14.6 (9.1–22.6)
Heterosexual	11.6 (10.6–12.7)	6.6 (5.8–7.4)	3.5 (3.0–4.2)	2.2 (1.8–2.8)	1.8 (1.4–2.3)	9.3 (8.4–10.4)	4.9 (4.3–5.7)	65.6 (53.9–75.7)	14.3 (8.3–23.5)
Not heterosexual (all)	18.2 (14.7–22.2)	9.7 (7.3–12.9)	4.2 (2.6–6.7)	—[h]	—[h]	14.3 (11.2–18.0)	5.5 (3.8–7.8)	—[h]	—[h]
Gay	—[h]	—[h]	—[h]	N/A	—[h]	—[h]	—[h]	N/A	—[h]
Lesbian	—[h]	—[h]	—[h]	N/A	N/A	—[h]	—[h]	—[h]	N/A
Bisexual	22.2 (17.5–27.7)	11.9 (8.5–16.3)	4.6 (2.7–7.9)	—[h]	—[h]	18.5 (14.0–23.9)	7.3 (4.9–10.9)	—[h]	—[h]

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021; ever use of cigarettes and current use of tobacco are based on 2019–2021 data; and smoking cessation outcomes are based on 2020 data.

Notes: **CI =** confidence interval; **N/A =** not available.

[a]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days.

Table 2.11 Continued

[b]People who had ever smoked cigarettes was defined as those who smoked at least 100 cigarettes in their lifetimes.

[c]Pipes included use of regular pipes, water pipes, or hookah.

[d]Any combination of more than one tobacco product.

[e]Attempt in past year was defined as the percentage of people who (a) currently smoked cigarettes and reported having stopped smoking for more than 1 day during the past 12 months because they were trying to quit smoking and (b) quit smoking during the past year.

[f]Quit for at least 6 months was defined as the percentage of people who used to smoke cigarettes and reported having quit smoking for ≥6 months during the past year, among people who currently smoked for at least 2 years and people who had quit smoking during the past year.

[g]Includes people who identified as gay, lesbian, or bisexual or who reported “something else.”

[h]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

students (4.2%; 95% CI, 1.6–10.4) than it was among heterosexual students (1.1%; 95% CI, 0.8–1.5); frequent cigarette use was comparable among bisexual students (2.1%; 95% CI, 1.1–4.2), students who were unsure of their sexual orientation (2.5%; 95% CI, 1.0–6.2), and heterosexual students (1.1%; 95% CI, 0.8–1.5) (CDC n.d.c). Regarding daily cigarette use, 0.9% (95% CI, 0.7–1.3) of heterosexual students; 4.1% (95% CI, 1.5–10.3) of gay or lesbian students; 1.4% (95% CI, 0.6–3.0) of bisexual students; and 2.4% (95% CI, 0.9–6.2) of students who were unsure of their sexual orientation smoked cigarettes daily (i.e., every day during the previous 30 days) (CDC n.d.b).

Adults

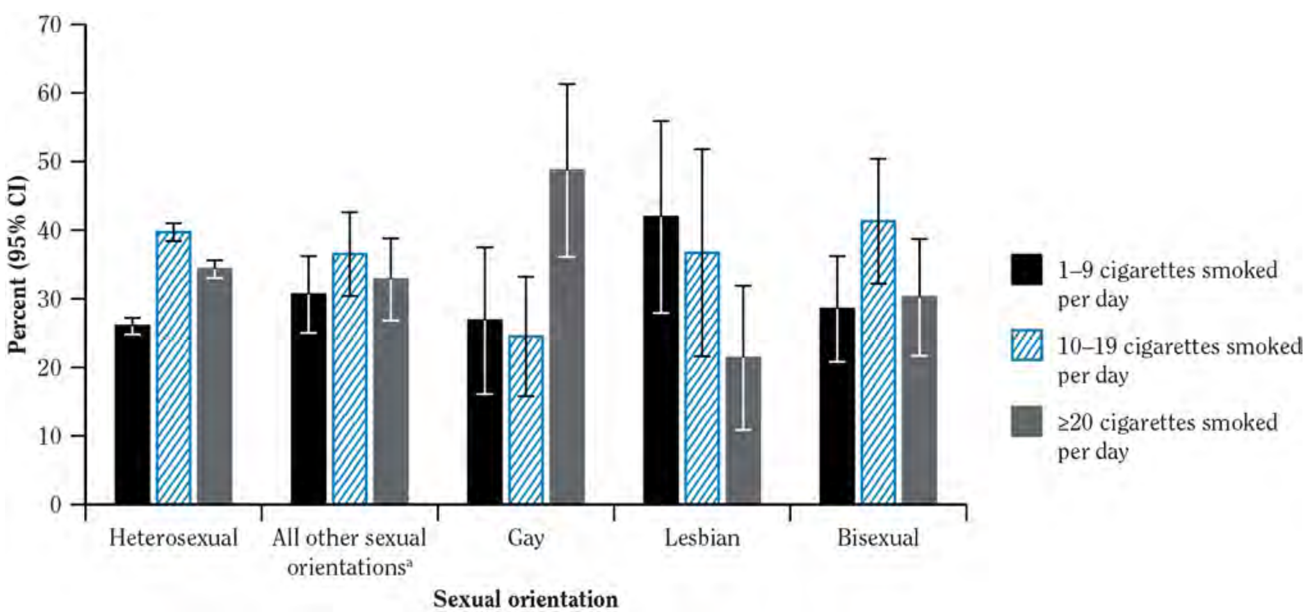
Data from the 2019–2021 NHIS indicate that the prevalence of daily cigarette use among adults was significantly higher among adults who identified with a minoritized sexual orientation group (12.1%; 95% CI, 10.7–13.6) than it was among heterosexual adults (9.6%; 95% CI, 9.3–9.9) (NHIS, public use data, 2019–2021; data not shown in tables). Among adults who currently smoke cigarettes, the percentage of adults smoking 20 or more cigarettes each day was higher among gay adults (48.7%; 95% CI, 36.1–61.2) than it was among heterosexual adults (34.3%; 95% CI, 33.0–35.6). In contrast, the percentage of adults smoking 1–9 cigarettes per day was higher among lesbian adults (41.9%; 95% CI, 27.9–55.9) than it was among heterosexual adults (26.0%; 95% CI, 24.8–27.2). (Figure 2.3).

The prevalence of daily cigarette use among young adults who identified with a minoritized sexual orientation group (6.1%; 95% CI, 4.1–9.1) was similar to that of young adults who were heterosexual (4.2%; 95% CI, 3.6–5.0). However, the prevalence of daily cigarette use was higher among young adults who were bisexual (7.8%; 95% CI, 5.1-12.0) than it was among young adults who were heterosexual (4.2%; 95% CI, 3.6–5.0) (NHIS, public use data, 2019–2021) (data not shown in tables or figures; no gay men 18–24 years of age reported daily cigarette use; estimate for lesbian women suppressed due to small numbers).

Patterns of Smoking Cessation

According to NHIS data from 2019 to 2021, estimates of making a quit attempt in the past year were higher among adults (18 years of age and older) who identified with a minoritized sexual orientation group (67.3%; 95% CI,

Figure 2.3 Percentage of adults, 18 years of age and older, who currently smoked cigarettes, by sexual orientation and number of cigarettes smoked per day; National Health Interview Survey (NHIS) 2019–2021 combined data, United States



Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.
Notes: **CI =** confidence interval.
[a]All other sexual orientations includes responses from those who reported identifying as gay, lesbian, bisexual, and those who reported "something else."

57.9–75.5)—and specifically, adults who were bisexual (71.1%; 95% CI, 57.1–82.0)—than it was among adults who were heterosexual (54.4%; 95% CI, 52.2–56.6). However, estimates of quitting smoking for at least 6 months were similar between adults who were heterosexual (8.0%; 95% CI, 6.9–9.2) and adults who identified with a minoritized sexual orientation group (13.1%; 95% CI, 8.0–20.9) (Table 2.11).

Among young adults (18–24 years of age), 68.5% (95% CI, 58.4–77.1) overall reported making a quit attempt during the past year, and 14.6% (95% CI, 9.1–22.6) reported quitting smoking for at least 6 months. Among young adults who were heterosexual, 65.6% (95% CI, 53.9–75.7) reported making a quit attempt during the past year and 14.3% (95% CI, 8.3–23.5) reported quitting smoking for at least 6 months. Data on making a quit attempt during the past year and quitting smoking for at least 6 months were suppressed for young adults who identified with a minoritized sexual orientation group (Table 2.11).

Patterns of Use of Other Tobacco Products

E-Cigarettes

Youth

Data from the 2019 YRBS indicate that ever use of electronic vapor products (referred to hereafter as e-cigarettes)—including e-cigars, e-pipes, e-hookahs, vaping pens, and hookah pens—was greater among gay, lesbian, or bisexual high school students (56.0%; 95% CI, 52.2–59.7) than heterosexual high school students (49.8%; 95% CI, 47.7–52.0) or high school students who were unsure of their sexual orientation (37.2%; 95% CI, 30.9–43.9) (Table 2.10). The prevalence of past-30-day use of e-cigarettes was greater among gay, lesbian, or bisexual high school students (34.1%; 95% CI, 30.8–37.6) than it was among high school students who were unsure of their sexual orientation (24.9%; 95% CI, 19.8–30.7) but was similar to the prevalence of past-30-day e-cigarette use among heterosexual high school students (32.8%; 95% CI, 30.5–35.2) (Table 2.10). Frequent use of e-cigarettes was similar among high school students who identified as heterosexual (10.8%; 95% CI, 9.4–12.3); gay, lesbian, or bisexual (10.5%; 95% CI, 8.1–13.5); and among those who were unsure of their sexual orientation (8.8%; 95% CI, 6.1–12.6) (CDC n.d.g). Daily use of e-cigarettes was also similar among high school students who identified as heterosexual (7.2%; 95% CI, 6.0–8.6); gay, lesbian, or bisexual (6.7; 95% CI, 4.8–9.3); and among those who were unsure of their sexual orientation (5.9%; 95% CI, 3.6–9.4) (CDC n.d.f).

Adults

From 2019 to 2021, NHIS data indicate that ever use of e-cigarettes was significantly higher among adults who identified with a minoritized sexual orientation group (37.8%; 95% CI, 35.7–40.0) than it was among heterosexual adults (16.5%; 95% CI, 16.1–16.9). Among adults who identified with a minoritized sexual orientation group, 31.8% (95% CI, 27.9–36.0) of gay men, 26.7% (95% CI, 22.5–31.4) of lesbian women, and 46.7% (95% CI, 43.4–50.1) of bisexual adults had ever used e-cigarettes (NHIS, public use data, 2019–2021).

Among all adults, current use of e-cigarettes was higher among adults who identified with a minoritized sexual orientation group (11.2%; 95% CI, 9.8–12.8), specifically gay (7.8%; 95% CI, 6.0–10.2) and bisexual (15.4%; 95% CI, 13.0–18.0) adults, than it was among heterosexual adults (4.0%; 95% CI, 3.8–4.1) (Table 2.11).

Among young adults, NHIS data from 2019 to 2021 show that the prevalence of ever e-cigarette use was higher among young adults who identified with a minoritized sexual orientation group (42.1%; 95% CI, 37.4–47.1) than it was among heterosexual young adults (30.3%; 95% CI, 28.7–31.9) (NHIS, public use data, 2019–2021). The prevalence of current e-cigarette use was also higher among young adults who identified with a minoritized sexual orientation group (14.3%; 95% CI, 11.2–18.0) than it was among heterosexual young adults (9.3%; 95% CI, 8.4–10.4). The prevalence of current e-cigarette use among individual groups of people who identified with a minoritized sexual orientation group was suppressed for young adults who identified as gay and lesbian; however, 18.5% (95% CI, 14.0–23.9) of young adults who identified as bisexual reported current e-cigarette use (Table 2.11).

Smokeless Tobacco

Youth

Data from the 2019 YRBS indicate that the prevalence of current use of smokeless tobacco was similar among high school students who were heterosexual (3.7%; 95% CI, 3.1–4.4); gay, lesbian, or bisexual (3.2%; 95% CI, 2.0–5.2); and high school students who were unsure of their sexual orientation (5.5%; 95% CI, 3.1–9.4) (Table 2.10). Data from the 2017 YRBS indicate that frequent use and daily use of smokeless tobacco did not differ by sexual orientation (Kann et al. 2018).

Adults

Ever use of smokeless tobacco among adults was comparable among heterosexual adults (11.0%; 95% CI, 10.7–11.3) and among adults who identified with a minoritized sexual orientation group (10.1%; 95% CI, 8.9–11.4;

NHIS, public use data, 2019–2021; data not shown in tables). Current use of smokeless tobacco was higher among heterosexual adults (2.4%; 95% CI, 2.2–2.5) than it was among adults who identified with a minoritized sexual orientation group (1.0%; 95% CI, 0.7–1.5) (Table 2.11).

An estimated 9.0% (95% CI, 8.1–10.1) of heterosexual young adults and 7.0% (95% CI, 4.7–10.3) of young adults who identified with a minoritized sexual orientation group had ever used smokeless tobacco (NHIS, public use data, 2019–2021). The prevalence of current use of smokeless tobacco among heterosexual young adults was 2.2% (95% CI, 1.8–2.8), but data were suppressed for young adults who identified with a minoritized sexual orientation group (Table 2.11).

Cigars

Youth

Data from the 2019 YRBS indicate that the prevalence of current cigar use was similar among high school students who were heterosexual (5.2%; 95% CI, 4.4–6.1); gay, lesbian, or bisexual (8.1%; 95% CI, 5.9–11.1); and those who were unsure of their sexual orientation (7.2%; 95% CI, 4.3–12.0) (Table 2.10). According to 2019 YRBS data, the prevalence of frequent and daily cigar use was highest among high school students who were unsure of their sexual orientation (3.7%; 95% CI, 1.8–7.4 and 3.2%; 95% CI, 1.5–6.8; respectively); frequent and daily cigar use in this population differed significantly from the prevalence among heterosexual youth (0.8%, 95% CI, 0.5–1.2 and 0.6%, 95% CI, 0.4–0.9, respectively) (CDC n.d.d, n.d.e).

Adults

Data from the 2019–2021 NHIS indicate that the prevalence of ever use of cigars (28.2%; 95% CI, 27.6–28.7) was lower among heterosexual adults than it was among adults who identified with a minoritized sexual orientation group (35.4%; 95% CI, 33.4–37.4). Overall, 31.3% (95% CI, 27.1–35.8) of lesbian, 35.1% (95% CI, 31.2–39.1) of gay, and 37.9% (95% CI, 34.7–41.1) of bisexual adults had ever used cigars (NHIS, public use data, 2019–2021). Current use of cigars was similar between heterosexual adults (3.5%; 95% CI, 3.3–3.7) and adults who identified with a minoritized sexual orientation group (4.3%; 95% CI, 3.4–5.4). However, adults identifying as bisexual (5.4%; 95% CI, 4.1–7.1) reported a higher prevalence of current use of cigars compared with heterosexual adults (Table 2.11).

Data from the 2019–2021 NHIS indicate that ever use of cigars was comparable among young adults who identified with a minoritized sexual orientation group (22.4%; 95% CI, 18.6–26.8) and young adults who were heterosexual (20.8%; 95% CI, 19.4–22.2) (NHIS, public use data, 2019–2021). Similarly, current use of cigars was comparable between young adults who identified with a minoritized sexual orientation group (4.2%; 95% CI, 2.6–6.7) and young adults who were heterosexual (3.5%; 95% CI, 3.0–4.2) (Table 2.11).

Pipes, Including Hookahs and Water Pipes

Youth

Data on pipe use by sexual orientation are not available in the YRBS, but NYTS data show that less than 1% of U.S. middle and high school students reported use of pipes during the past 30 days in 2020, making it difficult to obtain stable estimates among students with different sexual orientations (Gentzke et al. 2020).

Data from the 2020 NYTS indicate that the prevalence of current hookah use was greater among U.S. middle and high school students who were gay, lesbian, or bisexual (4.6%; 95% CI, 3.4–6.1) than it was among students who identified as heterosexual (1.7%; 95% CI, 1.4–2.1); 2.7% (95% CI, 1.5–4.7) of students who were unsure of their sexual orientation reported current hookah use (Gentzke et al. 2020).

Adults

More than a quarter of bisexual adults (27.3%; 95% CI, 24.5–30.2) and gay men 25.3% (95% CI, 21.7–29.3) reported ever use of pipes (including regular pipes, water pipes, or hookahs) compared with 18.0% (95% CI, 14.5–22.1) of lesbian women (NHIS, public use data, 2019–2021). Prevalence of current pipe use was lower among heterosexual adults (1.0%; 95% CI, 0.9–1.0) than it was among adults who identified with a minoritized sexual orientation group (2.3%; 95% CI, 1.7–3.1) (Table 2.11).

For young adults, estimates of the prevalence of ever use of pipes were 19.2% (95% CI, 15.2–24.0) for bisexual individuals and 11.2% (95% CI, 10.2–12.3) for heterosexual individuals (NHIS, public use data, 2019–2021; estimates were suppressed for gay, lesbian, and other sexual orientation individuals). The prevalence of current pipe use among heterosexual young adults was 1.8% (95% CI, 1.4–2.3), but data were suppressed for young adults who identified with a minoritized sexual orientation group (Table 2.11).

Patterns of Polytobacco Use

Youth

Data from the 2019 YRBS indicate that use of multiple tobacco products during the past 30 days was similar for high school students who were heterosexual (7.8%; 95% CI, 6.7–9.0), students who were unsure of their sexual orientation (8.1%; 95% CI, 5.4–11.9), and students who were gay, lesbian, or bisexual (10.4%; 95% CI, 8.0–13.5) (Table 2.10).

Adults

Data from the 2019–2021 NHIS indicate that current use of two or more tobacco products was lower for heterosexual adults (3.4%; 95% CI, 3.2–3.6) than it was for adults who identified with a minoritized sexual orientation group (6.5%; 95% CI, 5.5–7.8) (Table 2.11). The prevalence of polytobacco use among bisexual adults (8.3%; 95% CI, 6.7–10.2) and gay adults (6.2%; 95% CI, 4.0–9.4) was higher than the prevalence among heterosexual adults (3.4%; 95% CI, 3.2–3.6), while the prevalence among adults who were lesbian (3.9%; 95% CI, 2.5–5.9) was similar to that of heterosexual adults (Table 2.11).

The prevalence of current polytobacco use was similar between young adults who identified with a minoritized sexual orientation group (5.5%; 95% CI, 3.8–7.8) and young adults who were heterosexual (4.9%; 95% CI, 4.3–5.7) (Table 2.11).

Patterns of Co-Use with Other Substances

Few national studies report on the prevalence of tobacco co-use with other substances by sexual orientation, though several studies have used latent class analyses to identify patterns of substance co-use and the association between sexual orientation and these patterns of co-use. Three studies using national data on adolescents found three patterns of use that captured tobacco use with alcohol and cannabis (Dermody 2018; Coulter et al. 2019; Silveira et al. 2019). In these studies, the odds of tobacco and substance co-use were higher among adolescents who identified as gay, lesbian, or bisexual than the odds of such use among adolescents who identified as heterosexual.

Tobacco Use by Sexual Orientation and Race and Ethnicity

NHIS data during 2019–2021 highlight differences in tobacco use by sexual orientation and race and ethnicity. Due to small sample sizes, comparisons in current use of tobacco products or cessation behavior were not possible across all racial, ethnic, and sexual orientation populations.

Among Black adults, the prevalence of current e-cigarette use was higher among adults who identified with a minoritized sexual orientation group (including individuals who identified as gay, lesbian, bisexual, or who reported “something else”) (7.0%; 95% CI, 4.1–11.7) than it was among heterosexual adults (2.2%; 95% CI, 1.9–2.7). Current use of two or more tobacco products was also higher among Black adults who identified with a minoritized sexual orientation group (6.5%; 95% CI, 4.0–10.2) than it was among those who were heterosexual (3.1%; 95% CI, 2.7–3.6) (Table 2.12).

Among Hispanic adults, the prevalence of current use of e-cigarettes was higher among adults who identified with a minoritized sexual orientation group (10.7%; 95% CI, 7.6–14.8) than it was among heterosexual adults (2.7%; 95% CI, 2.4–3.1). Hispanic adults who identified with a minoritized sexual orientation group also reported a higher prevalence of current use of two or more tobacco products (4.4%; 95% CI, 2.6–7.4) compared with heterosexual Hispanic adults (2.1%; 95% CI, 1.8–2.4).

Among White adults, the prevalence of current cigarette use was higher among adults who identified with a minoritized sexual orientation group (16.7%; 95% CI, 14.9–18.6) than it was among heterosexual adults (13.8%; 95% CI, 13.4–14.2). Additionally, the prevalence of current e-cigarette use and current use of two or more tobacco products was higher among White adults who identified with a minoritized sexual orientation group than it was among those who were heterosexual: current e-cigarette use (minoritized sexual orientation group: 11.4%; 95% CI, 9.8–13.4 vs. heterosexual: 4.6%; 95% CI, 4.3–4.8) and current use of two or more tobacco products (minoritized sexual orientation group: 6.2%; 95% CI, 5.1–7.5 vs. heterosexual: 3.8%; 95% CI, 3.6–4.1). However, among White adults, the prevalence of current smokeless tobacco use was higher among heterosexual adults (3.3%; 95% CI, 3.1–3.5) than it was among adults who identified with a minoritized sexual orientation group (1.1%; 95% CI, 0.7–1.8).

Among adults who identified with “Other” or multiple races, the prevalence of current e-cigarette use was higher among adults who identified with a minoritized sexual orientation group (18.4%; 95% CI, 11.5–28.0) than it was among heterosexual adults (7.4%; 95% CI, 5.9–9.3).

Patterns of Tobacco Product Use by Gender Identity

Youth

Gender identity was not measured in the 2019 YRBS. However, the NYTS first assessed gender identity during the 2021 administration (Gentzke et al. 2022). Based on data from the 2021 NYTS, a higher percentage of U.S. middle and high school students who identified as transgender (37.9%; 95% CI, 31.3–45.0) had ever used any tobacco product compared with those who reported they were not transgender (23.4%; 95% CI, 21.3–25.7). In

Table 2.12 Prevalence of ever use of cigarettes, current use of tobacco products, and smoking cessation among adults, 18 years of age and older, by sexual orientation and race and ethnicity; National Health Interview Survey (NHIS) 2019–2021 combined data, United States

		Current use of tobacco products:[a] % (95% CI)						Smoking cessation (2020): % (95% CI)	
Sexual orientation and race and ethnicity	**Ever use of cigarettes:[b] % (95% CI)**	**Cigarettes**	**Cigars**	**Smokeless tobacco**	**Pipes[c]**	**E-cigarettes**	**≥2 tobacco products[d]**	**Attempt in past year[e]**	**Quit for ≥6 months[f]**
Heterosexual	35.4 (34.9–35.9)	12.5 (12.2–12.8)	3.5 (3.3–3.7)	2.4 (2.2–2.5)	1.0 (0.9–1.0)	4.0 (3.8–4.1)	3.4 (3.2–3.6)	54.4 (52.2–56.6)	8.0 (6.9–9.2)
American Indian and Alaska Native	45.7 (37.5–54.1)	22.1 (16.0–29.7)	3.6 (2.1–5.9)	5.4 (3.6–8.0)	—[g]	3.8 (2.2–6.7)	6.9 (4.6–10.3)	49.0 (32.4–65.9)	—[g]
Asian	18.9 (17.5–20.4)	6.6 (5.7–7.6)	1.1 (0.8–1.5)	0.5 (0.3–0.8)	0.7 (0.5–1.1)	2.9 (2.3–3.6)	1.5 (1.1–2.0)	67.4 (56.5–76.7)	—[g]
Black	26.9 (25.8–28.2)	13.6 (12.6–14.5)	4.7 (4.1–5.3)	0.8 (0.5–1.1)	1.5 (1.2–1.9)	2.2 (1.9–2.7)	3.1 (2.7–3.6)	61.3 (54.8–67.5)	6.7 (4.6–9.7)
Hispanic	23.2 (22.3–24.2)	8.1 (7.5–8.7)	2.5 (2.2–2.9)	0.6 (0.5–0.8)	0.8 (0.6–1.0)	2.7 (2.4–3.1)	2.1 (1.8–2.4)	56.0 (49.3–62.5)	6.3 (3.8–10.3)
Other and multiple races	39.4 (36.5–42.4)	17.3 (15.0–19.9)	4.4 (3.2–6.2)	2.5 (1.7–3.6)	—[g]	7.4 (5.9–9.3)	6.3 (4.7–8.5)	54.5 (40.2–68.1)	—[g]
White	41.5 (40.9–42.0)	13.8 (13.4–14.2)	3.7 (3.5–4.0)	3.3 (3.1–3.5)	0.9 (0.8–1.0)	4.6 (4.3–4.8)	3.8 (3.6–4.1)	52.3 (49.7–54.9)	8.7 (7.3–10.2)
Not heterosexual (all)[h]	38.0 (36.0–40.0)	16.3 (14.8–17.9)	4.3 (3.4–5.4)	1.0 (0.7–1.5)	2.3 (1.7–3.1)	11.2 (9.8–12.8)	6.5 (5.5–7.8)	67.3 (57.9–75.5)	13.1 (8.0–20.9)
American Indian and Alaska Native	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	N/A	N/A
Asian	22.7 (15.0–32.8)	11.5 (6.5–19.5)	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	N/A
Black	27.0 (21.9–32.7)	16.5 (12.6–21.4)	6.4 (4.0–10.0)	—[g]	—[g]	7.0 (4.1–11.7)	6.5 (4.0–10.2)	—[g]	—[g]
Hispanic	26.3 (21.6–31.5)	11.9 (8.3–16.8)	3.3 (1.8–5.7)	—[g]	—[g]	10.7 (7.6–14.8)	4.4 (2.6–7.4)	—[g]	—[g]
Other and multiple races	47.9 (37.3–58.7)	25.3 (15.9–37.7)	—[g]	—[g]	—[g]	18.4 (11.5–28.0)	—[g]	—[g]	—[g]
White	42.4 (39.9–44.9)	16.7 (14.9–18.6)	4.1 (3.2–5.4)	1.1 (0.7–1.8)	1.4 (0.9–2.1)	11.4 (9.8–13.4)	6.2 (5.1–7.5)	60.6 (49.2–70.9)	16.0 (9.1–26.4)

Table 2.12 Continued

Sexual orientation and race and ethnicity	Ever use of cigarettes:[b] % (95% CI)	Current use of tobacco products:[a] % (95% CI)						Smoking cessation (2020): % (95% CI)	
		Cigarettes	Cigars	Smokeless tobacco	Pipes[c]	E-cigarettes	≥2 tobacco products[d]	Attempt in past year[e]	Quit for ≥6 months[f]
Gay	40.7 (36.7–44.7)	16.3 (13.2–19.9)	—[g]	—[g]	—[g]	7.8 (6.0–10.2)	6.2 (4.0–9.4)	64.1 (46.4–78.6)	—[g]
American Indian and Alaska Native	—[g]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Asian	—[g]	—[g]	N/A	—[g]	N/A	—[g]	—[g]	—[g]	N/A
Black	33.3 (21.5–47.6)	20.0 (11.3–33.0)	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]
Hispanic	28.8 (20.5–38.8)	12.5 (7.4–20.5)	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]
Other and multiple races	—[g]	—[g]	—[g]	N/A	—[g]	—[g]	—[g]	—[g]	N/A
White	44.3 (39.8–48.9)	15.7 (12.7–19.4)	2.4 (1.4–3.9)	—[g]	—[g]	7.9 (5.8–10.6)	4.7 (3.2–7.0)	—[g]	—[g]
Lesbian	34.5 (30.2–39.0)	13.4 (10.5–16.9)	3.3 (1.9–5.7)	—[g]	—[g]	5.9 (4.0–8.5)	3.9 (2.5–5.9)	—[g]	—[g]
American Indian and Alaska Native	—[g]	—[g]	N/A	N/A	N/A	—[g]	N/A	N/A	N/A
Asian	—[g]	—[g]	N/A	N/A	N/A	—[g]	—[g]	—[g]	N/A
Black	21.4 (14.1–31.0)	—[g]	—[g]	N/A	—[g]	—[g]	—[g]	—[g]	—[g]
Hispanic	26.2 (17.0–38.1)	—[g]	—[g]	—[g]	N/A	—[g]	—[g]	—[g]	N/A
Other and multiple races	—[g]	—[g]	—[g]	N/A	N/A	—[g]	—[g]	N/A	N/A
White	39.3 (33.6–45.3)	14.3 (10.5–19.2)	—[g]	—[g]	—[g]	4.7 (2.9–7.5)	—[g]	—[g]	—[g]

Table 2.12 Continued

Sexual orientation and race and ethnicity	Ever use of cigarettes:[b] % (95% CI)	Current use of tobacco products:[a] % (95% CI)						Smoking cessation (2020): % (95% CI)	
		Cigarettes	Cigars	Smokeless tobacco	Pipes[c]	E-cigarettes	≥2 tobacco products[d]	Attempt in past year[e]	Quit for ≥6 months[f]
Bisexual	39.6 (36.4–42.9)	18.0 (15.7–20.6)	5.4 (4.1–7.1)	1.0 (0.6–1.8)	2.8 (1.9–4.1)	15.4 (13.0–18.0)	8.3 (6.7–10.2)	71.1 (57.1–82.0)	—[g]
American Indian and Alaska Native	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	N/A	N/A
Asian	—[g]	—[g]	N/A	N/A	—[g]	—[g]	—[g]	—[g]	N/A
Black	28.4 (19.9–38.9)	19.4 (12.8–28.2)	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]
Hispanic	28.7 (21.2–37.6)	15.4 (9.3–24.5)	—[g]	—[g]	—[g]	—[g]	—[g]	—[g]	N/A
Other and multiple races	50.4 (37.0–63.8)	23.9 (15.0–35.9)	—[g]	—[g]	—[g]	23.9 (13.7–38.3)	—[g]	—[g]	—[g]
White	43.7 (39.8–47.7)	18.1 (15.4–21.1)	5.8 (4.2–8.1)	—[g]	—[g]	15.5 (12.6–18.8)	8.3 (6.4–10.7)	68.5 (51.1–81.9)	—[g]

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021; ever use of cigarettes and current use of tobacco are based on 2019–2021 data; and smoking cessation outcomes are based on 2020 data.

Notes: **CI =** confidence interval; **N/A =** not available.

[a]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days.

[b]People who had ever smoked cigarettes was defined as those who smoked at least 100 cigarettes in their lifetimes.

[c]Pipes included use of regular pipes, water pipes, or hookah.

[d]Any combination of more than one tobacco product.

[e]Percentage of people who (a) currently smoked cigarettes and reported having stopped smoking for more than 1 day during the past 12 months because they were trying to quit smoking and (b) quit smoking during the past year.

[f]Quit for at least 6 months was defined as the percentage of people who used to smoke cigarettes and reported having quit smoking for at least 6 months during the past year, among people who currently smoked for at least 2 years and people who had quit smoking during the past year.

[g]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

[h]Includes people who identified as gay, lesbian, or bisexual or who reported "something else."

addition, 26.4% (95% CI, 20.7–33.1) of students who were unsure about their gender identity reported ever use of any tobacco product (Gentzke et al. 2022). An estimated 18.9% (95% CI, 13.8–25.4) of students who identified as transgender reported current (during the past 30 days) use of any tobacco product compared with 8.2% (95% CI, 7.3–9.3) of students who reported they were not transgender and 9.1% (95% CI, 6.1–13.5) of students who were unsure about their gender identity (Gentzke et al. 2022).

Adults

Gender identity was not measured in the 2019–2021 NHIS; however, it was added to the survey beginning in 2022 (National Center for Health Statistics 2022). According to data analyzed from Wave 2 of the PATH Study (fielded October 2014–October 2015), a higher prevalence of current use of cigarettes, e-cigarettes, or cigars was reported among transgender adults (33.0%; 95% CI, 24.3–41.7) compared with cisgender adults (23.8%; 95% CI, 23.2–24.4; $p = 0.021$). However, in multivariable-adjusted analyses, transgender identity was not associated with the use of tobacco products (Wheldon and Wiseman 2019). This finding contrasts with a previous study that found transgender adults use tobacco products at a higher prevalence compared with cisgender adults in adjusted analyses (Buchting et al. 2017).

Tobacco Use by Socioeconomic Status

In the United States, SES is typically measured by indicators of income (e.g., annual family income in dollars) or educational attainment (e.g., years of schooling or degrees earned). Regardless, SES is a complex construct that includes multiple dimensions of different health advantages and disadvantages. Lower SES is associated with unhealthy behaviors, and disparities in tobacco use exist in a gradient across SES levels (NCI 2017).

Despite declines in current cigarette use over time, adults with 9–12 years of education (but no diploma) and adults with a high school diploma or General Educational Development (GED) equivalent have consistently reported a higher prevalence of current cigarette use (Figure 2.4). Furthermore, disparities in the prevalence of smoking by educational attainment have increased over time. For example, in 1970, the prevalence of smoking among people with 9–12 years of education (but no diploma) was 15.8 percentage points higher than those with a college degree (44.6% vs. 28.8%). However, in 2018, the gap in the prevalence of smoking among people with 9–12 years of education (but no diploma) and those with a college degree increased to 21.7 percentage points (27.5% vs. 5.8%, respectively). Thus, the smoking prevalence ratio between those with a 9th- to 12th-grade education (but no diploma) and those with a college degree has increased by nearly 1.5 times over 50 years (Figure 2.4).

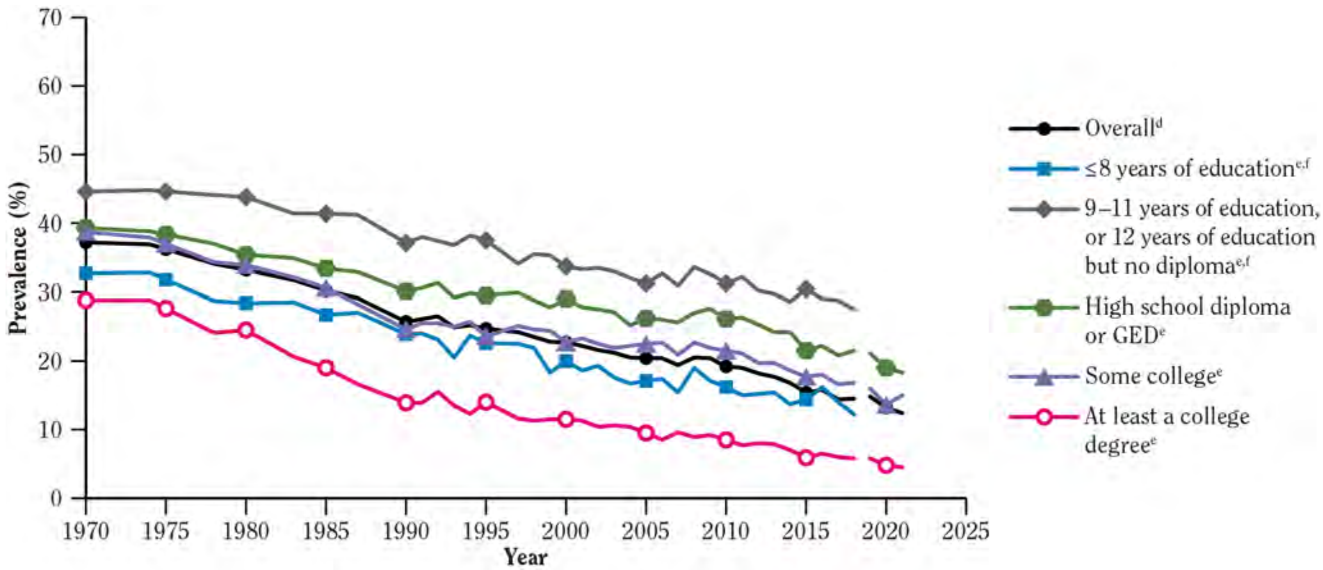
Prior research has shown that the prevalence of smoking in the U.S. population follows an educational gradient, where those with higher levels of educational attainment have lower rates of smoking and those with lower levels of educational attainment have higher rates of smoking (Pampel 2009; Ho and Fenelon 2015). However, these earlier data often used a single category for all people with less than a high school education. When this group is disaggregated into (a) those with an eighth-grade education or less and (b) those with 9–12 years of education (but no diploma), estimates of the prevalence of smoking do not follow this gradient.

Cao and colleagues (2018, 2023) found that people with less than an eighth-grade education had the second-lowest prevalence of smoking after college graduates. This may be due to demographic changes in people with less than an 8th-grade education, which includes an increasing proportion of people who are Hispanic and foreign-born, particularly individuals who were born in Mexico and Central America (Gambino 2017; Cao et al. 2023). As previously described in this chapter, these population groups, overall, have relative low rates of smoking (Cao et al. 2023). The proportion of the adult population that has completed high school or obtained a college degree by 25 years of age has increased steadily over time.

Even as levels of educational attainment have increased over the past several decades, the relative prevalence ranking of each educational group has remained largely the same. People with 9–12 years of education (but no diploma) have had the highest prevalence of smoking of any educational attainment category over the past several decades, and college graduates have consistently had the lowest prevalence of smoking (Cao et al. 2018).

This section focuses on tobacco use by SES among adults, with SES defined in multiple ways. Household income in relationship to the federal poverty level, which is published annually by the U.S. Census Bureau, is used primarily to create a categorical measure of SES (i.e., low, medium, or high). Low SES is defined as having a household income below the federal poverty level, medium SES is defined as having a household income equal to or up to nearly twice the federal poverty level, and high SES is

Figure 2.4 Prevalence of current cigarette smoking[a] among adults, 25 years of age and older, by level of educational attainment;[b] National Health Interview Survey (NHIS) 1970–2021,[c] United States



Source: NHIS, National Center for Health Statistics, public use data, 1970–2021.
Notes: **GED =** General Educational Development.
[a]People who reported having smoked at least 100 cigarettes during their lifetimes and who, at the time of the interview, reported smoking "every day" or "some days."
[b]Reporting format for level of educational attainment and smoking and tobacco use changed in 2016 for articles appearing in *Morbidity and Mortality Weekly Report*. Analyses are restricted to respondents 25 years of age and older.
[c]The NHIS underwent a redesign in 2019. Because of the changes in weighting and design methodology, direct comparisons between estimates beginning in 2019 and earlier years should be made with caution because the effects of these changes have not been fully evaluated yet. This change is represented by a break in the trend lines between 2018 and 2019.
[d]For the *Overall* category, data on level of educational attainment were not reported for 1971–1973, 1975–1977, 1979, 1981, 1982, 1984, 1986, 1988, 1989, and 1996.
[e]Data for the specific levels of educational attainment were not reported for 1971–1973, 1975–1977, 1979, 1981, 1982, 1984, 1986, 1988, 1989, and 1996.
[f]For 2019–2021, data could not be broken out because of how the education variable was recoded.

defined as having a household income at least twice the federal poverty level or higher. Patterns in current cigarette smoking are also persistent by poverty status, as people living below the poverty level have a higher prevalence of cigarette smoking than people living at or above the poverty level (Figure 2.5).

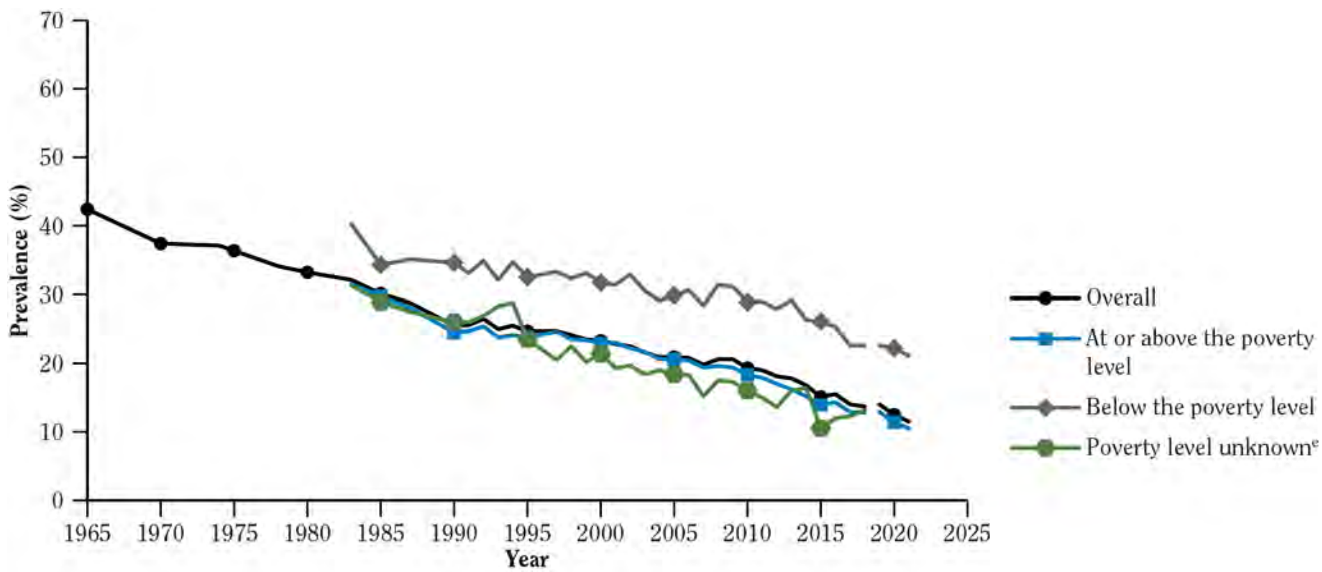
Data on youth are not presented in this section because of the lack of a reliable measure of SES for this age group. The YRBS—the principal source for data on youth used in this report—does not include a measure of SES.

Patterns of Ever and Current Use of Cigarettes

According to data from the NHIS, in 2020, people with the highest self-reported income (>$100,000 annual household income) had roughly one-third the prevalence of smoking (6.2%; 95% CI, 5.6–6.9) of those with the lowest household incomes (<$35,000) (20.2%; 95% CI, 19.0–21.4) (Table 2.13). Furthermore, tobacco use has consistently been 5–10 percentage points higher among people living below the federal poverty level (Figure 2.5).

The prevalence of ever use of cigarettes among all adults during 2019–2021 was higher in the medium-SES group (39.2%; 95% CI, 38.2–40.3) and low-SES group (39.1%; 95% CI, 37.7–40.6) than it was in the high-SES group (33.9%; 95% CI, 33.4–34.4), as defined by poverty level (Table 2.14). Current cigarette use varied by SES, as defined by poverty level, with the highest prevalence observed in the low-SES group (22.0%; 95% CI, 20.9–23.2), followed by the medium-SES group (18.1%; 95% CI, 17.4–18.9); the prevalence estimate for the high-SES group (10.0%; 95% CI, 9.7–10.3) was about half that of the low-SES group.

Figure 2.5 Trends in the prevalence of current cigarette smoking[a] among adults, 18 years of age and older, by poverty status;[b] National Health Interview Survey 1965–2021,[c,d] United States



Source: NHIS, National Center for Health Statistics, public use data, 1965–2021.

[a]People who reported having smoked 100 or more cigarettes during their lifetime and who, at the time of the interview, reported smoking "every day" or "some days."

[b]Based on self-reported family income and poverty thresholds published by the U.S. Census Bureau (n.d.b).

[c]For the *Overall* category, data for poverty status were not reported for 1966–1969, 1971–1973, 1975–1977, 1979, 1981, 1982, 1984, 1986, 1988, 1989, and 1996. Data on the specific levels of poverty status were collected starting in 1983. Thereafter, data on the specific levels of poverty status were not reported for 1984, 1986, 1988, 1989, and 1996.

[d]The NHIS underwent a redesign in 2019. Because of the changes in weighting and design methodology, direct comparisons between estimates beginning in 2019 and earlier years should be made with caution because the effects of these changes have not been fully evaluated yet. This change is represented by a break in the trend lines between 2018 and 2019.

[e]Data for *poverty level unknown* are not available for 2019–2021.

Table 2.13 Percentage of current cigarette smoking among adults[a] overall and by annual household income,[b] National Health Interview Survey (NHIS) 2019–2020, United States

Year	Overall: % (95% CI)	<$35,000: % (95% CI)	$35,000–74,999: % (95% CI)	$75,000–99,999: % (95% CI)	≥$100,000: % (95% CI)
2019	14.0 (13.4–14.5)	21.4 (20.3–22.6)	15.7 (14.8–16.7)	11.4 (10.1–12.7)	7.1 (6.4–7.8)
2020	12.5 (11.9–13.0)	20.2 (19.0–21.4)	14.1 (13.1–15.1)	10.5 (9.3–11.9)	6.2 (5.6–6.9)

Source: NHIS, National Center for Health Statistics, public use data, 2019–2020.

Notes: **CI** = confidence interval.

[a]People who currently smoked included adults who reported having smoked at least 100 cigarettes in their lifetimes and specified that they currently smoked "every day" or "some days."

[b]Based on self-reported family income and poverty thresholds published by the U.S. Census Bureau (n.d.b).

Table 2.14 Prevalence of ever use of cigarettes and current use of tobacco products among adults (≥18 years of age) and young adults (18–24 years of age), by socioeconomic status;[a] National Health Interview Survey (NHIS) 2019–2021, United States

		Current use of tobacco products:[b] % (95% CI)					
Age group and socioeconomic status	**Ever use of cigarettes:[c] % (95% CI)**	**Cigarettes**	**Cigars**	**Smokeless tobacco**	**Pipes[d]**	**E-cigarettes**	**≥2 tobacco products[e]**
Adults (≥18 years of age)							
Overall	35.4 (34.9–35.9)	12.7 (12.4–13.0)	3.5 (3.4–3.7)	2.3 (2.2–2.4)	1.0 (0.9–1.1)	4.2 (4.1–4.4)	3.5 (3.4–3.7)
Low (< the poverty level)	39.1 (37.7–40.6)	22.0 (20.9–23.2)	3.3 (2.9–3.8)	1.9 (1.5–2.3)	1.3 (1.0–1.6)	4.9 (4.4–5.5)	4.8 (4.3–5.5)
Medium (1–<2 times the poverty level)	39.2 (38.2–40.3)	18.1 (17.4–18.9)	3.3 (3.0–3.7)	2.0 (1.8–2.3)	1.3 (1.0–1.5)	4.8 (4.4–5.3)	4.6 (4.2–5.0)
High (≥2 times the poverty level)	33.9 (33.4–34.4)	10.0 (9.7–10.3)	3.6 (3.4–3.8)	2.4 (2.3–2.6)	0.9 (0.8–1.0)	4.0 (3.8–4.2)	3.1 (2.9–3.3)
Young adults (18–24 years of age)							
Overall	12.2 (11.2–13.3)	6.9 (6.2–7.7)	3.7 (3.1–4.3)	2.0 (1.6–2.5)	1.8 (1.4–2.2)	9.9 (9.0–10.8)	5.1 (4.4–5.8)
Low (< the poverty level)	12.2 (10.0–14.9)	8.2 (6.4–10.5)	3.4 (2.2–5.1)	—[f]	1.7 (0.9–3.0)	8.9 (7.0–11.3)	4.8 (3.4–6.7)
Medium (1–<2 times the poverty level)	14.7 (12.5–17.2)	9.6 (7.9–11.6)	4.1 (3.0–5.5)	1.7 (1.0–2.8)	2.3 (1.5–3.5)	11.2 (9.3–13.5)	5.8 (4.5–7.5)
High (≥2 times the poverty level)	11.3 (10.2–12.6)	5.6 (4.8–6.6)	3.6 (2.9–4.4)	2.4 (1.8–3.1)	1.6 (1.2–2.2)	9.6 (8.5–10.8)	4.9 (4.1–5.8)

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.
Notes: **CI =** confidence interval.
[a]Socioeconomic status was assessed by calculating the ratio of family income to the corresponding poverty threshold.
[b]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days at the time of the survey.
[c]People who had ever smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes.
[d]Pipes included use of regular pipes, water pipes, or hookah.
[e]Any combination of more than one tobacco product.
[f]Unstable estimate is not presented because of a relative standard error >0.3 or number of unweighted denominators <50.

The prevalence of ever use of cigarettes among young adults during 2019–2021 was similar across SES groups (Table 2.14). Current cigarette use was lower in the high-SES (5.6%; 95% CI, 4.8–6.6) group than it was in the medium-SES group (9.6%; 95% CI, 7.9–11.6).

Patterns in Frequency and Quantity of Cigarette Use

Prior studies using U.S. samples have reported that SES is inversely related to the frequency of cigarette smoking in adults, with people with higher levels of education being less likely to smoke daily (Hennrikus et al. 1996; Shiffman et al. 2014; Wang et al. 2018). The prevalence of daily cigarette use among adults overall during 2019–2021 was greater among people in the low-SES (17.2%; 95% CI, 16.2–18.2) and medium-SES (14.4%; 95% CI, 13.7–15.2) groups than it was among those in the high-SES group (7.4%; 95% CI,7.2–7.7) (NHIS, public use data, 2019–2021). Among adults in the low-SES group who currently smoke, a higher percentage currently smoke 10–19 cigarettes each day (37.8%; 95% CI, 34.9–40.8) compared with the percentage who currently smoke 1–9 cigarettes each day (28.5%; 95% CI, 25.7–31.3) (Figure 2.6). The prevalence of daily cigarette use among young adults in 2019–2021 was similar in the low-SES (4.8%; 95% CI, 3.4-6.8), medium-SES (6.9%; 95% CI, 5.5-8.7), and high-SES groups (3.3%; 95% CI, 2.7–4.2) (NHIS, public use data, 2019–2021). Among young adults who currently smoke in the high-SES group, a lower percentage currently smoke 20 or more cigarettes each day (17.9%; 95% CI, 10.2–25.6) compared with 1–9 (40.3%; 95% CI, 29.0–51.6) or 10–19 (41.8%; 95% CI, 30.4–53.2) cigarettes each day (Figure 2.7).

Patterns of Use for Other Tobacco Products

E-Cigarettes

The prevalence of ever use of e-cigarettes among adults in 2019–2021 was lower in the high-SES group (16.5%; 95% CI, 16.1–16.9) than it was in the low-SES group (20.3%; 95% CI, 19.1–21.5) and middle-SES group (18.7%; 95% CI, 17.9–19.6) (NHIS, public use data, 2019–2021). Overall, current use of e-cigarettes among adults was 4.2% (95% CI, 4.1–4.4), with a higher prevalence in the low-SES (4.9%; 95% CI, 4.4–5.5) and medium-SES (4.8%; 95% CI, 4.4–5.3) groups than in the high-SES group (4.0%; 95% CI, 3.8–4.2) (Table 2.14).

The prevalence of ever use of e-cigarettes during 2019–2021 was higher among young adults (31.2%; 95% CI, 29.7–32.7) than it was among adults overall (17.3%; 95% CI, 16.9–17.7) (NHIS, public use data, 2019–2021). Current use of e-cigarettes among young adults overall was 9.9% (95% CI, 9.0–10.8). In addition, among young adults, current e-cigarette use was similar across SES groups, ranging from 8.9% (95% CI, 7.0–11.3) in the low-SES group to 11.2% (95% CI, 9.3–13.5) in the medium-SES group (Table 2.14).

Smokeless Tobacco

The prevalence of ever use of smokeless tobacco among adults overall during 2019–2021 was 10.9% (95% CI, 10.6–11.2) (NHIS, public use data, 2019–2021). Current use of smokeless tobacco among adults overall was 2.3% (95% CI, 2.2–2.4). Current use of smokeless tobacco among adults was similar across SES groups, ranging from 1.9% (95% CI, 1.5–2.3) in the low-SES group to 2.4% (95% CI, 2.3–2.6) in the high-SES group (Table 2.14).

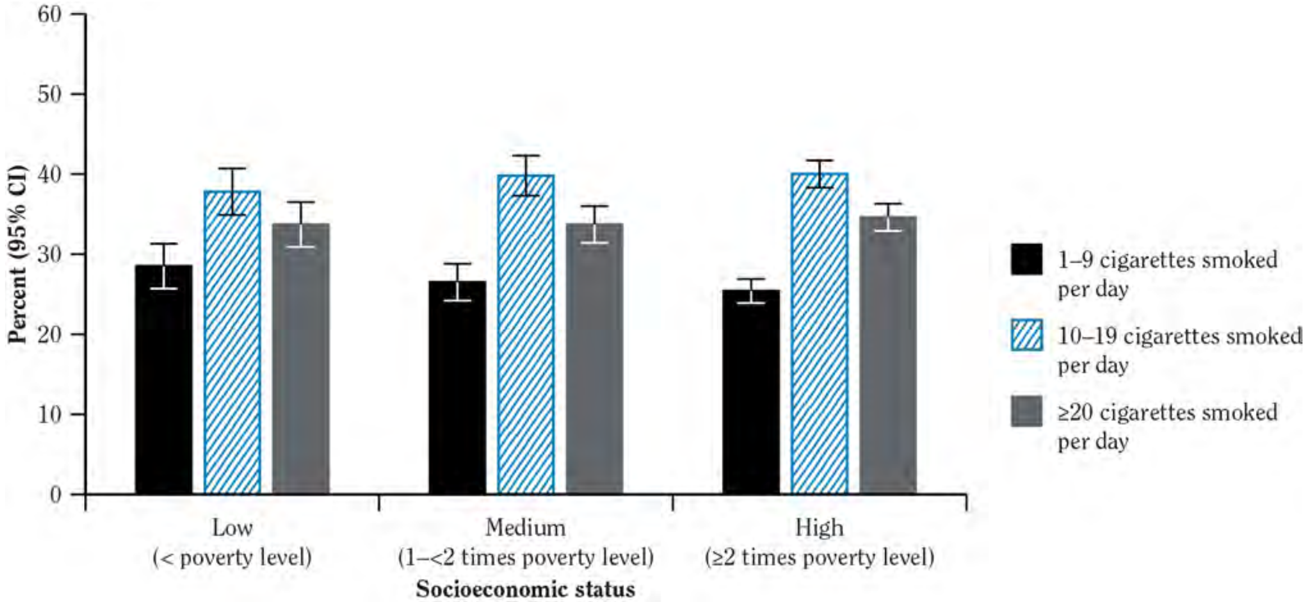
The prevalence of ever use of smokeless tobacco among young adults during 2019–2020 was lowest among people in the low-SES group (6.3%; 95% CI, 4.5–8.6) and highest among people in the high-SES group (9.6%; 95% CI, 8.5–10.9) (NHIS, public use data, 2019–2021). Overall, current use of smokeless tobacco among young adults was 2.0% (95% CI, 1.6–2.5). Current use of smokeless tobacco among young adults was similar in medium-SES (1.7%; 95% CI, 1.0–2.8) and high-SES (2.4%; 95% CI, 1.8–3.1) groups; data were suppressed for young adults in the low-SES group (Table 2.14).

Cigars

During 2019–2021, adults in the high-SES group (30.4%; 95% CI, 29.8–30.9) had the highest prevalence of ever cigar use by SES; the estimates were 23.9% (95% CI, 22.9–24.8) for the medium-SES group and 22.1% (95% CI, 20.9–23.3) for the low-SES group (NHIS, public use data, 2019–2021). Overall, current use of cigars among adults was 3.5% (95% CI, 3.4–3.7). Current use of cigars was similar across the three SES groups, ranging from 3.3% in the low-SES (95% CI, 2.9–3.8) and medium-SES (95% CI, 3.0–3.7) groups to 3.6% (95% CI, 3.4–3.8) in the high-SES group (Table 2.14).

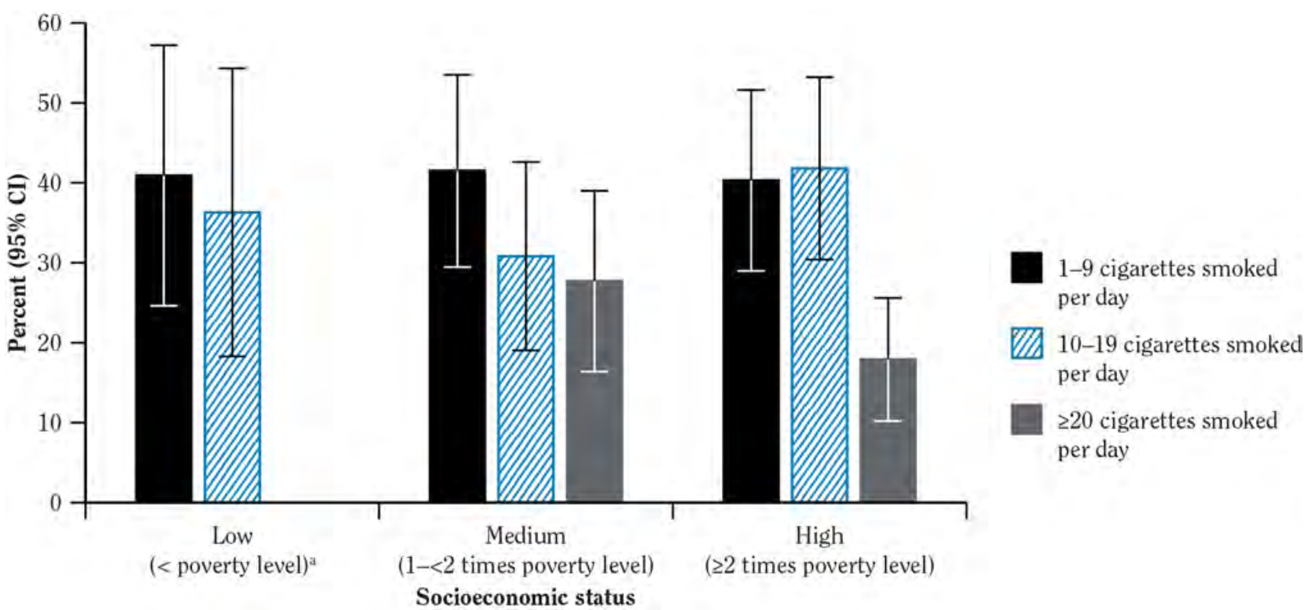
Ever use of cigars during 2019–2021 was similar among young adults in the high-SES group (21.1%; 95% CI, 19.6–22.6), middle-SES group (20.2%; 95% CI, 17.7–23.0), and low-SES group (20.8%; 95% CI, 17.8–24.3) (NHIS, public use data, 2019–2021). Current use of cigars among young adults was 3.7% (95% CI, 3.1–4.3). Current use of cigars among young adults was similar across the

Figure 2.6 Percentage of adults, 18 years of age and older, who currently smoked, by socioeconomic status and number of cigarettes smoked per day; National Health Interview Survey (NHIS) 2019–2021 combined data, United States



Source: NHIS, National Health Interview Survey, public use data, 2019–2021.

Figure 2.7 Percentage of young adults, 18–24 years of age, who currently smoked, by socioeconomic status and number of cigarettes smoked per day; National Health Interview Survey (NHIS) 2019–2021 combined data, United States



Source: NHIS, National Health Interview Survey, public use data, 2019–2021.
[a]Unstable estimate is not presented for those who currently smoked 20 or more cigarettes per day because of a relative standard error >0.3 or an unweighted denominator <50.

three levels of SES, ranging from 3.4% (95% CI, 2.2–5.1) in the low-SES group to 4.1% (95% CI, 3.0–5.5) in the medium-SES group (Table 2.14).

Pipes, Including Hookahs and Water Pipes

Ever use of pipes, including water pipe tobacco or hookahs, among adults overall during 2019–2021 was highest in the high-SES group (14.7%; 95% CI, 14.3–15.1); the prevalence was 12.3% (95% CI, 11.6–13.0) for the medium-SES group and 10.4% (95% CI, 9.5–11.3) for the low-SES group (NHIS, public use data, 2019–2021). Overall, current use of pipes among adults was 1.0% (95% CI, 0.9–1.1). Current pipe use among adults was similar in the low-SES (1.3%; 95% CI, 1.0–1.6), medium-SES (1.3%; 95% CI, 1.0–1.5), and high-SES groups (0.9%; 95% CI, 0.8–1.0) (Table 2.14).

The prevalence of ever use of pipes during 2019–2021 was higher among adults overall (13.8%; 95% CI, 13.5–14.2) than it was among young adults (11.7%; 95% CI, 10.8–12.8) (NHIS Public use data, 2019–2021); ever use of pipes was similar across the three levels of SES. Overall, current use of pipes among young adults was 1.8% (95% CI, 1.4–2.2). Current use of pipes among young adults was similar across the three SES groups, ranging from 1.6% (95% CI, 1.2–2.2) in the high-SES group to 2.3% (95% CI, 1.5–3.5) in the medium-SES group (Table 2.14).

Patterns of Polytobacco Use

The prevalence of current use of two or more tobacco products was 3.5% (95% CI, 3.4–3.7) among all adults and 5.1% (95% CI, 4.4–5.8) among young adults during 2019–2021. Prevalence was higher among all adults in the low-SES (4.8%; 95% CI, 4.3–5.5) and medium-SES (4.6%; 95% CI, 4.2–5.0) groups than it was among those in the high-SES group (3.1%; 95% CI, 2.9–3.3) (Table 2.14). Among young adults, current polytobacco use was similar across the three SES groups, ranging from 4.8% (95% CI, 3.4–6.7) in the low-SES group to 5.8% (95% CI, 4.5–7.5) in the medium-SES group (Table 2.14).

Tobacco Use by Socioeconomic Status and Sex

NHIS data from 2019 to 2021 show that, for all tobacco use measures and all levels of SES, the prevalence of use was significantly higher among men than it was among women, except for use of pipes and e-cigarettes among adults in the low-SES group (Table 2.15). Disparities by sex and SES varied by tobacco product. The absolute difference by sex in the prevalence of ever cigarette use was highest for adults in the medium-SES group (13.1 percentage points) compared with those in the low- and high-SES groups (about 10 percentage points in each group). The prevalence of current cigarette use was 5.7 percentage points higher among men than it was among women in the low-SES group and 5.6 percentage points higher among men than it was among women in the medium-SES group; in the high-SES group, the prevalence of current cigarette use was 2.8 percentage points higher among men than it was among women. For cigars, smokeless tobacco, and e-cigarettes, the absolute difference in the prevalence of use between men and women was most pronounced in the high-SES group. The absolute differences in the prevalence of use of pipes and multiple tobacco products between men and women were similar across SES levels.

Tobacco Use by Socioeconomic Status and Race and Ethnicity

Prior studies have highlighted the complexity of the intersectional relationship of race and ethnicity, income, and tobacco use (Epperson et al. 2022). Data from the 2019–2021 NHIS showed that ever use of cigarettes was highest among American Indian and Alaska Native people and White people in each of the SES groups (Table 2.16).

Within each SES level as defined by poverty level, current use of cigarettes was highest among White people (30.4%; 95% CI, 28.6–32.3) and people who identified as “Other” and multiple races (30.9%; 95% CI, 24.1–38.7) of low SES and American Indian and Alaska Native people of medium (29.9%; 95% CI, 18.9–43.9) and high (18.2%; 95% CI, 12.6–25.5) SES (Table 2.16). Comparisons across all SES and racial and ethnic groups were not possible for other tobacco products due to small numbers in some cells.

Tobacco Use by Socioeconomic Status and Sexual Orientation

Using 2019–2021 NHIS data, the prevalence of ever use and current use of cigarettes was higher among adults who identified with a minoritized sexual orientation group than it was among adults who identified as heterosexual across all SES categories, although CIs overlapped in some instances (Table 2.17). The general inverse gradient of SES and smoking held when examining current cigarette smoking across sexual orientation, whereby the prevalence of cigarette use was higher among adults who identified with a minoritized sexual orientation group in the

Table 2.15 Prevalence of ever use of cigarettes and current use of tobacco products among adults, 18 years of age and older, by socioeconomic status[a] and sex; National Health Interview Survey (NHIS) 2019–2021, United States

		Current use of tobacco products:[b] % (95% CI)					
Socioeconomic status and sex	**Ever use of cigarettes:[c] % (95% CI)**	**Cigarettes[c]**	**Cigars**	**Smokeless tobacco**	**Pipes[d]**	**E-cigarettes**	**≥2 tobacco products[e]**
Low (< the poverty level)	39.1 (37.7–40.6)	22.0 (20.9–23.2)	3.3 (2.9–3.8)	1.9 (1.5–2.3)	1.3 (1.0–1.6)	4.9 (4.4–5.5)	4.8 (4.3–5.5)
Male	45.2 (43.0–47.5)	25.4 (23.6–27.4)	5.5 (4.6–6.5)	3.6 (2.8–4.5)	1.8 (1.3–2.4)	5.3 (4.4–6.3)	7.1 (6.1–8.3)
Female	35.1 (33.3–36.8)	19.7 (18.4–21.1)	1.8 (1.5–2.3)	0.8 (0.5–1.2)	0.9 (0.7–1.3)	4.7 (4.0–5.4)	3.3 (2.8–3.9)
Medium (1–<2 times the poverty level)	39.2 (38.2–40.3)	18.1 (17.4–18.9)	3.3 (3.0–3.7)	2.0 (1.8–2.3)	1.3 (1.0–1.5)	4.8 (4.4–5.3)	4.6 (4.2–5.0)
Male	46.5 (44.9–48.1)	21.2 (20.0–22.5)	5.7 (5.0–6.4)	4.3 (3.7–5.0)	1.8 (1.4–2.2)	5.6 (4.9–6.4)	6.7 (5.9–7.5)
Female	33.4 (32.2–34.7)	15.6 (14.8–16.6)	1.5 (1.2–1.8)	0.2 (0.1–0.3)	0.9 (0.6–1.2)	4.1 (3.6–4.7)	2.9 (2.5–3.3)
High (≥2 times the poverty level)	33.9 (33.4–34.4)	10.0 (9.7–10.3)	3.6 (3.4–3.8)	2.4 (2.3–2.6)	0.9 (0.8–1.0)	4.0 (3.8–4.2)	3.1 (2.9–3.3)
Male	39.1 (38.4–39.8)	11.3 (10.9–11.8)	6.5 (6.1–6.8)	4.6 (4.3–4.9)	1.3 (1.1–1.5)	4.9 (4.6–5.3)	4.7 (4.4–5.0)
Female	28.6 (28.0–29.2)	8.5 (8.2–8.9)	0.7 (0.6–0.8)	0.2 (0.1–0.3)	0.5 (0.4–0.6)	3.0 (2.8–3.3)	1.4 (1.2–1.6)

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.
Notes: **CI =** confidence interval.
[a]Socioeconomic status was assessed by calculating the ratio of family income to the corresponding poverty threshold.
[b]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days at the time of the survey.
[c]People who had ever used cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes.
[d]Pipes included use of regular pipes, water pipes, or hookah.
[e]Any combination of more than one tobacco product.

Table 2.16 Prevalence of ever use of cigarettes and current use of tobacco products among adults, 18 years of age and older, by socioeconomic status[a] and race and ethnicity; National Health Interview Survey (NHIS) 2019–2021, United States

Socioeconomic status and race and ethnicity	Ever use of cigarettes:[c] % (95% CI)	Current use of tobacco products:[b] % (95% CI)					
		Cigarettes	Cigars	Smokeless tobacco	Pipes[d]	E-cigarettes	≥2 tobacco products[e]
Low (< the poverty level)	39.1 (37.7–40.6)	22.0 (20.9–23.2)	3.3 (2.9–3.8)	1.9 (1.5–2.3)	1.3 (1.0–1.6)	4.9 (4.4–5.5)	4.8 (4.3–5.5)
American Indian and Alaska Native	51.3 (38.5–64.0)	23.4 (13.2–38.0)	—[f]	—[f]	—[f]	—[f]	—[f]
Asian	18.3 (14.2–23.1)	9.1 (6.2–13.2)	—[f]	—[f]	—[f]	—[f]	—[f]
Black	36.7 (33.8–39.7)	22.6 (20.1–25.3)	5.1 (4.0–6.5)	1.4 (0.9–2.4)	1.2 (0.7–2.0)	2.5 (1.6–3.6)	3.9 (2.9–5.3)
Hispanic	23.4 (21.2–25.8)	11.0 (9.6–12.7)	1.7 (1.2–2.4)	—[f]	1.0 (0.6–1.7)	2.9 (2.2–3.8)	2.2 (1.6–3.1)
Other and multiple races	46.1 (38.2–54.3)	30.9 (24.1–38.7)	—[f]	—[f]	—[f]	—[f]	11.2 (6.7–18.2)
White	53.0 (50.8–55.3)	30.4 (28.6–32.3)	3.9 (3.2–4.8)	2.8 (2.2–3.6)	1.2 (0.9–1.6)	7.8 (6.8–9.0)	7.0 (6.1–8.1)
Medium (1–<2 times the poverty level)	39.2 (38.2–40.3)	18.1 (17.4–18.9)	3.3 (3.0–3.7)	2.0 (1.8–2.3)	1.3 (1.0–1.5)	4.8 (4.4–5.3)	4.6 (4.2–5.0)
American Indian and Alaska Native	54.1 (40.1–67.5)	29.9 (18.9–43.9)	—[f]	—[f]	—[f]	—[f]	—[f]
Asian	22.3 (18.3–26.8)	11.5 (8.6–15.3)	—[f]	—[f]	—[f]	—[f]	—[f]
Black	30.3 (28.1–32.7)	17.3 (15.6–19.3)	4.6 (3.7–5.8)	—[f]	1.9 (1.3–2.8)	2.0 (1.4–2.8)	3.8 (2.9–4.9)
Hispanic	22.3 (20.6–24.0)	8.2 (7.2–9.4)	2.5 (1.8–3.4)	0.4 (0.2–0.8)	0.6 (0.4–1.1)	2.6 (1.9–3.4)	1.8 (1.4–2.4)
Other and multiple races	50.3 (43.4–57.1)	26.3 (20.8–32.7)	6.1 (3.5–10.4)	—[f]	—[f]	13.6 (9.5–19.0)	9.5 (6.3–14.2)
White	52.2 (50.8–53.6)	23.8 (22.7–24.9)	3.4 (3.0–4.0)	3.4 (2.9–4.0)	1.4 (1.1–1.8)	6.7 (6.0–7.5)	6.3 (5.6–7.0)
High (≥2 times the poverty level)	33.9 (33.4–34.4)	10.0 (9.7–10.3)	3.6 (3.4–3.8)	2.4 (2.3–2.6)	0.9 (0.8–1.0)	4.0 (3.8–4.2)	3.1 (2.9–3.3)
American Indian and Alaska Native	39.5 (32.0–47.5)	18.2 (12.6–25.5)	—[f]	—[f]	—[f]	—[f]	5.9 (3.3–10.3)
Asian	18.2 (16.7–19.7)	5.6 (4.8–6.6)	1.2 (0.9–1.7)	0.6 (0.4–0.9)	0.8 (0.5–1.2)	3.2 (2.6–4.0)	1.5 (1.1–2.0)
Black	22.2 (20.9–23.7)	9.2 (8.2–10.3)	4.6 (3.9–5.4)	0.5 (0.3–0.8)	1.5 (1.2–2.0)	2.7 (2.2–3.3)	2.7 (2.2–3.3)
Hispanic	23.6 (22.4–24.9)	7.2 (6.5–8.0)	2.9 (2.4–3.4)	0.7 (0.5–0.9)	0.9 (0.7–1.2)	3.2 (2.8–3.8)	2.4 (2.0–2.8)
Other and multiple races	36.5 (33.0–40.1)	13.0 (10.4–16.2)	4.0 (2.4–6.5)	2.3 (1.4–3.7)	—[f]	7.7 (5.9–10.0)	5.8 (3.8–8.9)
White	38.5 (38.0–39.1)	10.8 (10.4–11.2)	3.8 (3.6–4.0)	3.1 (2.9–3.3)	0.8 (0.7–0.9)	4.3 (4.0–4.5)	3.3 (3.1–3.5)

Table 2.16 Continued

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.

Notes: **CI =** confidence interval.

[a]Socioeconomic status was assessed by calculating the ratio of family income to the corresponding poverty threshold.

[b]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days at the time of the survey.

[c]People who had ever used cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes.

[d]Pipes included use of regular pipes, water pipes, or hookah.

[e]Any combination of more than one tobacco product.

[f]Unstable estimate is not presented because of a relative standard error >0.3 or an unweighted denominator <50.

Table 2.17 Prevalence of ever use of cigarettes and current use of tobacco products among adults, 18 years of age and older, by socioeconomic status[a] and sexual orientation; National Health Interview Survey (NHIS) 2019–2021, United States

		Current use of tobacco products:[b] % (95% CI)					
Socioeconomic status and sexual orientation	**Ever use of cigarettes:[c] % (95% CI)**	**Cigarettes**	**Cigars**	**Smokeless tobacco**	**Pipes[d]**	**E-cigarettes**	**≥2 tobacco products[e]**
Low (< the poverty level)	39.1 (37.7–40.6)	22.0 (20.9–23.2)	3.3 (2.9–3.8)	1.9 (1.5–2.3)	1.3 (1.0–1.6)	4.9 (4.4–5.5)	4.8 (4.3–5.5)
Heterosexual	39.0 (37.5–40.5)	21.6 (20.4–22.8)	3.2 (2.7–3.7)	1.9 (1.6–2.4)	1.2 (0.9–1.5)	4.5 (4.0–5.1)	4.5 (4.0–5.2)
Not heterosexual (all)[f]	44.4 (38.3–50.7)	30.3 (25.0–36.1)	5.9 (3.7–9.2)	—[g]	3.8 (2.2–6.7)	13.9 (10.2–18.8)	11.8 (8.5–16.3)
Gay	34.9 (21.5–51.2)	31.2 (18.6–47.3)	—[g]	—[g]	—[g]	—[g]	—[g]
Lesbian	55.8 (40.6–70.1)	33.5 (20.1–50.2)	—[g]	—[g]	—[g]	—[g]	—[g]
Bisexual	44.8 (36.4–53.5)	30.5 (23.6–38.3)	7.8 (4.6–13.0)	—[g]	—[g]	17.8 (12.3–25.1)	13.7 (9.0–20.3)
Medium (1–<2 times the poverty level)	39.2 (38.2–40.3)	18.1 (17.4–18.9)	3.3 (3.0–3.7)	2.0 (1.8–2.3)	1.3 (1.0–1.5)	4.8 (4.4–5.3)	4.6 (4.2–5.0)
Heterosexual	39.3 (38.3–40.4)	17.9 (17.1–18.7)	3.2 (2.8–3.6)	2.1 (1.8–2.4)	1.3 (1.0–1.5)	4.3 (3.9–4.8)	4.3 (3.9–4.7)
Not heterosexual (all)	44.0 (39.1–49.0)	26.4 (22.3–30.9)	6.8 (4.7–9.8)	—[g]	—[g]	17.3 (13.6–21.6)	11.6 (8.8–15.1)
Gay	47.4 (35.7–59.5)	25.7 (17.0–36.9)	—[g]	N/A	N/A	—[g]	—[g]
Lesbian	33.9 (23.8–45.7)	19.2 (11.8–29.8)	—[g]	N/A	—[g]	—[g]	—[g]
Bisexual	49.6 (42.7–56.5)	31.6 (25.6–38.3)	9.5 (6.0–14.5)	—[g]	—[g]	23.6 (17.9–30.3)	16.2 (11.7–21.9)
High (≥2 times the poverty level)	33.9 (33.4–34.4)	10.0 (9.7–10.3)	3.6 (3.4–3.8)	2.4 (2.3–2.6)	0.9 (0.8–1.0)	4.0 (3.8–4.2)	3.1 (2.9–3.3)
Heterosexual	33.9 (33.4–34.4)	9.9 (9.6–10.2)	3.6 (3.4–3.8)	2.5 (2.3–2.7)	0.8 (0.8–0.9)	3.8 (3.6–4.0)	3.0 (2.8–3.2)
Not heterosexual (all)	35.3 (33.0–37.6)	11.1 (9.6–12.8)	3.3 (2.4–4.7)	0.9 (0.6–1.4)	2.2 (1.4–3.2)	9.1 (7.7–10.8)	4.2 (3.2–5.6)
Gay	40.0 (35.8–44.5)	13.7 (10.5–17.7)	—[g]	—[g]	—[g]	7.0 (5.2–9.4)	5.9 (3.5–9.9)
Lesbian	31.2 (26.8–36.1)	9.1 (6.7–12.4)	—[g]	—[g]	—[g]	5.1 (3.0–8.4)	—[f]
Bisexual	34.7 (30.9–38.7)	9.9 (7.6–12.7)	3.3 (2.1–5.3)	—[g]	2.5 (1.5–4.1)	11.8 (9.3–14.8)	4.1 (2.8–6.0)

Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.

Notes: **CI =** confidence interval; **N/A =** not available.

[a]Socioeconomic status was assessed by calculating the ratio of family income to the corresponding poverty threshold.

[b]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes and smoking cigarettes every day or some days at the time of the survey. People who currently used other products (cigars, smokeless tobacco, pipe, e-cigarettes) was defined as those who reported having used such products every day or some days at the time of the survey.

[c]People who had ever used cigarettes was defined as those who reported having smoked at least 100 cigarettes in their lifetimes.

[d]Pipes included use of regular pipes, water pipes, or hookah.

[e]Any combination of more than one tobacco product.

[f]Includes people who identified as gay, lesbian, or bisexual or who reported "something else."

[g]Unstable estimate is not presented because of a relative standard error >0.3 or an unweighted denominator <50.

low-SES (30.3%; 95% CI, 25.02–36.1) and medium-SES (26.4%; 95% CI, 22.3–30.9) categories than it was among their counterparts in the high-SES (11.1%; 95% CI, 9.6–10.2) category. Comparisons across all SES and sexual orientation categories were not possible for other tobacco products due to small numbers in some cells.

Tobacco Use Among Occupational Groups

This section describes disparities by occupational class, occupational profession and industry, and employment status across the spectrum of tobacco products to characterize current use and cessation. To the extent possible, information is included on the intersections between occupation and employment status and other population characteristics, such as sex, age, race and ethnicity, and sexual orientation. Although most of the relevant research focuses on cigarette use, research on the use of other tobacco products is included if available.

Consistent with previous reports (e.g., NCI 2017), *occupational class* generally refers to manual labor, service, or white-collar jobs.[2] *Occupational profession and industry* represents a breakdown of occupational class by profession and industry, which may vary among studies. Examples of professions may include construction workers, laborers, fabricators, food service personnel, health-diagnosing occupations, and teachers. Examples of industries may include construction, food service, retail trade, mining, finance, and educational services. Finally, *employment status* describes the participation of people in the labor force.

Data from the 1995–2018 TUS-CPS among adults (18 years of age and older) indicate that trends for ever smoking and current daily smoking were consistent for occupational categories, with the construction and manual labor or service sector industries having the highest rates for both smoking statuses (Figure 2.8, Parts A and B).[3] Trends for persistent smoking (defined as current daily smoking among those who reported ever smoking) were distinctly lower among white-collar workers than they were for the cluster of all other employment categories (Figure 2.8, Part C).

Studies reviewed by NCI in Tobacco Control Monograph 22 (2017) found that people working in manual labor and service jobs had significantly higher odds of current cigarette use than did white-collar workers (Table 2.18).[4] The literature is less consistent about differences in smoking cessation by occupation. The existing studies suggest that white-collar workers have somewhat higher odds of quitting successfully than manual labor or service workers (Table 2.18).

Patterns of Tobacco Use by Occupational Profession and Industry

The NHIS collects information on occupation and recodes responses to align with the U.S. Standard Occupational Classification System (U.S. Bureau of Labor Statistics n.d.). Based on data from the 2020–2021 NHIS on employment characteristics and use of tobacco products among an estimated 150 million working adults, 19.3% (95% CI, 18.7–19.9) currently used a tobacco product (Table 2.19). By product, estimates of current use among working adults were 11.4% (95% CI, 10.9–11.8) for cigarettes, 4.8% (95% CI, 4.5–5.1) for other combustible tobacco products, 1.7% (95% CI, 1.5–1.9) for smokeless tobacco, and 4.9% (95% CI, 4.6–5.2) for e-cigarettes (Table 2.19). Overall, 3.1% (95% CI, 2.8–3.3) of working adults used two or more tobacco products.

Table 2.20 presents the prevalence of current tobacco use among U.S. working adults by profession and

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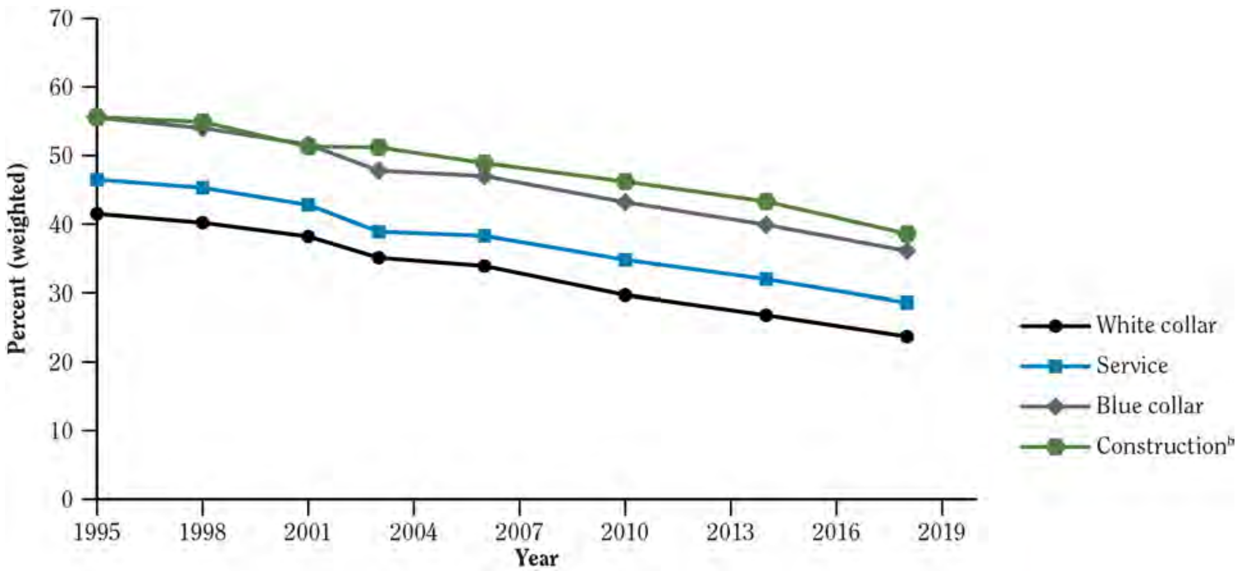
[2]In general, occupation classification codes from the U.S. Census Bureau can be used to classify occupational class. White-collar jobs can include occupational classification codes referring to management, business, and financial occupations; professional and related occupations; sales and related occupations; and office and administrative support occupations. The manual labor or blue-collar category can include occupation classification codes referring to construction and extraction occupations; installation, maintenance, and repair occupations; production occupations; and transportation and material moving occupations. The service category can include occupation classification codes referring to service occupations. Finally, the other category may include such occupation classification codes as farming, fishing, and forestry occupations and the armed forces.

[3]Data presented in Figure 2.8 are based on findings of Ham and colleagues (2011). As such, the terminology used to describe each occupational category is consistent with that study.

[4]Findings presented in Table 2.18 are a re-creation of Table 8.1 in NCI (2017). Thus, Table 2.18 retains the terminology used in NCI (2017).

Figure 2.8 Percentage of ever smoking, current daily smoking, and persistent smoking over time, by occupational category; Tobacco Use Supplement to the Current Population Survey (TUS-CPS) 1995–2018,[a] United States

A. Ever smoking



B. Current daily smoking

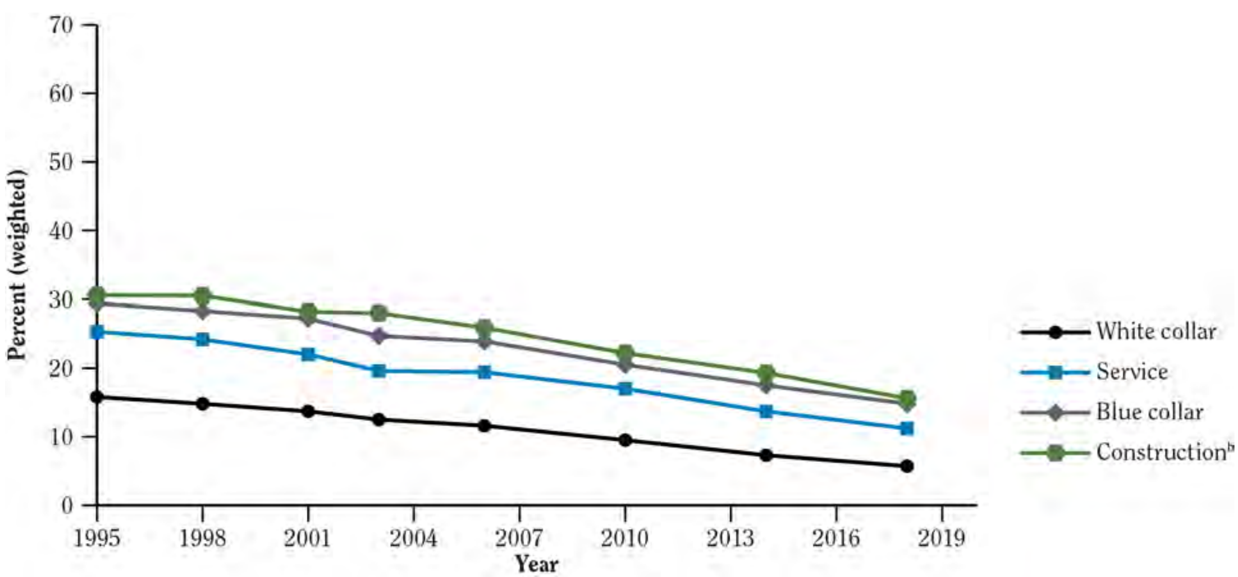
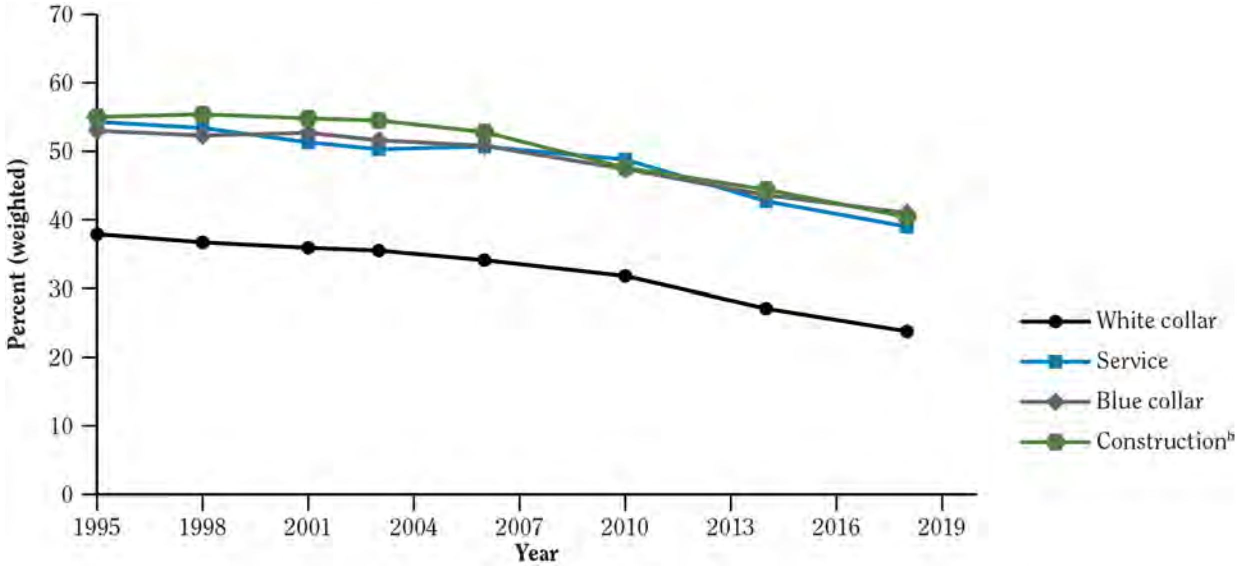


Figure 2.8 Continued

C. Persistent smoking[c]



Source: Harmonized TUS-CPS, National Cancer Institute, public use data, 1995–2018.
Notes: Figure is based on data presented in Figure 1 of Ham and colleagues (2011). As such, the terminology used to describe each occupational category is consistent with that study. However, analyses have been completed using the Harmonized TUS-CPS dataset, so some of the results present differently from those in Ham and colleagues (2011).
[a]TUS-CPS is administered approximately every 3–4 years, not annually. In this figure, data collected in 1995–1996 are presented as "1995"; 1998–1999 are presented as "1998"; 2001–2002 are presented as "2001"; 2006–2007 are presented as "2006"; 2010–2011 are presented as "2010"; 2014–2015 are presented as "2014"; and 2018–2019 are presented as "2018."
[b]The construction industry is a subset of blue collar occupations, so data from the construction industry are also included in blue collar category; however, construction-specific estimates are also provided. The *construction occupational* category from 1995 to 2002 contained handlers, equipment cleaners, helpers, laborers and a subset of precision production, craft and repair occupations titled, "construction trade." But due to changes to the Occupational Code starting in 2003, the *construction occupational* category includes only construction and extraction occupations (Ham et al. 2011).
[c]Persistent smoking is defined as current daily smoking among those who reported ever smoking.

industry. The highest prevalence of current tobacco use was among workers in construction (31.1%; 95% CI, 28.6–33.5), followed by workers in utilities (27.4%; 95% CI, 20.5–34.3); manufacturing (25.5%; 95% CI, 23.6–27.4); accommodation and food services (25.0%; 95% CI, 22.3–27.6); agriculture, forestry, fishing, and hunting (24.9%; 95% CI, 20.0–29.7); administrative and support and waste management and remediation services (24.8%; 95% CI, 22.1–27.5); and transportation and warehousing (24.3%; 95% CI, 21.6–27.5). The lowest prevalence of any tobacco use was among workers in education services (9.1%; 95% CI, 8.0–10.3).

Cigarettes

The highest prevalence of current cigarette smoking by industry was among workers in construction (20.2%; 95% CI, 18.0–22.4), followed by workers in manufacturing (16.4%; 95% CI, 14.8–18.0), utility workers (15.8%; 95% CI, 9.5–22.0), accommodation and food services workers (15.6%; 95% CI, 13.6–17.7), and administrative and support and waste management and remediation services workers (15.2%; 95% CI, 13.0–17.5). The lowest prevalence of smoking by industry was among workers in education services (4.1%; 95% CI, 3.3–4.9) (Table 2.20).

E-Cigarettes

The highest prevalence of current e-cigarette use by industry was among workers in accommodation and food services (9.0%; 95% CI, 7.1–10.9), followed by workers in retail trade (7.3%; 95% CI, 6.0–8.5), information workers (7.2%; 95% CI, 4.7–9.7), and transportation and warehousing workers (6.1%; 95% CI, 4.5–7.7). The lowest prevalence of e-cigarette use by industry was among workers in education services (2.2%; 95% CI, 1.6–2.8) (Table 2.20).

Table 2.18 Cigarette use across the tobacco use continuum, per nationally representative data, by occupational class

		Prevalence (%)				Odds ratio/relative risk (95% CI)			
Continuum phase and author(s)	**Data source and year, sample size, and age range**	**White collar**	**Blue collar**	**Service**	**Other**	**White collar**	**Blue collar**	**Service**	**Other**
Current use (prevalence of cigarette smoking)									
Barbeau et al. (2004)	• NHIS 2000 • n = 24,276 • 18–64 years of age • Adjusted for age, gender, race and ethnicity	20.3	35.4	31.1	24.2[a]	aOR = 1.00	aOR = 1.28 (1.15–1.41)	aOR = 1.19 (1.05–1.36)	aOR = 0.72 (0.55–0.94)
Fagan et al. (2007)	• TUS-CPS 1998–1999, 2001–2002 • n = 288,813 • 18–64 years of age • Adjusted for age, gender, marital status, level of educational attainment, family income, race and ethnicity, occupation, hours per week, number of jobs, self-employment	18	33	27	24[a,b]	aOR = 1.00	aOR = 1.31 (1.27–1.35)	aOR = 1.15 (1.10–1.20)	—[c]
Lawrence et al. (2007)	• TUS-CPS 1998–1999 • n = 15,394 • 18–24 years of age • Adjusted for gender, race and ethnicity, employment status, occupation, geographic region, income, metropolitan status, school enrollment	22.6	34.5	31.6	20.5[d]	aOR = 1.00	aOR = 1.50 (1.32–1.70)	aOR = 1.62 (1.42–1.84)	aOR = 1.11 (0.88–1.41)
Ham et al. (2011)	• TUS-CPS 2006–2007 • n = 106,604 • 18–64 years of age • Adjusted for all demographic categories	11.7	24.0	19.7	25.6[e]	aRR = 1.00	aRR = 1.41 (1.34–1.49)	aRR = 1.25 (1.18–1.32)	—[c]

Table 2.18 Continued

		Prevalence (%)				Odds ratio/relative risk (95% CI)			
Continuum phase and author(s)	**Data source and year, sample size, and age range**	**White collar**	**Blue collar**	**Service**	**Other**	**White collar**	**Blue collar**	**Service**	**Other**
Asfar et al. (2016)	• NHIS 2010 • n = 1,531 • 18–24 years of age • Adjusted for survey year, occupational group, age, gender, race and ethnicity, level of educational attainment, income, health insurance status	18.2	24.9	24.2	—[c]	aOR = 1.00	aOR = 1.40 (1.01–1.93)	aOR = 1.36 (1.02–1.98)	—[c]
Past-year quit attempt (stopped smoking for 1 or more days during past 12 months)									
Barbeau et al. (2004)	• NHIS 2000 • n = 24,276 • 18–64 years of age	44.8	42.1	46.7	42.4	—[c]	—[c]	—[c]	—[c]
Alexander et al. (2010)	• TUS-CPS 2006–2007 • n = 30,176 • 18 years of age and older	51.6	50.8	55.5	—[c]	OR = 1.00	OR = 0.87 (0.73–1.10)	OR = 0.80 (0.69–0.94)	—[c]
Ham et al. (2011)	• TUS-CPS 2006–2007 • n = 106,604 • 18–64 years of age • Adjusted for all demographic categories	46.0	38.6	41.7	37.6[e]	aRR = 1.00	aRR = 0.94 (0.88–1.01)	aRR = 0.99 (0.92–1.06)	—[c]
Asfar et al. (2016)	• NHIS 2010 • n = 1,531 • 18–24 years of age • Adjusted for survey year, occupational group, age, gender, race and ethnicity, level of educational attainment, income, health insurance status	57.8	57.9	53.9	—[c]	aOR = 1.00	aOR = 0.70 (0.46–1.06)	aOR = 0.85 (0.51–1.40)	—[c]

Table 2.18 Continued

Continuum phase and author(s)	Data source and year, sample size, and age range	Prevalence (%) White collar	Prevalence (%) Blue collar	Prevalence (%) Service	Prevalence (%) Other	Odds ratio/relative risk (95% CI) White collar	Odds ratio/relative risk (95% CI) Blue collar	Odds ratio/relative risk (95% CI) Service	Odds ratio/relative risk (95% CI) Other
Cessation (prevalence of former smoking)									
Barbeau et al. (2004)	• NHIS 2000 • n = 24,276 • 18–64 years of age	20.4	18.0	14.4	16.6[a]	—[c]	—[c]	—[c]	—[c]
Fagan et al. (2007)	• TUS-CPS 1998–1999, 2001–2002 • n = 288,813 • 18–64 years of age • Adjusted for age, gender, marital status, level of educational attainment, family income, occupation, hours per week, self-employment, age of onset, everyday smoking for 6 months	19	18	14	16[a,b]	aOR = 1.00	aOR = 0.80 (0.76–0.83)	aOR = 0.81 (0.77–0.85)	—[c]
Relapse									
None		—[c]	—[c]	—[c]	—[c]	—[c]	—[c]	—[c]	—[c]

Source: National Cancer Institute (2017, pp. 275–276).

Notes: **aOR =** adjusted odds ratio; **aRR =** adjusted relative risk; **CI =** confidence interval; **NHIS =** National Health Interview Survey; **OR =** odds ratio; **TUS-CPS =** Tobacco Use Supplement to the Current Population Survey.

[a]Other industry was farming.

[b]Other industry was forestry and fishing.

[c]Not applicable or insufficient data.

[d]Unknown or refused to answer.

[e]Other industry was construction.

Table 2.19 Estimated prevalence of current use of tobacco products among working adults,[a] by product type and selected demographic characteristics; National Health Interview Survey (NHIS) 2020–2021, United States

Characteristics	Number of currently employed adults:[b] (x1,000)	Cigarettes:[c] % (95% CI)	Other combustible tobacco products:[d] % (95% CI)	Smokeless tobacco products:[e] % (95% CI)	E-cigarettes:[f] % (95% CI)	Any tobacco product:[g] % (95% CI)	≥2 tobacco products:[h] % (95% CI)
Total (100%)	150,981	11.4 (10.9–11.8)	4.8 (4.5–5.1)	1.7 (1.5–1.9)	4.9 (4.6–5.2)	19.3 (18.7–19.9)	3.1 (2.8–3.3)
Age group (years)							
≥18–34	52,802	9.1 (8.4–9.8)	6.3 (5.7–7.0)	1.4 (1.1–1.7)	8.7 (8.0–9.4)	20.6 (19.5–21.6)	4.4 (3.9–4.9)
≥35–54	62,417	13.2 (12.5–13.8)	4.5 (4.1–5.0)	2.1 (1.8–2.4)	3.6 (3.2–4.0)	20.2 (19.4–21.0)	2.9 (2.6–3.2)
≥55	35,762	11.3 (10.5–12.0)	3.0 (2.7–3.4)	1.3 (1.1–1.6)	1.6 (1.3–1.9)	15.7 (14.8–16.5)	1.5 (1.2–1.7)
Sex							
Male	79,823	12.8 (12.2–13.5)	7.5 (7.0–8.0)	3.1 (2.8–3.5)	5.6 (5.2–6.0)	24.2 (23.4–25.1)	4.3 (3.9–4.7)
Female	71,132	9.5 (8.9–10.1)	1.8 (1.5–2.1)	0.1 (0.0–0.1)	4.1 (3.7–4.5)	13.7 (13.0–14.4)	1.7 (1.4–1.9)
Race and ethnicity							
Black, non-Hispanic	16,485	10.3 (9.0–11.7)	7.3 (6.1–8.5)	—[i]	2.4 (1.8–3.0)	17.1 (15.4–18.8)	2.9 (2.2–3.5)
Hispanic	26,954	8.3 (7.3–9.3)	3.6 (3.0–4.2)	0.3 (0.1–0.5)	3.6 (3.0–4.2)	13.2 (12.0–14.3)	2.3 (1.8–2.7)
White, non-Hispanic	94,389	12.7 (12.1–13.2)	5.0 (4.6–5.3)	2.5 (2.2–2.8)	5.7 (5.2–6.1)	22.0 (21.3–22.8)	3.4 (3.1–3.7)
Other	13,154	8.7 (7.4–10.4)	3.0 (2.3–3.7)	0.6 (0.3–0.9)	5.3 (4.3–6.3)	14.7 (13.0–16.3)	2.7 (2.0–3.5)
Education							
< High school	5,015	22.4 (19.2–25.6)	4.3 (2.8–5.8)	—[i]	3.5 (2.1–4.9)	26.3 (22.8–29.8)	4.4 (2.8–6.1)
High School/GED	25,574	20.1 (18.8–21.4)	4.9 (4.2–5.5)	2.4 (1.9–2.9)	6.6 (4.3–4.9)	28.8 (27.3–30.2)	4.7 (4.0–5.4)
> High school	120,002	8.9 (8.5–9.4)	4.8 (4.5–5.2)	1.5 (1.3–1.7)	4.6 (4.3–4.9)	16.9 (16.3–17.5)	2.7 (2.4–2.9)
Unknown	391	—[i]	—[i]	—[i]	—[i]	25.2 (12.6–45.8)	—[i]
Poverty index[j]							
Poor	9,018	18.3 (16.2–20.4)	4.6 (3.4–5.8)	0.6 (0.2–1.0)	5.2 (4.0–6.5)	24.3 (21.9–26.7)	3.9 (2.8–5.0)
Near poor	21,385	17.3 (16.0–18.7)	4.9 (4.1–5.7)	1.3 (0.9–1.6)	6.8 (5.7–7.8)	25.0 (23.5–26.6)	4.7 (4.0–5.5)
Not poor	110,604	9.4 (9.0–9.9)	4.8 (4.5–5.2)	1.8 (1.6–2.0)	4.4 (4.1–4.8)	17.6 (16.9–18.2)	2.7 (2.4–2.9)
Unknown	9,973	—[i]	—[i]	—[i]	—[i]	—[i]	—[i]

Table 2.19 Continued

Characteristics	Number of currently employed adults:[b] (x1,000)	Cigarettes:[c] % (95% CI)	Other combustible tobacco products:[d] % (95% CI)	Smokeless tobacco products:[e] % (95% CI)	E-cigarettes:[f] % (95% CI)	Any tobacco product:[g] % (95% CI)	≥2 tobacco products:[h] % (95% CI)
Health insurance							
Not insured	17,147	21.0 (19.3–22.7)	6.1 (5.1–7.1)	1.8 (1.3–2.4)	6.3 (5.2–7.4)	28.8 (26.8–30.7)	5.9 (4.9–6.8)
Insured	133,390	10.0 (9.6–10.5)	4.6 (4.3–4.9)	1.7 (1.5–1.9)	4.7 (4.4–5.0)	18.0 (17.5–18.6)	2.7 (2.5–2.9)
Unknown	445	—[i]	—[i]	—[i]	—[i]	—[i]	—[i]
U.S. Census region[k]							
Northeast	26,519	9.4 (8.4–10.4)	4.3 (3.6–5.1)	0.9 (0.6–1.2)	3.5 (2.8–4.1)	16.1 (14.7–17.6)	1.8 (1.4–2.3)
Midwest	32,821	14.1 (13.1–15.2)	5.1 (4.4–5.8)	2.5 (2.0–2.9)	5.2 (4.5–5.9)	22.8 (21.5–24.1)	3.7 (3.1–4.3)
South	55,189	12.4 (11.6–13.2)	5.4 (4.9–5.9)	1.9 (1.6–2.3)	5.0 (4.5–5.6)	20.8 (19.8–21.9)	3.6 (3.2–4.0)
West	36,451	8.4 (7.6–9.1)	4.0 (3.4–4.5)	1.2 (0.9–1.4)	5.5 (4.9–6.1)	16.0 (15.1–16.9)	2.7 (2.2–3.1)

Source: NHIS, National Center for Health Statistics, public use data, 2020–2021.

Notes: **CI =** confidence interval; **GED =** General Educational Development certificate or diploma.

[a]Adults who reported “working at a job or business,” “with a job or business but not at work,” or “working, but not for pay, at a family-owned job or business” during the week before the interview.

[b]Weighted to provide national annual average estimates for current employment.

[c]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes during their lifetimes and who currently smoked every day or some days (estimated n = 17.0 million).

[d]People who used other combustible tobacco products was defined as those who reported having smoked cigars, cigarillos, or little filtered cigars or smoking tobacco in a regular pipe, water pipe, or hookah at least once during their lifetimes and who currently use such a product every day or some days (estimated n = 7.3 million).

[e]People who used smokeless tobacco products was defined as those who reported having used chewing tobacco, snuff, dip, snus, or dissolvable tobacco at least once during their lifetimes and who currently use such a product every day or some days (estimated n = 2.5 million).

[f]People who used e-cigarettes was defined as those who reported having used e-cigarettes at least once during their lifetimes and who currently used e-cigarettes every day or some days (n = 7.4 million).

[g]People who used any tobacco product was defined as those who reported currently using cigarettes or other combustible tobacco or smokeless tobacco or e-cigarettes every day or some days (estimated n = 29.0 million).

[h]People who used two or more tobacco products was defined as those who reported currently using two or more tobacco products (estimated n = 4.6 million).

[i]Estimate suppressed (relative standard error >30%).

[j]Poverty status was based on family income and family size using the U.S. Census Bureau’s poverty thresholds for the previous calendar year. In the NHIS, poor was defined as having incomes below the poverty threshold; near poor was defined as having incomes of 100% to less than 200% of the poverty threshold; and not poor was defined as having incomes that are 200% or more of the poverty threshold. Additional information is available at National Center for Health Statistics (2016).

[k]U.S. Census Bureau (n.d.a).

Table 2.20 Prevalence of current use of tobacco products among U.S. working adults,[a] 18 years of age and older, by type of tobacco product and industry sector; National Health Interview Survey (NHIS) 2020–2021, United States

Industry sector	Number of currently working adults[b] (in 1,000s)	Cigarettes:[c] % (95% CI)	Other combustible tobacco products:[d] % (95% CI)	Smokeless tobacco:[e] % (95% CI)	E cigarettes:[f] % (95% CI)	Any tobacco product:[g] % (95% CI)	Two or more tobacco products:[h] % (95% CI)
Construction	11,460	20.2 (18.0–22.4)	6.5 (5.3–7.7)	5.1 (4.0–6.3)	5.2 (4.0–6.3)	31.1 (28.6–33.5)	5.4 (4.3–6.6)
Manufacturing	14,252	16.4 (14.8–18.0)	5.6 (4.6–6.5)	3.1 (2.3–4.0)	5.4 (4.4–6.4)	25.5 (23.6–27.4)	4.4 (3.5–5.2)
Utilities	1,346	15.8 (9.5–22.0)	5.7 (2.6–8.9)	5.3 (2.4–8.2)	—[i]	27.4 (20.5–34.3)	—[i]
Accommodation & food services	8,232	15.6 (13.6–17.7)	4.2 (2.8–5.5)	—[i]	9.0 (7.1–10.9)	25.0 (22.3–27.6)	3.9 (2.6–5.1)
Administrative & support & waste management & remediation services	6,997	15.2 (13.0–17.5)	6.3 (4.8–7.9)	2.0 (1.2–2.9)	6.0 (4.5–7.5)	24.8 (22.1–27.5)	4.2 (3.0–5.5)
Agriculture, forestry, fishing & hunting	1,971	13.9 (9.4–18.3)	3.3 (1.4–5.2)	6.9 (4.2–9.6)	4.6 (2.3–6.9)	24.9 (20.0–29.7)	3.8 (1.8–5.8)
Transportation & warehousing	7,509	13.7 (11.5–16.0)	6.8 (5.1–8.4)	2.2 (1.2–3.1)	6.1 (4.5–7.7)	24.3 (21.6–27.1)	4.0 (2.8–5.2)
Retail trade	14,317	12.9 (11.5–14.3)	4.3 (3.5–5.1)	0.9 (0.6–1.3)	7.3 (6.0–8.5)	21.4 (19.6–23.1)	3.8 (2.9–4.6)
Other services (except public administration)	7,890	11.4 (9.6–13.2)	5.0 (3.8–6.2)	1.8 (1.0–2.6)	4.8 (3.5–6.1)	19.7 (17.3–22.0)	3.0 (2.1–3.9)
Arts, entertainment, & recreation	2,648	11.3 (8.4–14.3)	6.0 (3.7–8.4)	—[i]	4.5 (2.5–6.5)	17.4 (13.9–20.9)	3.8 (1.9–5.7)
Information	2,984	10.3 (7.6–13.0)	7.2 (4.8–9.6)	—[i]	7.2 (4.7–9.7)	21.4 (17.8–25.0)	3.3 (1.7–4.9)
Wholesale trade	3,121	10.0 (7.3–12.8)	7.8 (5.3–10.3)	—[i]	6.0 (3.9–8.2)	21.9 (18.3–25.5)	3.0 (1.3–4.6)
Real estate & rental & leasing	2,782	9.6 (7.1–12.1)	5.7 (3.7–7.7)	—[i]	5.2 (3.1–7.4)	18.6 (15.3–21.9)	3.5 (1.8–5.1)
Healthcare & social assistance	20,646	8.8 (7.8–9.8)	2.6 (2.0–3.2)	0.3 (0.1–0.5)	3.6 (2.9–4.3)	13.4 (12.2–14.6)	1.7 (1.3–2.2)
Public administration	7,622	8.5 (7.1–9.8)	5.4 (4.2–6.7)	1.7 (1.0–2.4)	3.2 (2.2–4.1)	15.9 (14.1–17.7)	2.8 (1.8–3.7)
Professional, scientific, & technical services	12,704	5.9 (5.0–6.8)	5.7 (4.6–6.7)	0.7 (0.4–1.1)	3.8 (3.0–4.6)	13.6 (12.2–15.0)	2.3 (1.7–3.0)
Finance & insurance	7,384	5.8 (4.6–7.0)	4.5 (3.3–5.6)	—[i]	4.1 (3.0–5.2)	14.0 (12.1–15.9)	1.4 (0.8–2.1)
Education services	13,165	4.1 (3.3–4.9)	2.7 (2.0–3.4)	0.9 (0.5–1.4)	2.2 (1.6–2.8)	9.1 (8.0–10.3)	0.8 (0.4–1.1)
Mining	506	—[i]	—[i]	—[i]	—[i]	16.8 (9.4–24.2)	—[i]
Management of companies & enterprises	158	—[i]	—[i]	—[i]	—[i]	—[i]	—[i]
Armed Forces	89	—[i]	—[i]	—[i]	—[i]	—[i]	—[i]
Total	150,981	11.4 (10.9–11.8)	4.8 (4.5–5.1)	1.7 (1.5–1.9)	4.9 (4.6–5.2)	19.3 (18.7–19.9)	3.1 (2.8–3.3)

Table 2.20 Continued

Source: NHIS, National Center for Health Statistics, public use data, 2020–2021.

Notes: An estimated 3,200 workers with unknown/unascertained/missing industry information were included in the overall (total) estimate. The 2021 NHIS public use data are the most recent to report industry/occupation information. This information was not included in the 2019 NHIS public use data. **CI =** confidence interval.

[a]Adults who reported “working at a job or business,” “with a job or business but not at work,” or “working but not for pay at a family-owned job or business” during the week before the interview.

[b]Weighted to provide national annual average estimates for current employment.

[c]People who currently smoked cigarettes was defined as those who reported having smoked at least 100 cigarettes during their lifetimes and currently smoked every day or some days (estimated N = 17.0 million).

[d]People who used other combustible tobacco products was defined as those who reported having smoked cigars, cigarillos, or little filtered cigars or smoking tobacco in a regular pipe, water pipe, or hookah at least once during their lifetimes and currently using such a product every day or some days (estimated N = 7.3 million).

[e]People who used smokeless tobacco was defined as those who reported having used chewing tobacco, snuff, dip, snus, or dissolvable tobacco at least once during their lifetimes and currently using such a product every day or some days (estimated N = 2.5 million).

[f]People who used e-cigarettes was defined as those who reported having used e-cigarettes at least once during their lifetimes and currently using them every day or some days (N = 7.4 million).

[g]People who used any tobacco product was defined as those who reported currently using cigarettes or other combustible tobacco or smokeless tobacco products or e-cigarettes every day or some days (estimated N = 29.0 million).

[h]People who used two or more tobacco products was defined as those who reported currently using two or more tobacco products (estimated N = 4.6 million).

[i]Estimate suppressed (relative standard error >30%).

Smokeless Tobacco

The highest prevalence of current smokeless tobacco use by industry was among workers in agriculture, forestry, fishing, and hunting (6.9%; 95% CI, 4.2–9.6), followed by utility workers (5.3%; 95% CI, 2.4–8.2) and construction workers (5.1%; 95% CI, 4.0–6.3). The lowest prevalence of smokeless tobacco use by industry was among workers in healthcare and social assistance (0.3%; 95% CI, 0.1–0.5) (Table 2.20).

Other Combustible Tobacco Products

The highest prevalence of current use of other combustible tobacco products (including cigars, cigarillos, or little filtered cigars or smoking tobacco in a regular pipe, water pipe, or hookah) by industry was among workers in wholesale trade (7.8%; 95% CI, 5.3–10.3), followed by information workers (7.2%; 95% CI, 4.8–9.6) and workers in transportation and warehousing (6.8%; 95% CI, 5.1–8.4). The lowest prevalence of use of other combustible tobacco products by industry was among workers in healthcare and social assistance (2.6%; 95% CI, 2.0–3.2) (Table 2.20).

Patterns of Polytobacco Use by Occupational Profession and Industry

Backinger and colleagues (2008) reviewed several years of data (1995–1996, 1998, 2000, and 2001–2002) from the TUS-CPS to examine the use of cigarettes and at least one other tobacco product (concurrent use) by occupational status. These authors found that the prevalence of concurrent use was generally higher among manual labor or service workers (6.5–12.2%) than among workers in other occupational groups; categories were based on the Standard Occupational Classification System. In multivariable analyses, occupation was not a significant predictor of concurrent tobacco use among workers who smoked cigarettes currently and daily, but manual labor or service workers who smoked intermittently had 22% higher odds of any other tobacco use compared with white-collar workers.

NHIS data from 2020 to 2021 show that the prevalence of multiple tobacco product use was highest among people employed in construction (5.4%; 95% CI, 4.3–6.6), followed by those in manufacturing (4.4%; 95% CI, 3.5–5.5) and administrative and support and waste management and remediation services (4.2%; 95% CI, 3.0–5.5). The lowest prevalence of multiple tobacco product use by industry was among workers in education services (0.8%; 95% CI, 0.4–1.1) (Table 2.20).

Patterns of Smoking Cessation by Sex and by Occupational Profession and Industry

Table 2.21 shows data from the 2018–2019 TUS-CPS on past-year quit attempts and cessation of 6 months or longer by occupational category, tobacco product, and sex. Past-year quit attempts in men ranged from 33.9% (95% CI, 30.0–37.7) (manual labor, smokeless) to 52.4% (95% CI, 50.1–54.6) (white collar, cigarettes). Past-year quit attempts among women ranged from 37.1% (95% CI, 20.8–53.4) (manual labor, cigars) to 56.7% (95% CI, 50.4–63.0) (white collar, cigars). Prevalence of sustained cessation for 6 or more months among men ranged from 6.4% (95% CI, 5.4–7.4) (manual labor, cigarettes) to 28.4% (95% CI, 20.6–36.2) (service, cigars). Prevalence of sustained cessation for 6 or more months among women ranged from 4.8% (95% CI, 2.7–7.0) (manual labor, cigarettes) to 37.8% (95% CI, 31.4–44.2) (white collar, cigars). Sustained cessation differed by product, with cigarettes having the lowest rates of sustained cessation across occupational category and sex compared with other products.

Tobacco Use by Disability Status

People with disabilities comprise about one-quarter of the adult population (Okoro et al. 2018), but few studies have addressed the prevalence of tobacco use in this group. Data from the 2020 NHIS indicate that, compared with adults who report not having a disability, adults with disabilities reported a higher prevalence of current cigarette use (disability: 19.8%; 95% CI, 17.8–22.0 vs. no disability: 11.8%; 95% CI, 11.2–12.3), any tobacco product use (disability: 25.4%; 95% CI, 23.3–27.6 vs. no disability: 18.4%; 95% CI, 17.8–19.4), any combustible tobacco product use (disability: 21.6%; 95% CI, 19.6–23.8 vs. no disability: 14.6%; 14.0–15.2), and use of multiple tobacco products (disability: 4.8%; 95% CI, 3.6–6.1 vs. no disability: 3.2%; 95% CI, 2.8–3.5). The prevalence of use of other tobacco

Table 2.21 Prevalence of a past-year quit attempt[a] and a sustained quit for 6 or more months,[b] by occupational category,[c] type of tobacco product, and sex; Tobacco Use Supplement to the Current Population Survey (TUS-CPS) 2018–2019, United States

	White collar: % (95% CI)		Manual labor: % (95% CI)		Service: % (95% CI)		Other: % (95% CI)	
Type of tobacco product	Men	Women	Men	Women	Men	Women	Men	Women
Cigarettes								
Past-year quit attempt	52.4 (50.1–54.6)	53.6 (51.3–55.8)	46.3 (44.0–48.6)	53.1 (48.0–58.1)	50.8 (47.3–54.3)	55.6 (52.5–58.7)	49.6 (33.2–66.0)	—[d]
Sustained quit ≥6 months	10.1 (8.7–11.5)	8.2 (7.0–9.5)	6.4 (5.4–7.4)	4.8 (2.6–7.0)	7.0 (5.1–8.8)	8.2 (6.1–10.2)	—[d]	—[d]
Cigars								
Past-year quit attempt	41.9 (38.8–45.0)	56.7 (50.4–63.0)	41.4 (36.7–46.0)	37.1 (20.8–53.4)	43.7 (36.4–51.1)	54.1 (43.1–65.0)	—[d]	—[d]
Sustained quit ≥6 months	25.5 (22.9–28.1)	37.8 (31.4–44.2)	26.4 (22.8–30.0)	14.3 (1.2–27.3)	28.4 (20.6–36.2)	36.0 (25.9–46.1)	—[d]	—[d]
E-cigarettes								
Past-year quit attempt	47.1 (43.3–50.9)	48.2 (45.0–51.5)	48.4 (43.7–53.0)	47.5 (37.8–57.2)	48.0 (40.7–55.4)	53.0 (46.4–59.7)	—[d]	—[d]
Sustained quit ≥6 months	23.3 (20.1–26.5)	26.8 (23.5–30.1)	25.9 (22.3–29.5)	32.9 (24.2–41.7)	19.7 (13.4–26.0)	30.7 (24.5–36.9)	—[d]	—[d]
Smokeless tobacco								
Past-year quit attempt	43.6 (39.1–48.1)	—[d]	33.9 (30.0–37.7)	—[d]	42.5 (34.9–50.1)	—[d]	—[d]	—[d]
Sustained quit ≥6 months	19.2 (15.7–22.8)	—[d]	12.4 (9.8–15.0)	—[d]	14.0 (8.7–19.4)	—[d]	—[d]	—[d]

Source: TUS-CPS, National Cancer Institute, public use data, 2018–2019.

Notes: **CI =** confidence interval.

[a]Assessment of a past-year quit attempt for cigarette smoking differed from the assessment of a past-year quit attempt for other tobacco products (cigars, e-cigarette, smokeless tobacco). For cigarette smoking, the assessment included (a) people who currently smoked cigarettes and who tried to quit completely during the past 12 months, who attempted to quit for at least 1 day during the past 12 months, and who made serious efforts to quit smoking even if it lasted less than 1 day during the past 12 months and (b) people who quit smoking during the past 12 months. For other tobacco products, the assessment included people who currently used the respective tobacco product who tried to quit for 1 day or longer during the past 12 months and people who quit using the respective tobacco product during the past 12 months.

[b]Assessment of a sustained quit from cigarette smoking for 6 or more months differed from the assessment of a sustained quit from other tobacco products (cigars, e-cigarettes, smokeless tobacco) for 6 or more months. For cigarette smoking, the assessment included people who quit smoking for 6–12 months before the interview, among people who currently smoked cigarettes for at least 2 years and among people who quit smoking during the past 12 months. For other tobacco products, the assessment included

Table 2.21 Continued

people who quit using the respective tobacco product 6–12 months before the interview, among people who currently used the respective tobacco product and people who quit using the respective tobacco product during the past 12 months. The assessment did not include a variable to assess the 2-year use duration for cigars, e-cigarettes, and smokeless tobacco.

[c]The *white collar* category included the following 2010 U.S. Census occupation classification codes: 0010-0950 (management, business, and financial occupations), 1000-3540 (professional and related occupations), 4700-4965 (sales and related occupations), and 5000-5940 (office and administrative support occupations). The maanual labor (*blue collar*) category included the following 2010 U.S. Census occupation classification codes: 6200-6940 (construction and extraction occupations), 7000-7630 (installation, maintenance, and repair occupations), 7700-8965 (production occupations), and 9000-9750 (transportation and material moving occupations). The service category included the following occupation classification code: 3600-4650 (service occupations). The other category included the following occupation classification codes: 6000-6130 (farming, fishing and forestry occupations) and 9840 (armed forces). Not Categorized included responses for which occupations could not be categorized.

[d]Unstable estimate is not presented because of a relative standard error >30% or unweighted denominator <50.

products (e.g., e-cigarettes, pipes, cigars, and smokeless tobacco) was similar for people with and without disabilities (Cornelius et al. 2022).

When examining tobacco use by type of disability and degree of difficulty performing certain tasks in the 2019 NHIS, Schulz and colleagues (2022b) found that the prevalence of current cigarette use was higher among adults who reported "a lot of difficulty/cannot do at all" than it was among adults who reported "no difficulty" to questions about vision (21.5%; 95% CI, 17.3–26.4 vs. 13.1%; 95% CI, 12.5–13.6), hearing (19.6%; 95% CI, 16.0–23.8 vs. 13.6%; 95% CI, 13.0–14.2), mobility (20.0%; 95% CI, 17.8–22.4 vs. 12.9%; 95% CI, 12.3–13.5), and cognitive (25.4%; 95% CI, 21.6–29.7 vs. 12.9%; 95% CI, 12.3–13.4) disabilities. The odds of current cigarette, pipe, and smokeless tobacco use were significantly higher among adults who reported "a lot of difficulty/cannot do at all" to any disability question (adjusted odds ratio [aOR] range = 1.32–1.85) and significantly higher for current cigarette, e-cigarette, pipe, and smokeless tobacco use for adults who reported "some difficulty" to any disability (aOR range = 1.24–1.45) compared with adults who reported "no difficulty." Pipe use was correlated with a response of "a lot of difficulty/cannot do at all" in mobility (aOR = 1.68) while smokeless tobacco use was correlated with "a lot of difficulty/cannot do at all" in hearing (aOR = 1.95) (Schulz et al. 2022b).

Disability status was only added to the NSDUH in 2015 and a study of NSDUH data from 2015 to 2019 showed that in each year, there were overall declines in the prevalence of current cigarette smoking, but the prevalence of current smoking remained higher among people with disabilities compared to their counterparts without disabilities during this time period (Schulz et al. 2022a). According to these data, people with cognitive, independent living, and self-care disabilities experienced the highest prevalence of past-month daily cigarette use for all years. With respect to smoking cessation, the odds of former smoking were similar between people with any disability and those with no disability (aOR = 1.00; 95% CI, 0.95–1.06). Further examination of cessation by type of disability showed that people with a cognitive (aOR = 0.79; 95% CI, 0.71–0.87), independent living (aOR = 0.84; 95% CI, 0.77–0.93), self-care (aOR = 0.81; 95% CI, 0.72–0.92), or visual (aOR = 0.78; 95% CI, 0.70–0.87) disability had significantly lower odds of being a former smoker than those without such disabilities; people with a hearing disability had significantly higher odds of being a former smoker (aOR = 1.39; 95% CI, 1.27–1.51) than those who did not have a hearing disability (Schulz et al. 2022a).

Although people with disabilities disproportionately use tobacco products compared with people with no disabilities, research and tailored interventions to reduce tobacco use in this population remain scarce.

Tobacco Use by Mental Health and Substance Use Status

Since the 1990s, a higher prevalence of smoking and use of other forms of tobacco has persisted among adults living with mental health conditions. Although smoking has declined among the rest of the population, few changes have been observed among people with mental health conditions, creating a wide disparity in tobacco use by mental health status in the United States and in England (Cook et al. 2014; Steinberg et al. 2015; Szatkowski and McNeill 2015; Weinberger et al. 2020). Given the persistent social stigma associated with behavioral health conditions (i.e., mental health conditions and substance use disorders) and increasing social stigmas toward people who use tobacco products, people with these conditions who also use tobacco products have become an increasingly socially isolated population (Brown-Johnson et al. 2015). The following sections use data from the NSDUH and cited literature to review tobacco use by mental health or substance use statuses among adults and youth.

The NSDUH captures data and self-reported information about mental health conditions[5] or substance use disorders, including lifetime and past-year major depressive episode, serious psychological distress, and past-year alcohol or drug use disorder.

Patterns of Ever and Current Use of Cigarettes

Youth

Data from the 2019 NSDUH show that among youth overall, the prevalence of past-month cigarette smoking was 2.4% (95% CI, 2.0–2.7); and among youth 12–17 years

[5]Sometimes described in NSDUH reports as any mental illness or AMI (see SAMHSA 2022).

of age, the prevalence of ever and past-month cigarette use was higher among those with past-year alcohol use disorder, drug use disorder, or major depressive episode (Table 2.22, Part A). The prevalence of past-month smoking was 3.9% (95% CI, 3.0–4.8) among youth with a past-year major depressive episode, 4.0% (95% CI, 3.1–4.8) among youth with a lifetime major depressive episode, 17.4% (95% CI, 12.9–21.8) among youth with a past-year illicit drug use disorder, 19.7% (95% CI, 14.1–25.2) among youth with a past-year alcohol use disorder, and 30.0% (95% CI, 21.9–38.0) among youth with past-year alcohol and illicit drug use disorders (Table 2.22, Part A).

Adults

Analyses of NESARC data over time indicate a higher prevalence of ever or past-year cigarette smoking among people living with a mental health condition compared with people living without a mental health condition (Smith et al. 2014a, 2020b; Parker and Villanti 2021). Ever cigarette use was significantly higher among people with any past-year mental health condition (53.6%) compared with people with no past-year mental health condition (36.4%); this pattern was consistent across all specific conditions that were assessed (Smith et al. 2020b). According to Smith and colleagues (2020b), the prevalence of past-year cigarette smoking among those with any past-year mental health condition was also higher (33.3%) compared to those with no past-year mental health condition (17.2%).

Table 2.22 presents 2019 NSDUH data on the prevalence of tobacco product use by current and lifetime mental health conditions or substance use disorders. The prevalence of ever cigarette use was high among adults with past-year illicit drug and alcohol use disorders (91.2%; 95% CI, 84.7–97.7) and adults with a serious mental health condition during the past year (72.4%; 95% CI, 69.3–75.5) (Table 2.22, Part A). Ever cigarette use was higher among adults reporting serious psychological distress in the past month (69.9%; 95% CI, 67.0–72.7) than it was among adults without such distress (58.4%; 95% CI, 57.7–59.2). Among all adults, the prevalence of past-month cigarette use was 18.5% (95% CI, 18.1–19.0). The prevalence of past-month cigarette use was 56.7% (95% CI, 46.8–66.6) among adults with a past-year illicit drug and alcohol use disorder. Among adults with any serious mental health condition during the past year, 30.9% (95% CI, 28.0–33.8) reported past-month cigarette use (Table 2.22, Part A). Similarly, past-month cigarette use was higher among adults reporting serious psychological distress in the past month (35.2%; 95% CI, 32.5–37.9) than it was among adults without such distress (17.4%; 95% CI, 16.9–17.9) (Table 2.22, Part A).

Patterns of Frequency and Quantity of Cigarette Use

Table 2.23 shows that, among adults who smoke, the prevalence of daily smoking is similar by mental health status. According to data from the NSDUH for 2019, the mean number of cigarettes smoked during the past month was similar among adults without any mental health condition (291 cigarettes) and adults with any mental health condition (288 cigarettes) (NSDUH, public use data, 2019). As shown in Figure 2.9, in 2019, regardless of gender and mental health status, the average number of cigarettes smoked by adults during the past month increased by age category. For all genders and across all age groups, no differences in the average number of cigarettes smoked during the past month were observed by past-year mental health status. Among men and women living with any mental health condition in the past year, 18- to 25-year-olds smoked 134 cigarettes on average during the past month; 26- to 49-year-olds smoked 295 cigarettes on average; and those 50 years of age and older smoked 352 cigarettes on average (NSDUH, public use data, 2019). Men living with any mental health condition in the past year smoked 300 cigarettes on average in the past month compared with 279 cigarettes for women living with any mental health condition in the past year.

Focusing on 2005–2014 data from the NSDUH, Weinberger and colleagues (2018) conducted time-trend analyses of smoking behaviors among people with and without past-year mental health conditions (defined as a major depressive episode or serious psychological distress) or substance use disorders (defined as alcohol or other substance use disorder, heavy alcohol use, or daily cannabis use). Overall, the prevalence of daily cigarette smoking declined significantly between 2005 and 2014 among people with mental health conditions or substance use disorders (from 29.4% in 2005 to 24.2% in 2014) and among people without mental health conditions or substance use disorders (from 13.5% in 2005 to 10.2% in 2014). In contrast, the prevalence of nondaily cigarette use increased between 2005 and 2014 among people with mental health conditions or substance use disorders (from 29.5% in 2005 to 33.7% in 2014) but decreased among those without mental health conditions or substance use disorders (from 29.1% in 2005 to 27.4% in 2014). As a result, the disparity in nondaily cigarette use increased between people with and without mental health conditions or substance use disorders, and in 2014, the prevalence of current, daily, and nondaily cigarette smoking all remained significantly higher among people with mental health conditions or substance use disorders than it was among people without such disorders (Weinberger et al. 2018).

Table 2.22 Age-adjusted prevalence of patterns of tobacco product use, by mental health conditions or substance use disorders; National Survey on Drug Use and Health (NSDUH) 2019, United States

A. Overall prevalence of mental health conditions or substance use disorders, current use of two or more tobacco products, and ever and current use of cigarettes

Age group and mental health conditions and substance use disorders	Overall prevalence of mental health conditions		Current use of ≥2 tobacco products[a]		Ever use of cigarettes[b]		Current use of cigarettes[c]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Adults and youth (≥12 years of age) (n = 56,136)								
Prevalence of ever and current use of tobacco products—overall	—	—	2,169	3.3 (3.1–3.5)	25,671	54.4 (53.8–55.1)	9,142	17.0 (16.5–17.4)
Past-year alcohol use disorder[d]	3,363	5.4 (5.2–5.7)	474	10.4 (8.8–11.9)	2,725	82.7 (80.5–84.8)	1,384	37.0 (34.2–39.7)
Past-year illicit drug use disorder[e]	2,385	3.2 (3.0–3.4)	409	14.6 (11.8–17.4)	1,897	86.8 (84.5–89.1)	1,102	45.1 (40.8–49.3)
Past-year illicit drug or alcohol disorder[f]	5,061	7.7 (7.4–8.0)	719	10.3 (9.0–11.6)	4,027	82.7 (80.9–84.4)	2,112	37.8 (35.6–40.1)
Past-year illicit drug and alcohol use disorder[g]	687	0.9 (0.8–1.0)	164	27.6 (18.0–37.1)	595	89.6 (83.7–95.6)	374	54.8 (45.7–63.8)
Adults (≥18 years of age) (n = 42,739)								
Prevalence of ever and current use of tobacco products—overall	—	—	2,007	3.5 (3.3–3.7)	24,320	59.3 (58.6–60.0)	8,781	18.5 (18.1–19.0)
Serious psychological distress during the past month[h]								
Yes	4,148	6.9 (6.6–7.2)	405	8.1 (6.6–9.6)	2,678	69.9 (67.0–72.7)	1,398	35.2 (32.5–37.9)
No	38,591	93.1 (92.8–93.4)	1,602	3.2 (3.0–3.4)	21,642	58.4 (57.7–59.2)	7,383	17.4 (16.9–17.9)
Serious psychological distress during the past year[i]								
Yes	7,664	13.0 (12.5–13.4)	610	6.9 (5.8–8.1)	4,834	68.8 (66.7–70.9)	2,241	30.6 (28.6–32.7)
No	35,075	87.0 (86.6–87.5)	1,397	3.1 (2.9–3.3)	19,486	57.7 (57.0–58.5)	6,540	17.0 (16.5–17.4)

Table 2.22 Continued

Age group and mental health conditions and substance use disorders	Overall prevalence of mental health conditions		Current use of ≥2 tobacco products[a]		Ever use of cigarettes[b]		Current use of cigarettes[c]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Past-year alcohol use disorder	3,107	5.8 (5.5–6.1)	437	9.6 (8.0–11.1)	2,564	85.2 (83.0–87.4)	1,301	37.7 (34.9–40.5)
Past-year illicit drug use disorder	1,868	3.1 (2.9–3.3)	339	14.6 (11.6–17.7)	1,624	90.7 (88.3–93.2)	979	47.6 (42.9–52.2)
Past-year illicit drug or alcohol disorder	4,405	8.0 (7.7–8.4)	636	9.9 (8.5–11.2)	3,683	86.3 (84.4–88.1)	1,956	39.5 (37.1–42.0)
Past-year illicit drug and alcohol use disorder	570	0.9 (0.8–1.0)	140	27.8 (17.3–38.3)	505	91.2 (84.7–97.7)	324	56.7 (46.8–66.6)
Lifetime major depressive episode[j]	7,552	14.6 (14.1–15.1)	477	4.3 (3.7–4.9)	4,943	70.2 (68.6–71.9)	1,904	23.1 (21.7–24.4)
Past-year major depressive episode[k]	4,467	8.2 (7.8–8.5)	335	5.0 (4.0–6.0)	2,904	69.5 (66.9–72.1)	1,258	26.7 (24.6–28.8)
Suicidal thoughts during the past year[l]	3,071	5.1 (4.8–5.3)	297	7.0 (5.7–8.3)	1,981	71.2 (67.8–74.6)	927	26.0 (23.4–28.7)
Suicidal plans during the past year[m]	962	1.4 (1.3–1.6)	128	9.9 (6.5–13.2)	634	68.0 (60.6–75.5)	332	28.4 (23.0–33.8)
A suicide attempt during the past year[n]	431	0.6 (0.5–0.7)	69	7.4 (4.7–10.1)	283	62.5 (49.1–75.8)	162	24.8 (20.9–28.6)
Any mental health condition during the past year[o]	10,796	21.2 (20.6–21.7)	750	5.4 (4.8–6.0)	7,018	69.3 (67.9–70.7)	3,047	26.8 (25.6–28.0)
Serious mental health condition during the past year[o]	3,005	5.5 (5.2–5.8)	245	5.6 (4.4–6.8)	2,100	72.4 (69.3–75.5)	996	30.9 (28.0–33.8)
Mild or moderate mental health condition during the past year[o]	7,791	15.7 (15.2–16.2)	505	5.3 (4.5–6.0)	4,918	68.1 (66.5–69.7)	2,051	25.4 (24.0–26.8)
Youth (12–17 years of age) (n = 13,397)								
Prevalence of ever and current use of tobacco products—overall	—	—	162	1.2 (1.0–1.5)	1,351	9.4 (8.8–10.0)	361	2.4 (2.0–2.7)

Table 2.22 Continued

Age group and mental health conditions and substance use disorders	Overall prevalence of mental health conditions		Current use of ≥2 tobacco products[a]		Ever use of cigarettes[b]		Current use of cigarettes[c]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Past-year alcohol use disorder	256	1.7 (1.5–2.0)	37	12.1 (7.1–17.1)	161	52.4 (45.3–59.5)	83	19.7 (14.1–25.2)
Past-year illicit drug use disorder	517	3.8 (3.4–4.3)	70	11.6 (8.1–15.1)	273	44.7 (37.2–52.1)	123	17.4 (12.9–21.8)
Past-year illicit drug or alcohol disorder	656	4.7 (4.2–5.2)	83	10.9 (7.8–13.9)	344	44.5 (37.3–51.7)	156	17.1 (13.1–21.0)
Past-year illicit drug and alcohol use disorder	117	0.8 (0.6–1.0)	24	21.5 (12.1–30.9)	90	67.3 (60.3–74.2)	50	30.0 (21.9–38.0)
Lifetime major depressive episode	2,869	21.9 (21.0–22.7)	56	1.8 (1.1–2.4)	508	14.4 (12.8–15.9)	151	4.0 (3.1–4.8)
Past-year major depressive episode	2,098	15.8 (15.0–16.6)	40	1.4 (0.8–2.1)	392	15.2 (13.4–17.1)	112	3.9 (3.0–4.8)

B. Ever and current use of cigars and pipes

Age group and mental health conditions and substance use disorders	Ever use of cigars[p]		Current use of cigars[q]		Ever use of pipes[r]		Current use of pipes[s]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Adults and youth (≥12 years of age) (n = 56,136)								
Prevalence of ever and current use of tobacco products—overall	15,443	31.2 (30.7–31.8)	2,638	4.4 (4.1–4.6)	4,703	10.9 (10.5–11.4)	486	0.7 (0.6–0.8)
Past-year alcohol use disorder[d]	1,955	60.1 (56.8–63.4)	440	12.0 (9.9–14.2)	689	24.1 (21.0–27.1)	106	2.3 (1.6–3.0)
Past-year illicit drug use disorder[e]	1,356	55.7 (50.4–60.9)	438	15.2 (11.4–19.0)	516	29.8 (25.1–34.4)	108	3.1 (2.1–4.0)
Past-year illicit drug or alcohol disorder[f]	2,877	58.8 (55.7–61.8)	734	12.4 (10.5–14.3)	1,033	25.4 (22.9–28.0)	174	2.4 (1.8–3.1)

Table 2.22 Continued

Age group and mental health conditions and substance use disorders	Ever use of cigars[p]		Current use of cigars[q]		Ever use of pipes[r]		Current use of pipes[s]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Past-year illicit drug and alcohol use disorder[g]	434	63.7 (57.4–70.0)	144	24.2 (14.6–33.7)	172	29.1 (20.2–38.0)	40	3.5 (1.6–5.3)
Adults (≥18 years of age) (n = 42,739)								
Prevalence of ever and current use of tobacco products—overall	14,715	34.1 (33.4–34.7)	2,441	4.7 (4.4–4.9)	4,500	12.0 (11.5–12.4)	434	0.8 (0.7–0.9)
Serious psychological distress during the past month[h]								
Yes	1,644	37.6 (34.6–40.7)	414	7.2 (5.9–8.5)	546	15.7 (13.2–18.3)	105	2.8 (1.8–3.9)
No	13,071	33.7 (33.0–34.4)	2,027	4.5 (4.2–4.7)	3,954	11.7 (11.2–12.1)	329	0.6 (0.5–0.7)
Serious psychological distress during the past year[i]								
Yes	3,046	38.4 (36.0–40.8)	663	7.0 (5.9–8.2)	959	15.3 (13.4–17.2)	151	2.0 (1.4–2.7)
No	11,669	33.3 (32.6–34.0)	1,778	4.3 (4.1–4.6)	3,541	11.4 (11.0–11.9)	283	0.6 (0.5–0.7)
Past-year alcohol use disorder	1,857	62.3 (58.7–65.8)	407	11.7 (9.4–13.9)	655	25.3 (21.9–28.7)	94	2.0 (1.3–2.7)
Past-year illicit drug use disorder	1,172	57.6 (51.9–63.3)	359	15.0 (10.9–19.2)	453	31.6 (26.5–36.8)	89	3.0 (1.9–4.0)
Past-year illicit drug or alcohol disorder	2,646	61.2 (57.8–64.5)	642	12.2 (10.1–14.2)	956	26.9 (24.0–29.7)	152	2.3 (1.7–3.0)
Past-year illicit drug and alcohol use disorder	383	65.4 (58.6–72.3)	124	24.0 (13.5–34.5)	152	30.6 (20.7–40.4)	31	3.1 (1.1–5.1)
Lifetime major depressive episode[j]	3,152	40.3 (38.2–42.3)	549	5.8 (4.9–6.7)	1,018	15.9 (14.1–17.6)	111	0.9 (0.7–1.2)
Past-year major depressive episode[k]	1,896	40.9 (38.3–43.5)	383	6.7 (5.2–8.1)	616	17.7 (15.4–20.0)	79	1.2 (0.8–1.6)
Suicidal thoughts during the past year[l]	1,310	44.1 (40.5–47.7)	323	7.6 (6.1–9.2)	452	20.2 (17.1–23.4)	73	1.4 (0.8–2.0)

Table 2.22 Continued

Age group and mental health conditions and substance use disorders	Ever use of cigars[p]		Current use of cigars[q]		Ever use of pipes[r]		Current use of pipes[s]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Suicidal plans during the past year[m]	396	40.2 (33.0–47.4)	114	8.1 (5.4–10.8)	158	18.3 (12.2–24.4)	33	2.0 (0.9–3.1)
A suicide attempt during the past year[n]	170	31.4 (21.0–41.8)	62	6.8 (4.0–9.5)	—[t]	—[t]	19	1.7 (1.1–2.3)
Any mental health condition during the past year[o]	4,393	39.1 (37.6–40.5)	848	6.2 (5.5–6.9)	1,402	15.7 (14.5–17.0)	182	1.4 (1.0–1.7)
Serious mental health condition during the past year[o]	1,317	41.1 (37.6–44.6)	274	6.5 (5.1–8.0)	439	18.2 (15.1–21.4)	62	1.5 (0.9–2.1)
Mild or moderate mental health condition during the past year[o]	3,076	38.5 (37.0–40.1)	574	6.0 (5.2–6.8)	963	15.2 (13.7–16.6)	120	1.3 (0.9–1.7)
Youth (12–17 years of age) (n = 13,397)								
Prevalence of ever and current use of tobacco products—overall	728	5.3 (4.8–5.8)	197	1.5 (1.2–1.7)	203	1.5 (1.2–1.7)	52	0.4 (0.2–0.5)
Past-year alcohol use disorder	98	34.2 (24.6–43.8)	33	13.6 (6.1–21.2)	—[t]	—[t]	—[t]	—[t]
Past-year illicit drug use disorder	184	30.4 (23.9–37.0)	79	12.7 (9.3–16.1)	63	13.3 (7.2–19.3)	—[t]	—[t]
Past-year illicit drug or alcohol disorder	231	30.4 (23.9–36.9)	92	11.5 (8.5–14.4)	77	13.1 (7.1–19.0)	22	2.6 (1.1–4.1)
Past-year illicit drug and alcohol use disorder	51	34.0 (24.8–43.3)	20	21.4 (11.7–31.1)	—[t]	—[t]	—[t]	—[t]
Lifetime major depressive episode	241	7.3 (6.1–8.4)	64	2.1 (1.5–2.8)	84	2.4 (1.7–3.2)	21	0.5 (0.2–0.7)
Past-year major depressive episode	177	7.1 (5.7–8.5)	49	2.0 (1.3–2.8)	68	2.8 (1.8–3.7)	—[t]	—[t]

Table 2.22 Continued

C. Ever and current use of combustible and smokeless tobacco products

Age group and mental health conditions and substance use disorders	Ever use of combustible tobacco products[u]		Current use of combustible tobacco products[v]		Ever use of smokeless tobacco products[w]		Current use of smokeless tobacco products[x]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Adults and youth (≥12 years of age) (n = 56,136)								
Prevalence of ever and current use of tobacco products—overall	28,461	59.4 (58.8–60.0)	10,681	19.6 (19.1–20.0)	8,526	15.7 (15.3–16.2)	1,996	3.2 (3.0–3.4)
Past-year alcohol use disorder[d]	2,918	87.9 (86.0–89.7)	1,584	43.2 (40.3–46.1)	1,219	32.0 (29.1–35.0)	333	7.1 (5.8–8.3)
Past-year illicit drug use disorder[e]	2,055	91.0 (89.2–92.9)	1,298	50.7 (46.3–55.1)	781	32.2 (27.6–36.9)	184	5.9 (4.6–7.2)
Past-year illicit drug or alcohol disorder[f]	4,340	88.0 (86.5–89.5)	2,459	44.4 (41.9–46.8)	1,717	31.2 (28.7–33.7)	435	6.3 (5.3–7.3)
Past-year illicit drug and alcohol use disorder[g]	633	94.0 (90.8–97.2)	423	58.5 (49.5–67.5)	283	41.0 (30.3–51.8)	82	9.1 (6.0–12.2)
Adults (≥18 years of age) (n = 42,739)								
Prevalence of ever and current use of tobacco products—overall	26,806	64.5 (63.9–65.2)	10,195	21.3 (20.8–21.8)	7,936	17.0 (16.5–17.5)	1,852	3.4 (3.2–3.6)
Serious psychological distress during the past month[h]								
Yes	2,896	74.0 (71.4–76.6)	1,569	37.6 (34.8–40.4)	863	17.6 (15.7–19.4)	220	4.0 (3.0–5.1)
No	23,910	63.8 (63.1–64.4)	8,626	20.2 (19.6–20.7)	7,073	16.9 (16.4–17.4)	1,632	3.4 (3.2–3.6)
Serious psychological distress during the past year[i]								
Yes	5,268	73.2 (71.2–75.2)	2,541	33.3 (31.1–35.4)	1,507	16.9 (15.4–18.4)	341	3.4 (2.6–4.1)
No	21,538	63.1 (62.4–63.8)	7,654	19.7 (19.2–20.2)	6,429	17.0 (16.4–17.5)	1,511	3.5 (3.2–3.7)
Past-year alcohol use disorder	2,734	90.0 (88.2–91.9)	1,488	44.0 (41.0–47.1)	1,142	32.3 (29.2–35.5)	311	6.8 (5.5–8.1)

Table 2.22 Continued

Age group and mental health conditions and substance use disorders	Ever use of combustible tobacco products[u]		Current use of combustible tobacco products[v]		Ever use of smokeless tobacco products[w]		Current use of smokeless tobacco products[x]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Past-year illicit drug use disorder	1,731	94.3 (92.3–96.2)	1,139	52.9 (48.1–57.8)	672	33.3 (28.1–38.5)	154	5.8 (4.4–7.3)
Past-year illicit drug or alcohol disorder	3,929	91.0 (89.4–92.6)	2,259	46.0 (43.4–48.7)	1,577	32.2 (29.5–34.9)	394	6.2 (5.1–7.3)
Past-year illicit drug and alcohol use disorder	536	95.3 (91.9–98.8)	368	60.1 (50.2–70.0)	237	40.9 (29.1–52.7)	71	9.0 (5.7–12.3)
Lifetime major depressive episode[j]	5,358	74.8 (73.2–76.4)	2,180	26.3 (24.8–27.8)	1,514	17.6 (16.3–18.9)	261	2.6 (2.2–3.0)
Past-year major depressive episode[k]	3,156	74.7 (72.2–77.1)	1,446	30.4 (28.1–32.6)	887	17.7 (15.7–19.8)	163	2.6 (1.9–3.2)
Suicidal thoughts during the past year[l]	2,159	76.0 (73.0–79.1)	1,068	29.4 (26.5–32.3)	677	20.3 (17.2–23.4)	149	4.0 (2.8–5.3)
Suicidal plans during the past year[m]	687	73.4 (66.4–80.3)	370	30.6 (25.1–36.1)	230	20.0 (15.0–25.0)	62	5.6 (2.8–8.5)
A suicide attempt during the past year[n]	308	67.8 (54.5–81.1)	184	27.2 (23.6–30.7)	105	14.1 (8.4–19.7)	33	3.6 (1.8–5.5)
Any mental health condition during the past year[o]	7,587	73.8 (72.5–75.1)	3,449	29.7 (28.5–31.0)	2,170	17.5 (16.4–18.6)	436	3.0 (2.5–3.4)
Serious mental health condition during the past year[o]	2,246	76.9 (73.8–80.0)	1,118	34.0 (30.9–37.1)	621	16.8 (14.6–19.0)	108	2.6 (1.8–3.3)
Mild or moderate mental health condition during the past year[p]	5,341	72.6 (71.2–74.1)	2,331	28.2 (26.8–29.6)	1,549	17.7 (16.5–19.0)	328	3.1 (2.6–3.6)
Youth (12–17 years of age) (n = 13,397)								
Prevalence of ever and current use of tobacco products—overall	1,655	11.7 (11.0–12.3)	486	3.3 (2.9–3.7)	590	4.3 (3.9–4.7)	144	1.0 (0.8–1.2)
Past-year alcohol use disorder	184	58.0 (51.1–64.8)	96	25.3 (17.2–33.3)	77	36.4 (30.4–42.4)	22	21.2 (18.3–24.1)

Table 2.22 Continued

Age group and mental health conditions and substance use disorders	Ever use of combustible tobacco products[u]		Current use of combustible tobacco products[v]		Ever use of smokeless tobacco products[w]		Current use of smokeless tobacco products[x]	
	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)	Unweighted frequency	Weighted % (age adjusted) (95% CI)
Past-year illicit drug use disorder	324	54.2 (46.5–62.0)	159	23.7 (18.4–29.0)	109	22.3 (15.3–29.2)	—[t]	—[t]
Past-year illicit drug or alcohol disorder	411	53.8 (46.3–61.2)	200	23.1 (18.4–27.8)	140	21.2 (14.6–27.9)	41	10.2 (4.2–16.1)
Past-year illicit drug and alcohol use disorder	97	71.5 (65.3–77.8)	55	33.2 (25.0–41.4)	46	65.5 (58.0–73.1)	11	21.0 (17.2–24.9)
Lifetime major depressive episode	589	16.9 (15.3–18.6)	187	5.0 (4.1–6.0)	141	4.2 (3.4–5.1)	39	1.0 (0.6–1.5)
Past year major depressive episode	453	17.9 (15.9–19.9)	144	5.1 (4.1–6.2)	105	4.1 (3.1–5.1)	27	0.9 (0.4–1.4)

Source: National Survey on Drug Use and Health, public use data, 2019.

Notes: Proportions and 95% CIs are age adjusted using the direct method based on the 2010 U.S. standard population. For the overall analyses, the denominator is the entire sample (n = 56,136) and the following age groups: 12–17, 18–25, 26–34, 35–49, and 50–64 years of age and 65 years of age and older. For the analyses of adults, the denominator is adults 18 years of age and older (n = 42,739) and the following age groups: 18–25, 26–34, 35–49, and 50–64 years of age and 65 years of age and older. For the analyses of youth, the denominator is youth 12–17 years of age (n = 13,397) and the age groups by single year: 12, 13, 14, 15, 16, and 17. **CI =** confidence interval; **DSM IV =** *Diagnostic and Statistical Manual of Mental Disorders,* 4th edition.

[a]Current use of two or more tobacco products was defined as having used any combination of two or more of the following products during the past 30 days: cigarettes, cigars, tobacco in a pipe, or smokeless tobacco (snuff, dip, chewing tobacco, or snus).

[b]Ever use of cigarettes was defined as having ever smoked part or all of a cigarette, even one time, during the lifetime.

[c]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.

[d]Past-year alcohol use disorder was defined as having met alcohol dependence or abuse criteria during the past 12 months.

[e]Past-year illicit drug use disorder was defined as having met dependence or abuse criteria during the past 12 months for any of the following illicit drugs: marijuana (cannabis), hallucinogens, inhalants, methamphetamine, tranquilizers, cocaine, heroin, pain relievers, stimulants, or sedatives.

[f]Past-year illicit drug or alcohol disorder was defined as having met criteria for past-year dependence or abuse of either alcohol or any of the illicit drugs during the past 12 months.

[g]Past-year illicit drug and alcohol use disorder was defined as having met criteria for past-year dependence or abuse of both alcohol and any of the illicit drugs during the past 12 months.

[h]Serious psychological distress during the past month was defined using the Kessler-6 measure. Respondents were rated on a Likert scale for how frequently they experienced the following symptoms of psychological distress during the past 30 days: (1) nervousness, (2) hopelessness, (3) feeling restless or fidgety, (4) feeling so depressed that nothing could cheer them up, (5) feeling that everything was an effort, and (6) feeling worthless. Responses were coded as follows: “all of the time” was coded as 4; “most of the time”

Table 2.22 Continued

as 3; "some of the time" as 2; "a little of the time" as 1; and "none of the time" as 0. Response codes 0–4 were summed to yield a score range of 0–24. Serious psychological distress was defined as a value of 13 or more.

[i]Serious psychological distress during the past year was defined based on the higher score between the past-month Kessler-6 items and the worst month of Kessler-6 items during the 12 months. After responding to Kessler-6 items for the past month, respondents were asked if there was a month during the past 12 months when they felt more depressed, anxious, or emotionally stressed than they had felt during the past 30 days. This level of psychological distress is referenced as the "worst month in past year."

[j]Lifetime major depressive episode was defined as having experienced at least five of the nine criteria used to define having had a major depressive episode during the lifetime, where at least one of the criteria is a depressed mood or loss of interest or pleasure in daily activities. To screen for major depressive episode, youth and adults were asked separate sets of questions.

[k]Past-year major depressive episode was defined as having met criteria for major depressive episode during the past 12 months. Youth and adults were asked separate sets of questions.

[l]Suicidal thoughts during the past year was defined as a positive response to the following question: "At any time during the past 12 months, that is from [DATE] up to and including today, did you seriously think about trying to kill yourself?"

[m]Suicidal plans during the past year was defined as a positive response to the following question: "During the past 12 months, did you make any plans to kill yourself?"

[n]A suicide attempt during the past year was defined as a positive response to the following question: "During the past 12 months, did you try to kill yourself?"

[o]Any, serious, and mild or moderate mental health conditions during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study.

[p]Ever use of cigars was defined as having ever smoked part or all of any type of cigar, even one time, during the lifetime.

[q]Current use of cigars was defined as having smoked part or all of any type of cigar during the past 30 days.

[r]Ever use of pipes was defined as having ever smoked tobacco in a pipe, waterpipe, or hookah, even one time, during the lifetime.

[s]Current use of pipes was defined as having ever smoked tobacco in a pipe, water pipe, or hookah during the past 30 days.

[t]Standard error >30% of the point estimate (percentage) or the unweighted denominator is <50.

[u]Ever use of combustible tobacco products was defined as having ever smoked part or all of a cigarette; part or all of any type of cigar; or tobacco in a pipe, waterpipe, or hookah, even one time, during the lifetime.

[v]Current use of combustible tobacco products was defined as having ever smoked part or all of a cigarette, part or all of any type of cigar; or tobacco in a pipe, waterpipe, or hookah during the past 30 days.

[w]Ever use of smokeless tobacco was defined as having ever used smokeless tobacco (such as, snuff, dip, chewing tobacco, or snus), even one time, during the lifetime.

[x]Current use of smokeless tobacco was defined as having used smokeless tobacco (such as, snuff, dip, chewing tobacco, or snus) during the past 30 days.

Table 2.23 Age-adjusted percentage of smoking frequency and quit smoking status among adults who smoked cigarettes, by mental health status; National Survey on Drug Use and Health (NSDUH) 2019, United States

	No past-year any mental health condition[a]		With past year any mental health condition[a]		Any excluding serious mental health condition[b]		Serious mental health condition[c]	
Smoking frequency and quit smoking status	**Unweighted frequency**	**Weighted % (age adjusted) (95% CI)**	**Unweighted frequency**	**Weighted % (age adjusted) (95% CI)**	**Unweighted frequency**	**Weighted % (age adjusted) (95% CI)**	**Unweighted frequency**	**Weighted % (age adjusted) (95% CI)**
Smoking frequency[d]								
Every day (30 days)	3,107	58.4 (56.4–60.3)	1,689	61.3 (58.6–64.1)	1,129	60.8 (57.6–64.0)	560	62.0 (55.1–68.8)
Some days (1–29 days)	2,627	41.6 (39.7–43.6)	1,358	38.7 (35.9–41.4)	922	39.2 (36.0–42.4)	436	38.0 (31.2–44.9)
Total	5,734	—	3,047	—	2,051	—	996	—
Quit smoking status[e]								
Never quit or quit for ≤30 days[f]	5,788	29.8 (29.0–30.6)	3,066	39.0 (37.4–40.7)	2,068	37.7 (35.9–39.5)	998	42.7 (38.9–46.4)
Quit for >30 days but <1 year[g]	1,461	6.8 (6.4–7.2)	734	7.6 (6.7–8.5)	504	8.0 (7.0–9.1)	230	5.9 (4.8–7.1)
Quit for 1 year or more[h]	10,029	63.4 (62.5–64.3)	3,198	53.4 (51.7–55.1)	2,336	54.3 (52.4–56.1)	862	51.4 (47.6–55.2)
Total	17,278	—	6,998	—	4,908	—	2,090	—

Source: NSDUH, National Survey on Drug Use and Health, public use data, 2019.

Notes: Proportions and 95% confidence intervals are age adjusted using the direct method based on the 2010 U.S. standard population for the following age groups: 18–25, 26–34, 35–49, and 50–64 years of age and 65 years of age and older. **CI =** confidence intervals.

[a]Any mental health condition was defined as having a serious, moderate, or mild mental health condition.

[b]Any excluding serious mental condition was defined as having a mild or moderate mental health condition.

[c]Serious mental health condition was defined as having a diagnosable mental, behavioral, or emotional disorder resulting in serious functional impairment.

[d]Smoking frequency was defined as every day (if the respondent smoked cigarettes on 30 days during the 30 days before the interview) and as some days (if the respondent smoked cigarettes on 1–29 days during the 30 days before the interview.

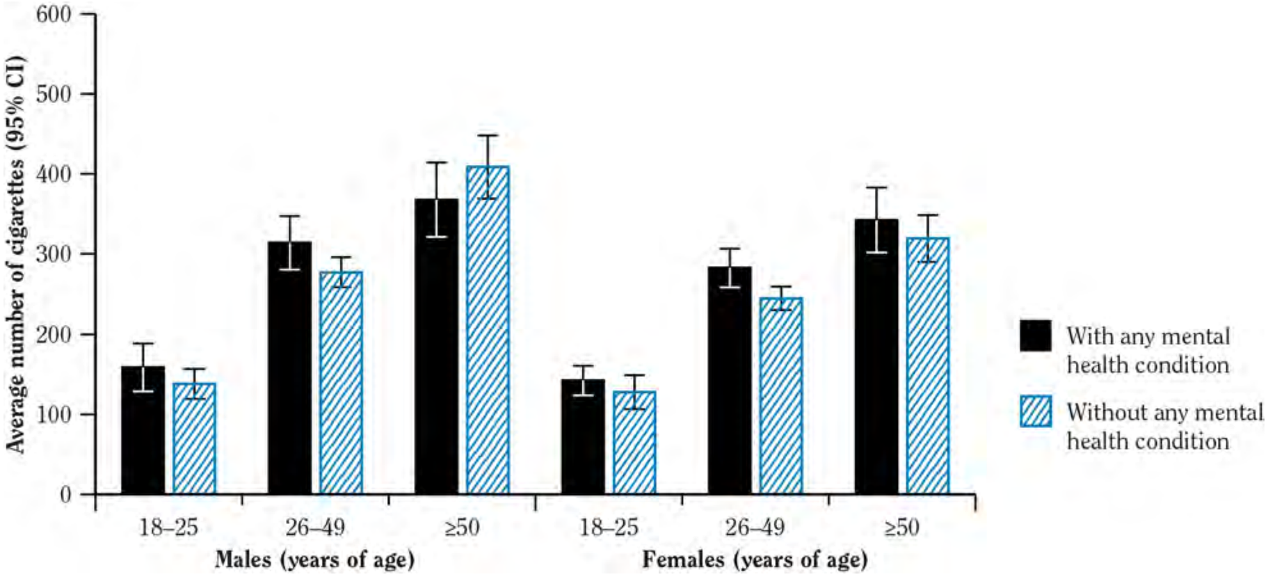
[e]Cigarette smoking cessation estimates were calculated among those who responded "Yes" to "Have you ever smoked part or all of a cigarette?"

[f]Among ever cigarette smokers, respondent answered "Within the past 30 days" to the question, "Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?"

[g]Among ever cigarette smokers, respondent answered "More than 30 days ago but within the past 12 months." to the question, "Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?"

[h]Among ever cigarette smokers, respondent answered "More than 12 months ago but within the past 3 years" or "More than 3 years ago" to the question, "Now think about the past 30 days, that is, from [DATEFILL] up to and including today. During the past 30 days, have you smoked part or all of a cigarette? How long has it been since you last smoked part or all of a cigarette?"

Figure 2.9 Average number of cigarettes smoked during the past month among adults, 18 years of age and older, who smoked during the past month, by status of past-year mental health condition,[a] age group, and sex; National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.

Patterns of Smoking Cessation

The 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions III (NESARC-III) is a U.S. survey that uses a population-based sample that includes both specific mental health diagnoses and cigarette use. Based on the *Diagnostic and Statistical Manual of Mental Disorders,* 5th edition, past-year mental health conditions were assessed using the Alcohol Use Disorder and Associated Disabilities Interview Schedule-5 (AUDADIS-5). In an analysis of 2012–2013 data from NESARC-III, Smith and colleagues (2020b) included the following diagnoses from the AUDADIS-5 in their analyses: major depressive episode, dysthymia, bipolar disorder, specific phobia, social phobia, panic disorder, agoraphobia, generalized anxiety disorder, posttraumatic stress disorder, any eating disorder, alcohol use disorder, and drug use disorder. The authors found that the prevalence of lifetime cessation—defined as having smoked at least 100 cigarettes in a lifetime (i.e., people who have ever smoked) and reporting having not smoked during the previous year—was lower among adults with a past-year mental health condition (39.4%) than it was among adults without such a past-year diagnosis (47.1%) after accounting for age, sex, race and ethnicity, and level of education and income. The prevalence of lifetime smoking cessation varied by mental health condition. Many of the lowest estimates of the prevalence of lifetime cessation were observed in adults who were also diagnosed with a substance use disorder, including a past-year diagnosis of drug use disorder (26.8%), dual substance use and nonsubstance mood or anxiety disorder (32.2%), and alcohol use disorder (32.9%). This finding may reflect, in part, a systemic failure to treat tobacco use in substance use treatment or mental healthcare settings (Prochaska 2010; Cohn et al. 2017; Marynak et al. 2018).

Smith and colleagues (2020b) also reported that the adjusted prevalence of lifetime smoking cessation among people who had ever smoked was significantly higher among people who had no mental health condition or substance use disorder (47.1%) than it was among people with various past-year mental health conditions that were not co-occurring with a substance use disorder. Specifically, the adjusted prevalence of lifetime cessation was lower among those with past-year bipolar disorder (29.2%), dysthymia (33.5%), panic disorder (33.5%), agoraphobia (36.3%), generalized anxiety disorder (36.5%), posttraumatic stress disorder (36.7%), major depressive episode (36.8%), and specific phobia and social phobia (39.7% each) (Smith et al. 2020b).

Analyses of 2019 data from the NSDUH show that the prevalence of recent quitting (having last smoked a cigarette more than 30 days ago but less than 1 year ago) was similar between adults with no past-year mental health condition (6.8%; 95% CI, 6.4–7.2) and adults with serious mental health conditions (5.9%; 95% CI, 4.8–7.1). However, the prevalence of quitting for at least 1 year differed significantly between adults with no past-year mental health condition (63.4%; 95% CI, 62.5–64.3) and adults with serious mental health conditions (51.4%; 95% CI, 47.6–55.2) (Table 2.23).

According to other data from the 2016 NSDUH, quit rates—defined as the proportion of people who used to smoke (those who have smoked 100 cigarettes in their lifetime but did not smoke in the past year) among people who ever smoked (those who have smoked at least 100 cigarettes in their lifetime)—were significantly lower among people with past-month serious psychological distress than they were among those without such distress (Streck et al. 2020). Additionally, quit rates among those without past-month serious psychological distress increased slightly between 2008 and 2016, but quit rates did not change among those with serious psychological distress (Streck et al. 2020).

Patterns of Use of Other Tobacco Products

Table 2.22 shows data from the 2019 NSDUH related to tobacco product use by mental health conditions or substance use disorders in youth and adults.

E-Cigarettes

Youth

Baseline data from the PATH Study (2013–2014) documented a correlation between ever e-cigarette use and mental health conditions among youth 12–17 years of age (Conway et al. 2018) and higher odds of trying an e-cigarette among youth with high severity externalizing behavior (e.g., conduct, Attention Deficit Hyperactivity Disorder, oppositional/defiant problems) compared with youth with no, low, or moderate severity externalizing behavior (Green et al. 2018).

Adults

Cummins and colleagues (2014) used a national probability sample from 2012 and found that e-cigarette use in the United States was 2.8 times higher among people living with a mental health condition compared with people living without such a condition. Among people with a mental health condition, 3.1% (95% CI, 2.0–4.3) currently used e-cigarettes and 14.8% (95% CI, 12.4–17.2) ever used e-cigarettes. By comparison, among people without a mental health condition, 1.1% (95% CI, 0.8–1.4) currently used e-cigarettes and 6.6% (95% CI, 5.9–7.3) ever used e-cigarettes. Baseline data from the PATH Study also documented a correlation between current e-cigarette use and mental health conditions in U.S. adults (Conway et al. 2017). Using data from the 2014–2017 NHIS, Weinberger and colleagues (2020) found that the prevalence of e-cigarette use did not change significantly from 2014 to 2017 among adults with serious psychological distress (from 6.9% in 2014 to 7.4% in 2017), whereas a significant decrease in the prevalence of e-cigarette use was observed among individuals without serious psychological distress (from 3.7% in 2014 to 2.7% in 2017).

Smokeless Tobacco

Youth

In 2019, the prevalence of ever use of smokeless tobacco was 36.4% (95% CI, 30.4–42.4) among youth with a past-year alcohol use disorder, 22.3% (95% CI, 15.3–29.2) among youth with a past-year illicit drug use disorder, and 4.3% (95% CI, 3.9–4.7) among all youth (Table 2.22, Part C). The prevalence of ever use of smokeless tobacco was similar for youth with a lifetime depressive disorder (4.2%; 95% CI, 3.4–5.1) and for youth with a past-year depressive disorder (4.1%; 95% CI, 3.1–5.1) (Table 2.22, Part C).

The prevalence of current use of smokeless tobacco was 21.2% (95% CI, 18.3–24.1) among youth with a past-year alcohol use disorder, 21.0% (95% CI, 17.2–24.9) among youth with a past-year illicit drug and alcohol use disorder, 10.2% (95% CI, 4.2–16.1) among youth with a past-year illicit drug or alcohol use disorder, and 1.0% (95% CI, 0.8–1.2) among all youth (Table 2.22, Part C). The prevalence of current smokeless tobacco use was similar among youth with a lifetime depressive disorder (1.0%; 95% CI, 0.6–1.5) and youth with a past-year depressive episode (0.9%; 95% CI, 0.4–1.4) (Table 2.22, Part C).

Adults

In 2019, ever use of smokeless tobacco was 17.5% (95% CI, 16.4–18.6) among adults 18 years of age and older living with any past-year mental health condition. The prevalence of ever use of smokeless tobacco for adults with other mental health conditions or substance use disorders is provided in Table 2.22 Part C.

Current use of smokeless tobacco was 3.0% (95% CI, 2.5–3.4) among adults 18 years of age and older living with any past-year mental health condition. Current smokeless tobacco use did not differ between adults with (4.0%; 95% CI, 3.0–5.1) and without (3.4%; 95% CI, 3.2–3.6) past-month serious psychological distress. The prevalence of current smokeless tobacco use was 6.8% (95% CI, 5.5–8.1) among adults with a past-year alcohol use disorder, 5.8% (95% CI, 4.4–7.3) among adults with a past-year illicit drug use disorder, 9.0% (95% CI, 5.7–12.3) among adults with both past-year alcohol and illicit drug use disorders, and 3.4% (95% CI, 3.2–3.6) among adults overall (Table 2.22, Part C).

Cigars

Youth

In 2019, ever use of cigars was 34.2% (95% CI, 24.6–43.8) among youth with a past-year alcohol use disorder, 30.4% (95% CI, 23.9–36.9) among youth with a past-year illicit drug use disorder, 34.0% (95% CI, 24.8–43.3) among youth with both past-year alcohol and illicit drug use disorders, 7.3% (95% CI, 6.1–8.4) among youth with a lifetime major depressive episode, and 5.3% (95% CI, 4.8–5.8) among youth overall (Table 2.22, Part B).

Current use of cigars was 13.6% (95% CI, 6.1–21.2) among youth with a past-year alcohol use disorder, 12.7% (95% CI, 9.3–21.2) among youth with a past-year illicit drug use disorder, 21.4% (95% CI, 11.7–31.1) among youth with both past-year alcohol and illicit drug use disorders, 2.1% (95% CI, 1.5–2.8) among youth with a lifetime major depressive episode, 2.0% (95% CI, 1.3–2.8) among youth with past-year major depressive episodes, and 1.5% (95% CI, 1.2–1.7) among youth overall (Table 2.22, Part B).

Adults

In 2019, ever use of cigars was 39.1% (95% CI, 37.6–40.5) among adults with any past-year mental health condition and 34.1% (95% CI, 33.4–34.7) among all adults (Table 2.22, Part B). The prevalence of ever use of cigars for adults with other mental health conditions or substance use disorders is provided in Table 2.22 Part C.

Current cigar use during the past month was 6.2% (95% CI, 5.5–6.9) among adults with any past-year mental health condition and 6.7% (95% CI, 5.2–8.1) among adults with a past-year major depressive episode. The prevalence of current cigar use was higher among adults with past-month serious psychological distress (7.2%; 95% CI, 5.9–8.5) than it was among those without past-month serious psychological distress (4.5%; 95% CI, 4.2–4.7). Current cigar use during the past month was 11.7% (95% CI, 9.4–13.9) among adults with past-year alcohol use disorder, 15.0% (95% CI, 10.9–19.2) among adults with past-year illicit drug use disorder, and 24.0% (95% CI, 13.5–34.5) among adults with both past-year alcohol and illicit drug use disorder. Among all adults, 4.7% (95% CI, 4.4–4.9) reported past-month cigar use (Table 2.22, Part B).

Pipes

Youth

Ever pipe use was 13.3% (95% CI, 7.2–19.3) among youth with past-year illicit drug use disorder and 13.1% (95% CI, 7.1–19.0) among youth with past-year illicit drug or alcohol disorder. The prevalence of ever pipe use was 2.8% (95% CI, 1.8–3.7) among youth with past-year major depressive episode, 2.4% (95% CI, 1.7–3.2) among youth with a lifetime major depressive disorder, and 1.5% (95% CI, 1.2–1.7) among youth overall (Table 2.22, Part B). Current pipe use was 2.6% (95% CI, 1.1–4.1) among youth with a past-year illicit drug or alcohol disorder, 0.5% (95% CI, 0.2–0.7) among youth with a lifetime major depressive disorder, and 0.4% (95% CI, 0.2–0.5) among youth overall (Table 2.22, Part B).

Adults

According to the 2019 NSDUH, ever use of pipes was 15.7% (95% CI, 14.5–17.0) among adults with any past-year mental health condition (Table 2.22, Part B). The prevalence of ever use of pipes for adults with other mental health conditions or substance use disorders is provided in Table 2.22 Part B.

Current use of pipes was 1.4% (95% CI, 1.0–1.7) among adults with any past-year mental health condition and 1.2% (95% CI, 0.8–1.6) among adults with a past-year major depressive episode. The prevalence of current pipe use was higher among adults with past-month serious psychological distress (2.8%; 95% CI, 1.8–3.9) than it was among adults without past-month serious psychological distress (0.6%; 95% CI, 0.5–0.7). Current pipe use was 2.0% (95% CI, 1.3–2.7) among adults with a past-year alcohol use disorder, 3.0% (95% CI, 1.9–4.0) among adults with a past-year illicit drug use disorder, 3.1% (95% CI, 1.1–5.1) among adults with both past-year alcohol and illicit drug use disorders, and 0.8% (95% CI, 0.7–0.9) among adults overall (Table 2.22, Part B).

Patterns of Polytobacco Use

Youth

According to NSDUH data from 2019, the prevalence of current polytobacco use among youth overall was 1.2% (95% CI, 1.0–1.5). The prevalence of current polytobacco use did not differ between youth with a lifetime (1.8%; 95% CI, 1.1–2.4) or past-year (1.4%; 95% CI, 0.8–2.1) major depressive episode (Table 2.22, Part A). However, the prevalence of current polytobacco use was 12.1% (95% CI, 7.1–17.1) among youth with a past-year alcohol use disorder, 11.6% (95% CI, 8.1–15.1) among youth living with a drug use disorder, and 21.5% (95% CI, 12.1–30.9) among youth with both past-year alcohol and illicit drug use disorders (Table 2.22, Part A).

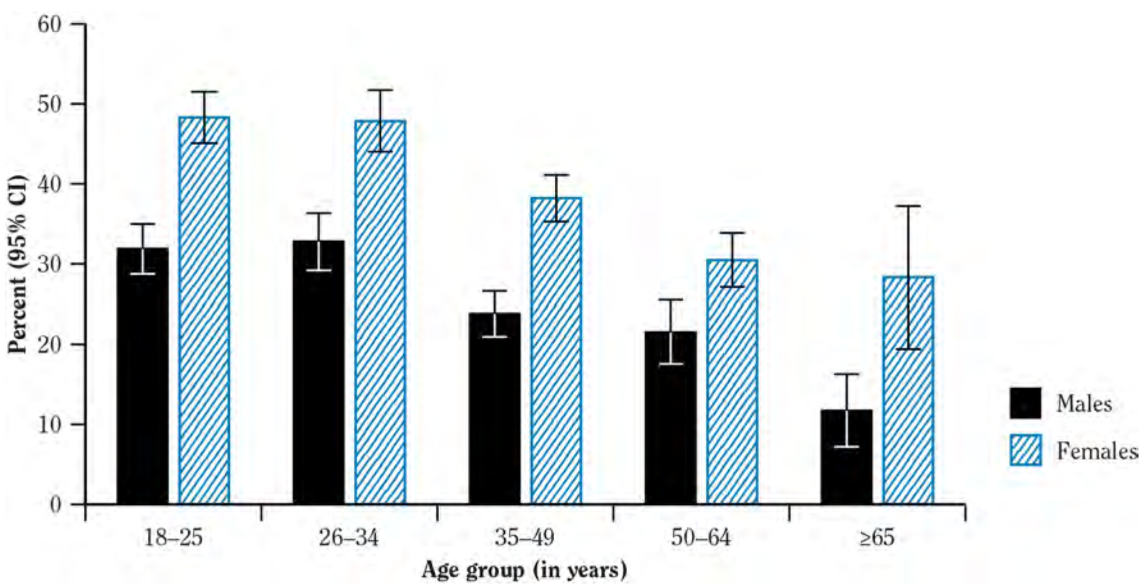
Adults

In 2019, the prevalence of current polytobacco use among adults overall was 3.5% (95% CI, 3.3–3.7). The prevalence of current polytobacco use was 5.4% (95% CI, 4.8–6.0) among adults with any past-year mental health condition. Current polytobacco use was higher among adults with serious psychological distress during the past month (8.1%; 95% CI, 6.6–9.6) than it was among adults without serious psychological distress during the past month (3.2%; 95% CI, 3.0–3.4). The prevalence of current polytobacco use was 9.6% (95% CI, 8.0–11.0) among adults with a past-year alcohol use disorder, 14.6% (95% CI, 11.6–17.7) among adults with a past-year illicit drug use disorder, and 27.8% (95% CI, 17.3–38.3) among adults with both past-year alcohol and illicit drug use disorders (Table 2.22, Part A).

Tobacco Use by Mental Health Condition and Sex

According to data from the 2019 NSDUH, 21.2% (95% CI, 20.6–21.7) of the U.S. adult population 18 years of age and older had a past-year mental health condition, and in that group, 26.8% (95% CI, 25.6–28.0) currently smoked cigarettes (Table 2.22, Part A). Overall, the prevalence of having a past-year mental health condition among currently smoking adults was highest in the younger age groups (i.e., 18–25 years of age and 26–34 years of age) and lowest among people 50 years of age and older (Figure 2.10). In every age group, the proportion of adults reporting a past-year mental health condition was greater among women who currently smoked than it was among men who currently smoked. For example, 48.3% (95% CI, 45.1–51.5) of young women (18–25 years of age) who smoked had a past-year mental health condition compared with 31.9% (95% CI, 28.7–35.0) of young men (18–25 years of age) who smoked.

Figure 2.10 Percentage of adults, 18 years of age and older, who had any mental health condition during the past year,[a] among people who currently smoked cigarettes,[b] by age group and sex; National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.
[b]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.

Tobacco Use by Mental Health Condition and Race and Ethnicity

According to data from the 2019 NSDUH, among younger adults (18–25 and 26–34 years of age) who currently (during the past 30 days) smoked cigarettes, the proportion who reported a past-year mental health condition was higher among non-Hispanic White people than among non-Hispanic African American people (Figure 2.11). Differences in past-year mental health conditions among adults who currently smoke cigarettes by race and ethnicity were not consistent across all age groups, possibly due to sparse data on the prevalence of a past-year mental health conditions for each combination of age and racial and ethnic groups. Further, disparities in the reporting of mental health symptoms and the receipt of mental health treatment among racial and ethnic groups may reduce the validity of estimates from national surveys on this topic (Dobalian and Rivers 2008).

Tobacco Use by Mental Health Condition and Sexual Orientation

NSDUH data from 2019 show that among adults 18–25, 26–34, and 35–49 years of age who currently smoked, the proportion who had a past-year mental health condition was higher among bisexual people compared with heterosexual people (Figure 2.12). Among bisexual people who smoke, 63.9% (95% CI, 57.5–70.3) of 18- to 25-year-olds, 61.0% (95% CI, 52.8–69.1) of 26- to 34-year-olds, and 53.0% (95% CI, 42.8–63.2) of 35- to 49-year-olds had a past-year mental health condition. In comparison, the prevalence of a past-year mental health condition among heterosexual people who smoke was 33.3% (95% CI, 30.9–35.7) for 18- to 25-year-olds, 37.0% (95% CI, 33.9–40.2) for 26- to 34-year-olds, and 29.0% (95% CI, 26.6–31.4) for 35- to 49-year-olds. Among young adults 18–25 years of age who currently smoked, the prevalence of a mental health condition differed between those who identified as lesbian or gay (51.2%; 95% CI, 39.3–63.1) and those who identified as heterosexual (33.3%; 95% CI, 30.9–35.7).

Tobacco Use by Mental Health Condition and Socioeconomic Status

According to data from the 2019 NSDUH, adults who currently smoked and were employed part-time generally had a higher prevalence of past-year mental health conditions than adults who currently smoked and were employed full-time (Figure 2.13). However, the differences were not significant within each age group.

Among adults who currently smoked cigarettes, the association between having a past-year mental health condition and poverty status differed across age groups. Although data from the 2019 NSDUH show similar prevalence of a past-year mental health condition among 18- to 25-year-olds who currently smoke cigarettes by poverty status, the prevalence of a past-year mental health condition among those with incomes more than two times the federal poverty threshold decreases across age groups. Among people who smoke cigarettes, the proportion of people who had a past-year mental health condition was higher for those living below the poverty threshold than it was for those living with an income more than two times the federal poverty threshold in two age groups: adults 35–49 years of age and adults 50–64 years of age (Figure 2.14). Among adults 65 years of age and older who currently smoke cigarettes, the prevalence of a past-year mental health condition by poverty status was higher among those with incomes up to two times the federal poverty threshold than it was among those with incomes more than two times the federal poverty threshold. Significant differences by poverty status in the proportion of a past-year mental health condition were not observed for people who smoke in other age groups.

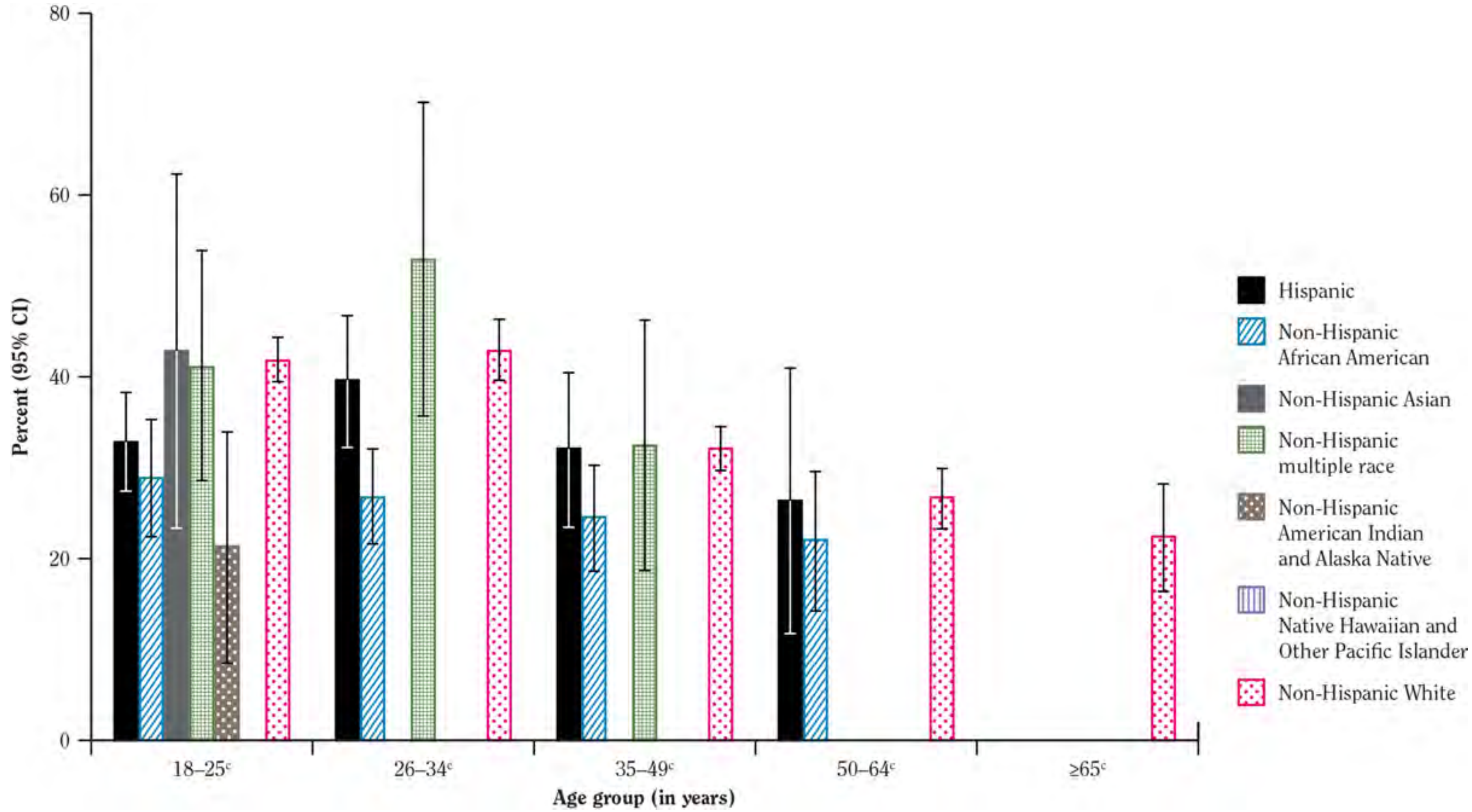
Tobacco Use by Mental Health Condition and Geographic Setting

Data from the 2019 NSDUH showed that across all age groups, the proportion of people who currently smoke who had a past-year mental health condition did not differ by classification of residence (large metropolitan, small metropolitan, nonmetropolitan) (Figure 2.15).

Tobacco Use and Cessation Behaviors by Geographic Setting

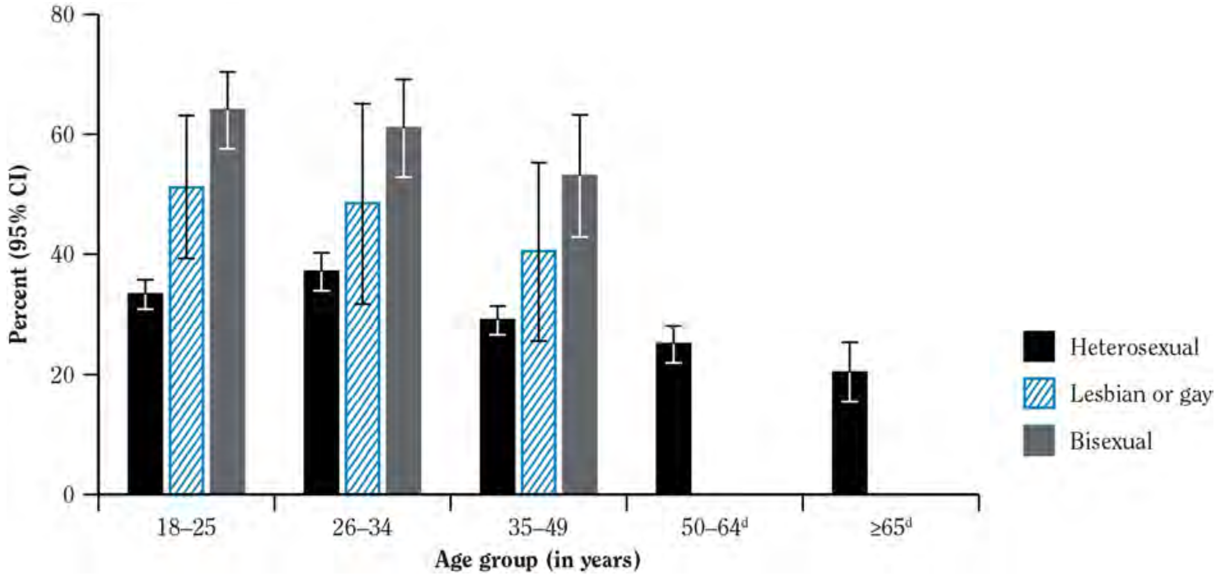
The prevalence of tobacco use across the United States differs by geographic setting. Variations in the taxing of tobacco products, the presence and comprehensiveness of tobacco control policies, the farming of tobacco, and other factors may contribute to disparities in tobacco use based on where one lives (Capehart 2004; Fallin and

Figure 2.11 Percentage of adults, 18 years of age and older, who had any mental health condition during the past year,[a] among people who currently smoked cigarettes,[b] by age group and race and ethnicity; National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.
[b]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.
[c]Estimates with a relative standard error ≥30% or an unweighted denominator <50 were suppressed for the following population and age groups: Hispanic (65 years of age and older), non-Hispanic African American (65 years of age and older), non-Hispanic Asian (26–34, 35–49, and 50–64 years of age and 65 years of age and older), non-Hispanic multiple race (50–64 years of age and 65 years of age and older), non-Hispanic American Indian and Alaska Native (26–34, 35–49, and 50–64 years of age and 65 years of age and older), and non-Hispanic Native Hawaiian and Other Pacific Islander (all age groups).

Figure 2.12 Percentage of adults, 18 years of age and older, who had any mental health condition during the past year,[a] among people who currently smoked cigarettes,[b] by age group and sexual orientation;[c] National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.
[b]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.
[c]Sexual orientation was determined by the following question: "Which one of the following do you consider yourself to be?" with three response options: "heterosexual, that is, straight" (n = 39,206), "lesbian or gay" (n = 880), or "bisexual" (n = 1,773). Data were ascertained only from adults 18 years of age or older.
[d]Estimates with a relative standard error ≥30% or an unweighted denominator <50 were suppressed for the following sexual orientation and age groups: lesbian or gay and bisexual (50–64 years of age and 65 years of age and older).

Glantz 2015; CDC n.d.j). This section compares the prevalence of tobacco use by state, Census region, and by urban and rural area for youth and adults. Data from the 2019 YRBS were used for estimates of tobacco use among youth, and data from the 2020 BRFSS were used for estimates of tobacco use among adults. In both datasets, estimates for product use were not consistently available for all 50 states and the District of Columbia.

State-Specific Differences

Patterns of Ever and Current Use of Cigarettes

Youth

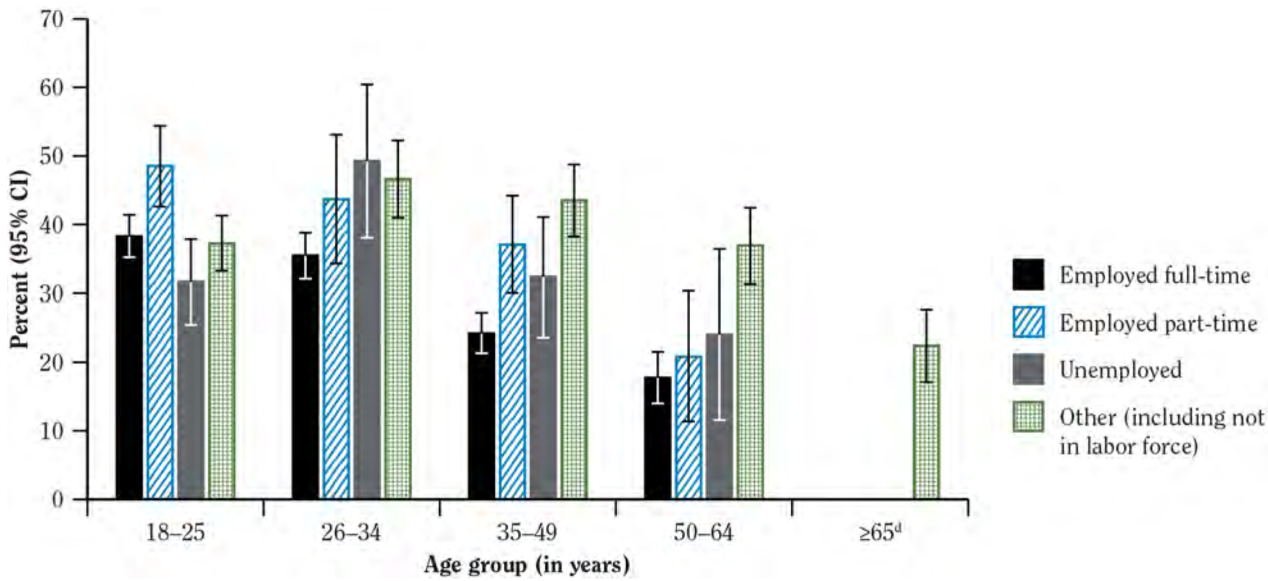
For the 34 states with available YRBS data, the state-specific prevalence of ever use of cigarettes (ever tried cigarettes, even one or two puffs) among U.S. high school students in 2019 (Table 2.24) was 27.9 percentage points higher in West Virginia (38.5%; 95% CI, 33.7–43.6) than Utah (10.6%; 95% CI, 8.1–13.7).

For the 42 states with available YRBS data, the prevalence of past-30-day use of cigarettes ranged from 2.2% (95% CI, 1.4–3.5) in Utah to 13.5% (95% CI, 11.1–16.3) in West Virginia (11.3 percentage points higher than Utah).

Adults

The state-specific prevalence of ever use of cigarettes among all adults (18 years of age and older) in 2020 ranged from 25.0% (95% CI, 23.9–26.1) in Utah to 48.5% (95% CI, 46.9–50.1) in West Virginia (Table 2.25). The prevalence of ever cigarette use among adults was 5.1 percentage points (California, 30.1%; 95% CI, 28.3–31.9) to 23.5 percentage points (West Virginia, 48.5%; 95% CI, 46.9–50.1) higher in other states than it was in Utah. The highest prevalence of ever smoking cigarettes by region was in the Midwest (41.3%; 95% CI, 40.7–41.8), followed by the South (39.8%; 95% CI, 39.2–40.4), the Northeast

Figure 2.13 Percentage of adults, 18 years of age and older, who had any mental health condition during the past year,[a] among people who currently smoked cigarettes,[b] by age group and employment status;[c] National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.
[b]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.
[c]Employment status was recoded using a combination of questions about having work, number of hours working per week, and reasons for not having worked in the past week, looking for work in the past 30 days, and working at a job or business at any time during the past 12 months. Refer to NSDUH 2019 Codebook for more details.
[d]Estimates with a relative standard error ≥30% or an unweighted denominator <50 were suppressed for people 65 years of age and older in the following employment status groups: employed full time, employed part time, and unemployed.

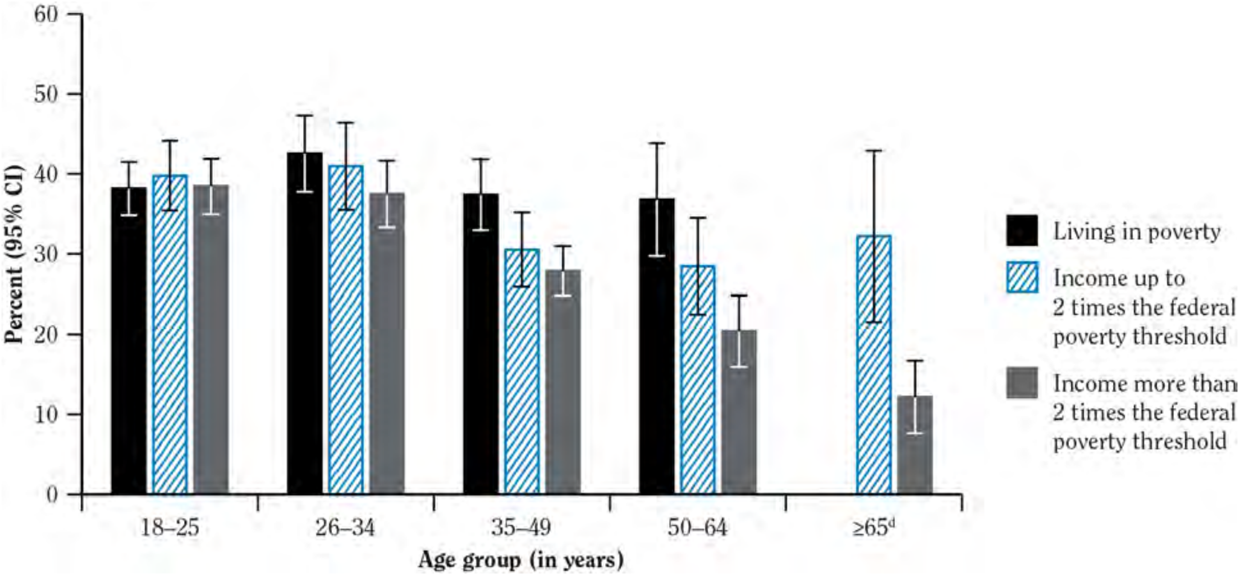
(37.4%; 95% CI, 36.8–38.0), and the West (34.1%; 95% CI, 33.2–35.1).

The state-specific prevalence of current cigarette use (defined as having smoked at least 100 cigarettes in one's lifetime and smoking every day or some days) among all adults in 2020 ranged from 8.2% (95% CI, 7.4–8.9) in Utah to 22.6% (95% CI, 21.2–23.9) in West Virginia (Table 2.26). The prevalence of current cigarette use among adults was 0.7 percentage points (California, 8.9%; 95% CI, 7.7–10.0) to 14.4 percentage points (West Virginia, 22.6%; 95% CI, 21.2–23.9) higher in other states than it was in Utah. In four Southern states—Arkansas, Kentucky, Mississippi, and West Virginia—the prevalence of current cigarette use among adults was more than 20.0%. By region, the prevalence of current cigarette use among adults was higher in the Midwest (16.6%; 95% CI, 16.1–17.0) and the South (15.8%; 95% CI, 15.8–16.2) than it was in the Northeast (12.8%; 95% CI, 12.3–13.2) and the West (10.9%; 95% CI, 10.3–11.5) (Figure 2.16).

Among young adults (18–24 years of age) in 2020, the state-specific prevalence of ever use of cigarettes (defined as having smoked at least 100 cigarettes in one's lifetime) ranged from 9.2% (95% CI, 6.6–11.8) in Maryland to 30.2% (95% CI, 22.1–38.2) in Wyoming (Table 2.25). The prevalence of ever cigarette use among young adults was 0.6 percentage points (New Jersey, 9.8%; 95% CI, 7.5–12.2) to 21.0 percentage points (Wyoming, 30.2%; 95% CI, 22.1–38.2) higher in other states than it was in Maryland. Ever use of cigarettes among young adults was lower in the Northeast (11.6%; 95% CI, 10.1–13.1) than it was in the Midwest (16.8%; 95% CI, 15.3–18.3) and the South (17.2%; 95% CI, 15.6–18.8); ever use of cigarettes among young adults in the West was 14.1% (95% CI, 12.0–16.1).

Among the 48 states with available data, the prevalence of current cigarette use among young adults in 2020 ranged from 4.4% (95% CI, 2.7–6.1) in New Jersey to 17.2% (95% CI, 10.5–23.9) in Wyoming (12.8 percentage points higher than New Jersey) (Table 2.26). Current cigarette use among young adults was highest in the Midwest (10.0%;

Figure 2.14 Percentage of adults, 18 years of age and older, who had any mental health condition during the past year,[a] among people who currently smoked cigarettes,[b] by age group and poverty status;[c] National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.
[b]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.
[c]Poverty status was created for each individual based on their poverty threshold (determined by their age, family size, number of children in the household, and total family income). Respondents 18 to 22 years of age currently living in a college dormitory (GQTYPE2="C") were set to "system missing" and do not have a valid value for this variable. Refer to NSDUH 2019 Codebook for more details (p. 569).
[d]Estimates with a relative standard error ≥30% or an unweighted denominator <50 were suppressed for people who were 65 years of age and older and living in poverty.

95% CI, 8.8–11.1) and lowest in the West (7.1%; 95% CI, 5.7–8.6) and the Northeast (6.5%; 95% CI, 5.4–7.7).

Patterns of Frequency of Cigarette Use

Youth

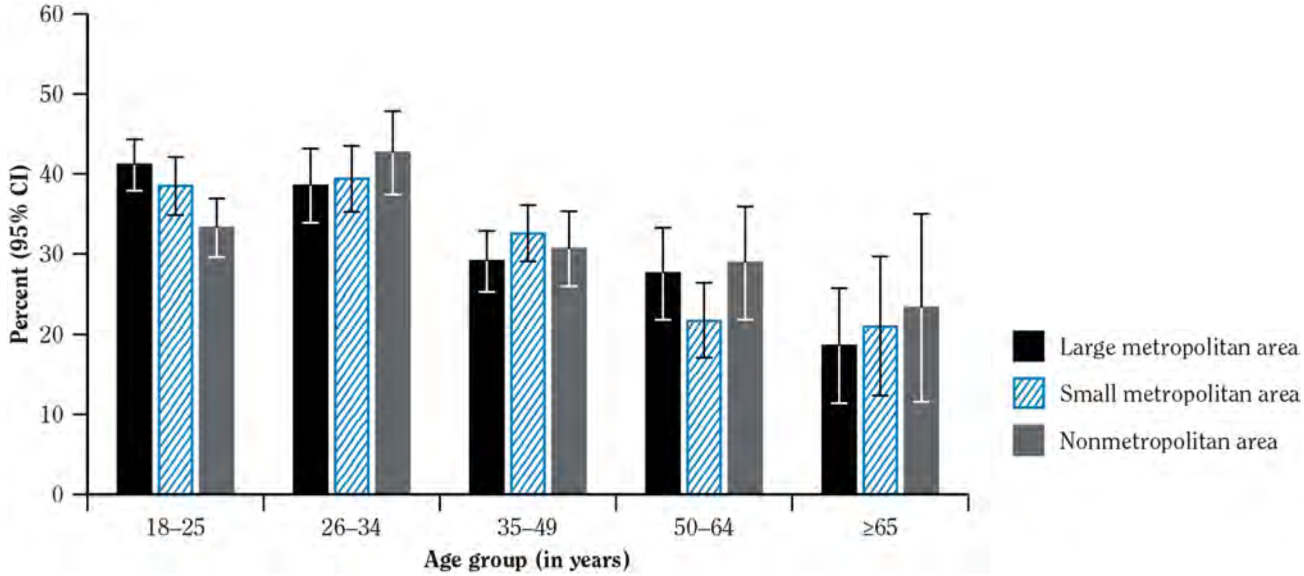
Among the 43 states with available data, the prevalence of using cigarettes on 20 or more of the past 30 days among U.S. high school students in 2019 ranged from 0.3% (95% CI, 0.1–0.8) in Utah to 5.4% (95% CI, 3.6–7.8) in West Virginia (an absolute difference of 5.1 percentage points). The prevalence of using cigarettes daily ranged from 0.3% (95% CI, 0.1–0.8) in Utah to 4.2% (95% CI, 2.6–6.7) in West Virginia, an absolute difference of 3.9 percentage points. (Table 2.24).

Adults

The range in the state-specific prevalence of cigarette use in 2020 varied more for daily cigarette use (from 5.4% [95% CI, 4.8–5.9] in Utah to 18.2% [95% CI, 16.9–19.5] in West Virginia) (Table 2.27) than it did for nondaily cigarette use (from 2.8% [95% CI, 2.3–3.3] in Utah to 6.1% in Mississippi [95% CI, 5.2–7.0] and New Mexico [95% CI, 5.1–7.1]) (Table 2.28). In every state, the prevalence of daily cigarette use was higher than that of nondaily cigarette use. The prevalence of daily cigarette use among adults was 0.5 percentage points (California, 5.9%; 95% CI, 4.9–6.9) to 12.8 percentage points (West Virginia, 18.2%; 95% CI, 16.9–19.5) higher in other states than it was in Utah. The prevalence of nondaily cigarette use among adults was 0.2 percentage points (California, 3.0%; 95% CI, 2.3–3.6) to 3.3 percentage points (New Mexico, 6.1%; 95% CI, 5.1–7.1) higher in other states than it was in Utah.

By region, daily cigarette use was more prevalent in the Midwest (12.3%; 95% CI, 12.0–12.7) than it was in the other three regions (Table 2.27). Nondaily cigarette use was more prevalent in the South (4.8%; 95% CI, 4.5–5.1) and the Midwest (4.2%; 95% CI, 4.0–4.5) than it was in the

Figure 2.15 Percentage of adults, 18 years of age and older, who had any mental health condition during the past year,[a] among people who currently smoked cigarettes,[b] by age group and metropolitan area status;[c] National Survey on Drug Use and Health (NSDUH) 2019, United States



Source: NSDUH, Substance Abuse and Mental Health Services Administration, public use data, 2019.
[a]Any mental health condition during the past year was defined based on the predicted probability model developed using a subsample of NSDUH respondents who underwent a diagnostic interview via a clinical follow-up study. Refer to NSDUH 2019 Codebook for more details.
[b]Current use of cigarettes was defined as having smoked part or all of a cigarette during the past 30 days.
[c]Living in metropolitan areas is recoded based on the 2013 Rural/Urban Continuum Codes.

West (3.5%; 95% CI, 3.2–3.8), and it was more prevalent in the South (4.8%; 95% CI, 4.5–5.1) than it was in the Northeast (3.8%; 95% CI, 3.5–4.0) (Table 2.28).

Many estimates of daily and nondaily cigarette use among young adults (18–24 years of age) in 2020 were suppressed due to a relative standard error greater than or equal to 30.0%. The estimates of daily and nondaily cigarette use among young adults in 2020 were similar across states where data were available (Tables 2.27 and 2.28). In all but 11 states, the prevalence of daily cigarette use was higher than that of nondaily use. Daily cigarette use was higher in the Midwest (6.3%; 95% CI, 5.4–7.2) than it was in the other three regions, and nondaily cigarette use was similar across all four regions.

Patterns of Smoking Cessation

According to data from the 2020 BRFSS, the state-specific proportion of adults making a past-year quit attempt ranged from 55.5% (95% CI, 51.3–59.6) in Kentucky to 71.0% (95% CI, 65.2–76.8) in the District of Columbia; a quit attempt was defined as a person who (a) currently smoked cigarettes and reported having stopped smoking for at least 1 day during the past 12 months because they were trying to quit smoking or (b) quit smoking during the past year. The prevalence of a past-year quit attempt among adults was 1.4 percentage points (Arkansas, 56.9%; 95% CI, 52.7–61.1) to 15.5 percentage points (District of Columbia, 71.0%; 95% CI, 65.2–76.8) higher in other states than it was in Kentucky. By region, the prevalence of a past-year quit attempt was higher in the West (66.0%; 95% CI, 63.6–68.3) and the Northeast (64.8%; 95% CI, 63.1–66.4) than it was in the Midwest (60.4%; 95% CI, 59.2–61.7); in the South, the prevalence of a past-year quit attempt was 62.9% (95% CI, 61.5–64.2) (Table 2.29).

According to data from the 2020 BRFSS, the prevalence of adults who had quit smoking for at least 6 months during the past year ranged from 3.3% (95% CI, 2.1–4.5) in Mississippi to 10.2% (95% CI, 7.5–12.9) in Utah (Table 2.30). The prevalence of quitting smoking for at least 6 months among adults was 0.1 percentage points (Alaska, 3.4%; 95% CI, 1.5–5.3) to 6.9 percentage points (Utah, 10.2%; 95% CI, 7.5–12.9) higher in other states than it was in Mississippi. By region, the prevalence of having quit smoking for at least 6 months during the past year was higher in the West (7.7%; 95% CI, 6.5–9.0) than it was in the Midwest (5.7%; 95% CI, 5.1–6.2); the

Table 2.24 Prevalence of cigarette use among high school students, by location; national Youth Risk Behavior Survey (YRBS) 2019, United States

Location	Ever use:[a] % (95% CI)	Past-30-day use:[b] % (95% CI)	≥20-days use:[c] % (95% CI)	Daily use:[d] % (95% CI)
Alabama	28.3 (24.3–32.06)	7.1 (5.3–9.5)	1.5 (0.9–2.6)	1.2 (0.7–2.1)
Alaska	27.5 (24.4–30.9)	8.4 (6.7–10.4)	1.6 (0.9–3.5)	0.8 (0.3–1.8)
Arizona	24.6 (21.4–28.0)	5.3 (4.3–6.4)	0.7 (0.9–1.1)	0.4 (0.2–1.1)
Arkansas	32.7 (27.3–38.6)	9.7 (7.3–12.9)	2.2 (0.9–3.6)	1.5 (0.8–2.5)
California	13.5 (11.5–15.7)	—[e]	—[e]	—[e]
Colorado	—[e]	5.3 (3.8–7.3)	1.4 (0.9–2.4)	1.1 (0.6–2.0)
Connecticut	—[e]	3.7 (2.4–5.7)	1.3 (0.6–2.4)	1.1 (0.5–2.5)
Delaware	—[e]	—[e]	—[e]	—[e]
District of Columbia	—[e]	—[e]	—[e]	—[e]
Florida	16.8 (15.3–18.4)	4.8 (4.1–5.7)	1.3 (1.0–1.7)	1.1 (0.8–1.4)
Georgia	18.6 (15.5–22.2)	4.0 (3.0–5.4)	0.9 (0.5–1.6)	0.8 (0.4–1.4)
Hawai'i	17.8 (15.9–19.8)	5.3 (4.2–6.6)	1.2 (0.8–1.9)	0.9 (0.6–1.4)
Idaho	22.2 (19.2–25.4)	5.3 (4.1–6.9)	0.8 (0.3–2.1)	0.5 (0.2–1.3)
Illinois	19.8 (17.2–22.6)	4.7 (3.6–6.1)	1.2 (0.7–2.2)	0.9 (0.5–1.4)
Indiana	—[e]	—[e]	—[e]	—[e]
Iowa	25.0 (21.1–29.2)	6.7 (5.2–8.6)	1.6 (0.8–3.0)	1.2 (0.5–2.6)
Kansas	24.8 (22.3–27.6)	5.8 (4.4–7.7)	1.6 (1–2.5)	1.3 (0.8–2.1)
Kentucky	30.6 (26.4–35.1)	8.9 (6.7–11.8)	3.0 (1.8–4.7)	2.2 (1.3–3.6)
Louisiana	31.0 (25.5–37.1)	8.4 (5.8–12.2)	2.3 (1.3–4.0)	1.6 (0.8–3.1)
Maine	22.9 (21.1–24.9)	6.8 (5.9–7.9)	1.8 (1.4–2.3)	1.3 (1.0–1.8)
Maryland	17.7 (15.0–20.8)	5.0 (4.5–5.4)	1.1 (0.9–1.2)	0.8 (0.7–0.9)
Massachusetts	21.1 (18.4–24.2)	5.0 (3.8–6.6)	0.6 (0.3–1.1)	0.4 (0.2–0.9)
Michigan	—[e]	4.5 (2.9–7.0)	1.0 (0.4–2.7)	0.6 (0.2–1.3)
Minnesota	—[e]	—[e]	—[e]	—[e]
Mississippi	30.6 (27.2–34.2)	6.6 (4.9–8.8)	1.4 (0.9–2.2)	1.0 (0.6–1.6)
Missouri	—[e]	6.5 (4.8–8.9)	1.1 (0.6–2.1)	0.9 (0.5–1.7)
Montana	31.0 (28.6–33.6)	7.7 (6.5–9.0)	1.5 (1.1–2.1)	1.2 (0.8–1.7)
Nebraska	22.8 (19.7–26.2)	4.2 (3.0–5.8)	1.2 (0.6–2.4)	0.9 (0.4–1.9)
Nevada	17.5 (14.6–20.8)	3.6 (2.7–5.0)	0.7 (0.4–1.1)	0.4 (0.2–0.6)
New Hampshire	—[e]	5.5 (5.1–6.0)	1.7 (1.4–1.9)	1.4 (1.1–1.6)
New Jersey	—[e]	3.8 (2.6–5.5)	0.7 (0.3–1.8)	0.7 (0.3–1.8)
New Mexico	30.3 (27.5–33.3)	8.9 (7.7–10.3)	1.6 (1.1–2.1)	0.9 (0.7–1.3)
New York	14.7 (12.9–16.6)	4.2 (3.4–5.2)	0.8 (0.6–1.2)	0.6 (0.4–0.9)
North Carolina	—[e]	8.3 (6.5–10.6)	1.9 (1.0–3.7)	1.5 (0.8–3.0)
North Dakota	29.3 (26.4–32.4)	8.3 (6.6–10.5)	2.1 (1.3–3.3)	1.4 (0.8–2.4)
Ohio	21.5 (16.3–27.8)	4.9 (3.1–7.5)	0.5 (0.2–1.1)	0.4 (0.2–1.0)
Oklahoma	34.1 (30.2–38.2)	9.1 (6.9–11.9)	2.4 (1.5–3.7)	1.8 (1.2–2.6)
Oregon	—[e]	—[e]	—[e]	—[e]
Pennsylvania	21.8 (19.2–24.7)	6.6 (5.1–8.6)	2.1 (1.4–3.2)	1.6 (1.0–2.6)
Rhode Island	17.5 (15.4–19.7)	4.2 (3.2–5.5)	1.6 (0.9–3.0)	1.6 (0.9–3.0)
South Carolina	23.1 (18.7–28.1)	5.9 (4.7–7.4)	1.8 (1.0–3.0)	1.5 (0.8–2.8)

Table 2.24 Continued

Location	Ever use:[a] % (95% CI)	Past-30-day use:[b] % (95% CI)	≥20-days use:[c] % (95% CI)	Daily use:[d] % (95% CI)
South Dakota	31.4 (25.2–38.2)	12.0 (7.7–18.2)	3.4 (2.0–5.8)	2.2 (1.2–4.0)
Tennessee	29.2 (24.7–34.1)	7.1 (5.1–9.9)	1.9 (1.0–3.5)	1.5 (0.8–2.9)
Texas	—[e]	4.9 (3.8–6.3)	0.7 (0.3–1.4)	0.6 (0.3–1.4)
Utah	10.6 (8.1–13.7)	2.2 (1.4–3.5)	0.3 (0.1–0.8)	0.3 (0.1–0.8)
Vermont	—[e]	—[e]	2.0 (1.8–2.2)	1.6 (1.4–1.8)
Virginia	—[e]	5.5 (4.6–6.5)	1.3 (0.9–1.9)	1.1 (0.7–1.6)
Washington	—[e]	—[e]	—[e]	—[e]
West Virginia	38.5 (33.7–43.6)	13.5 (11.1–16.3)	5.4 (3.6–7.8)	4.2 (2.6–6.7)
Wisconsin	19.1 (15.1–23.9)	5.7 (4.0–8.0)	0.7 (0.3–1.5)	0.6 (0.2–1.5)
Wyoming	—[e]	—[e]	—[e]	—[e]

Source: CDC (n.d.a).
Notes: **CI =** confidence interval.
[a]Even one or two puffs.
[b]On at least 1 day during the 30 days before the survey.
[c]On 20 or more days during the 30 days before the survey.
[d]On all 30 days during the 30 days before the survey.
[e]The number of respondents within the subgroup did not meet the minimum reporting threshold or data were not available.

Table 2.25 Prevalence of ever use of cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	43.4 (41.6–45.2)	21.9 (16.1–27.7)	43.5 (40.1–46.9)	47.6 (44.7–50.5)	48.6 (45.5–51.7)
Alaska	43.9 (41.4–46.4)	14.7 (8.7–20.6)	47.5 (43.0–52.0)	49.4 (45.4–53.5)	46.9 (42.3–51.4)
Arizona	39.2 (37.8–40.6)	14.7 (11.3–18.1)	37.6 (35.0–40.2)	42.3 (40.0–44.7)	49.9 (47.3–52.5)
Arkansas	44.8 (42.8–46.8)	19.8 (13.2–26.4)	46.2 (42.2–50.2)	48.8 (45.8–51.9)	51.1 (48.5–53.7)
California	30.1 (28.3–31.9)	12.5 (8.6–16.4)	26.5 (23.6–29.3)	32.7 (29.2–36.1)	43.8 (39.7–48.0)
Colorado	38.6 (37.5–39.8)	16.6 (13.6–19.6)	40.9 (38.7–43.0)	39.6 (37.7–41.5)	46.6 (44.4–48.8)
Connecticut	37.5 (35.9–39.1)	10.1 (6.6–13.7)	34.9 (31.8–37.9)	41.0 (38.5–43.5)	50.3 (47.5–53.1)
Delaware	41.3 (39.1–43.5)	13.0 (7.6–18.5)	41.3 (36.9–45.6)	43.5 (40.0–46.9)	50.5 (46.6–54.4)
District of Columbia	30.4 (28.3–32.4)	13.6 (6.8–20.4)	26.8 (23.6–30.0)	37.6 (34.1–41.1)	41.5 (37.7–45.3)
Florida	41.7 (39.8–43.7)	16.3 (11.7–20.9)	38.7 (34.8–42.6)	46.1 (42.6–49.6)	49.9 (47.0–52.8)
Georgia	37.0 (35.4–38.7)	14.5 (10.2–18.8)	36.7 (33.5–39.9)	40.1 (37.3–42.9)	47.5 (44.9–50.2)
Hawaiʻi	37.4 (35.8–38.9)	23.0 (18.3–27.7)	35.4 (32.6–38.2)	37.6 (35.0–40.2)	46.0 (43.1–48.9)
Idaho	37.8 (36.1–39.6)	18.4 (14.0–22.8)	36.4 (33.1–39.7)	43.0 (39.8–46.2)	44.0 (40.8–47.2)
Illinois	35.1 (33.1–37.1)	15.1 (9.6–20.7)	30.9 (27.5–34.4)	39.8 (36.0–43.6)	45.8 (41.9–49.6)
Indiana	43.2 (41.9–44.5)	17.4 (13.6–21.2)	46.0 (43.4–48.6)	48.8 (46.8–50.8)	46.3 (44.1–48.5)
Iowa	39.9 (38.7–41.1)	16.0 (13.0–19.0)	43.9 (41.6–46.1)	43.2 (41.3–45.2)	43.9 (41.8–46.0)
Kansas	41.1 (39.9–42.4)	19.1 (15.5–22.6)	41.5 (39.2–43.9)	47.0 (44.9–49.1)	46.3 (44.3–48.3)
Kentucky	47.9 (45.9–50.0)	21.3 (15.2–27.4)	50.5 (46.7–54.3)	52.6 (49.3–55.9)	52.2 (48.6–55.8)

Table 2.25 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Louisiana	41.7 (39.8–43.6)	22.0 (16.1–28.0)	40.8 (37.1–44.4)	46.7 (43.7–49.8)	46.9 (43.6–50.3)
Maine	46.5 (45.0–48.0)	18.7 (12.9–24.4)	50.6 (47.4–53.8)	46.3 (44.0–48.7)	53.1 (51.0–55.1)
Maryland	33.0 (31.9–34.1)	9.2 (6.6–11.8)	30.6 (28.4–32.8)	35.3 (33.5–37.1)	46.2 (44.1–48.2)
Massachusetts	35.6 (34.1–37.1)	10.8 (7.6–14.0)	31.5 (28.6–34.3)	39.2 (36.6–41.8)	50.1 (47.1–53.2)
Michigan	45.6 (44.1–47.2)	18.6 (14.1–23.0)	47.0 (43.9–50.0)	49.8 (47.3–52.3)	52.2 (49.7–54.7)
Minnesota	39.5 (38.6–40.4)	13.2 (10.8–15.6)	39.9 (38.2–41.7)	42.6 (41.1–44.2)	48.2 (46.3–50.0)
Mississippi	40.5 (38.9–42.2)	17.9 (12.7–23.2)	41.8 (38.6–44.9)	45.2 (42.6–47.8)	43.2 (40.7–45.7)
Missouri	43.1 (41.7–44.5)	17.8 (14.2–21.3)	44.0 (41.4–46.7)	48.3 (46.0–50.6)	47.9 (45.5–50.3)
Montana	43.7 (42.2–45.3)	23.7 (19.2–28.3)	45.6 (42.5–48.6)	44.8 (42.3–47.4)	49.4 (46.9–51.9)
Nebraska	37.8 (36.6–39.0)	16.0 (13.0–19.0)	38.7 (36.3–41.1)	42.0 (40.0–44.1)	43.5 (41.6–45.4)
Nevada	39.4 (36.7–42.2)	14.6 (9.0–20.2)	30.9 (26.3–35.5)	43.3 (38.5–48.0)	59.8 (54.3–65.3)
New Hampshire	43.2 (41.4–44.9)	14.5 (9.1–19.9)	44.2 (40.3–48.2)	45.1 (42.6–47.6)	52.8 (50.4–55.3)
New Jersey	35.1 (33.9–36.3)	9.8 (7.5–12.2)	31.9 (29.7–34.1)	38.7 (36.8–40.7)	47.2 (44.7–49.7)
New Mexico	41.3 (39.3–43.2)	17.0 (11.8–22.2)	44.1 (40.2–48.0)	41.4 (38.2–44.7)	49.5 (46.5–52.6)
New York	34.9 (33.8–36.0)	10.9 (8.3–13.5)	30.6 (28.6–32.6)	39.7 (37.8–41.5)	47.0 (44.8–49.2)
North Carolina	40.3 (38.7–41.9)	17.5 (13.3–21.6)	37.9 (35.0–40.8)	44.4 (41.7–47.1)	50.1 (47.0–53.1)
North Dakota	40.2 (38.1–42.2)	20.9 (14.7–27.2)	42.7 (38.7–46.8)	40.3 (37.1–43.5)	48.0 (45.3–50.8)
Ohio	43.3 (42.1–44.5)	17.9 (14.7–21.2)	45.2 (42.8–47.6)	46.7 (44.9–48.6)	49.4 (47.3–51.4)
Oklahoma	44.4 (42.6–46.2)	20.2 (15.2–25.1)	45.8 (42.4–49.2)	48.2 (45.3–51.2)	51.2 (48.3–54.1)
Oregon	40.4 (38.8–42.0)	18.2 (13.9–22.5)	37.2 (34.5–39.9)	44.7 (42.0–47.4)	49.6 (46.4–52.8)
Pennsylvania	41.6 (39.8–43.4)	13.4 (9.2–17.6)	42.1 (38.8–45.5)	44.6 (41.7–47.4)	50.1 (46.6–53.6)
Rhode Island	38.2 (36.3–40.2)	10.4 (5.2–15.6)	34.6 (30.7–38.6)	44.0 (41.0–46.9)	50.0 (46.9–53.2)
South Carolina	43.4 (41.4–45.5)	18.4 (13.0–23.8)	42.2 (38.0–46.4)	46.7 (43.4–50.0)	52.9 (49.7–56.1)
South Dakota	43.5 (40.8–46.2)	20.4 (13.3–27.5)	49.2 (43.7–54.8)	43.9 (39.6–48.2)	47.5 (43.6–51.4)
Tennessee	44.7 (42.7–46.8)	20.2 (13.4–27.1)	43.8 (40.1–47.6)	49.6 (46.2–52.9)	51.7 (48.0–55.3)
Texas	35.5 (33.7–37.3)	17.1 (12.5–21.7)	35.7 (32.6–38.8)	37.9 (34.8–40.9)	44.4 (40.6–48.2)
Utah	25.0 (23.9–26.1)	11.6 (9.3–13.9)	27.1 (25.2–29.0)	28.8 (26.7–30.8)	26.9 (24.8–29.0)
Vermont	42.5 (40.6–44.3)	19.6 (12.5–26.7)	43.7 (39.9–47.4)	45.6 (43.0–48.2)	48.9 (46.0–51.8)
Virginia	36.9 (35.5–38.2)	15.5 (12.1–18.9)	35.4 (32.8–38.0)	40.6 (38.3–42.9)	46.3 (43.9–48.7)
Washington	37.5 (36.3–38.6)	12.4 (9.9–15.0)	36.1 (34.1–38.2)	39.5 (37.6–41.3)	49.2 (47.1–51.4)
West Virginia	48.5 (46.9–50.1)	19.4 (13.8–25.1)	53.3 (50.0–56.5)	51.8 (49.3–54.3)	51.3 (48.8–53.8)
Wisconsin	42.1 (40.1–44.0)	14.8 (9.2–20.3)	44.2 (40.2–48.1)	45.3 (42.2–48.4)	48.9 (45.6–52.1)
Wyoming	44.3 (42.2–46.4)	30.2 (22.1–38.2)	46.7 (42.6–50.8)	43.4 (40.1–46.8)	49.7 (46.8–52.7)
Region					
Northeast	37.4 (36.8–38.0)	11.6 (10.1–13.1)	34.7 (33.6–35.9)	41.1 (40.1–42.2)	48.8 (47.5–50.1)
Midwest	41.3 (40.7–41.8)	16.8 (15.3–18.3)	41.7 (40.7–42.8)	45.4 (44.5–46.4)	48.0 (47.0–49.0)
South	39.8 (39.2–40.4)	17.2 (15.6–18.8)	38.8 (37.7–39.9)	43.4 (42.4–44.5)	48.4 (47.3–49.5)
West	34.1 (33.2–35.1)	14.1 (12.0–16.1)	31.7 (30.1–33.2)	36.7 (34.9–38.5)	46.2 (44.2–48.2)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Ever use of cigarettes was defined as having smoked at least 100 cigarettes in one's lifetime.

Table 2.26 Prevalence of current use of cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	18.5 (17.0–19.9)	11.1 (6.7–15.5)	24.3 (21.2–27.3)	21.5 (18.9–24.0)	9.9 (8.1–11.7)
Alaska	18.0 (16.0–20.0)	10.1 (5.0–15.2)	23.7 (19.9–27.6)	19.8 (16.6–23.0)	8.1 (5.5–10.8)
Arizona	13.1 (12.2–14.1)	6.9 (4.5–9.2)	16.7 (14.7–18.7)	15.1 (13.5–16.8)	8.7 (7.4–10.1)
Arkansas	20.5 (18.8–22.1)	12.9 (7.4–18.4)	25.7 (22.2–29.2)	24.7 (21.9–27.5)	11.7 (9.9–13.4)
California	8.9 (7.7–10.0)	6.5 (3.7–9.2)	10.5 (8.4–12.5)	10.1 (7.9–12.4)	5.4 (3.7–7.1)
Colorado	12.4 (11.6–13.2)	8.0 (5.9–10.1)	15.8 (14.3–17.4)	13.1 (11.8–14.4)	7.3 (6.2–8.5)
Connecticut	11.8 (10.8–12.9)	6.7 (3.9–9.4)	16.7 (14.3–19.1)	12.8 (11.0–14.6)	7.0 (5.4–8.6)
Delaware	15.1 (13.5–16.8)	7.3 (3.0–11.5)	20.9 (17.3–24.6)	16.5 (14.0–19.1)	9.8 (7.1–12.5)
District of Columbia	11.3 (9.8–12.9)	—[b]	10.9 (8.5–13.3)	15.6 (13.0–18.2)	8.8 (6.6–11.1)
Florida	14.7 (13.2–16.2)	5.9 (3.6–8.3)	19.2 (15.9–22.6)	18.3 (15.6–21.1)	8.6 (7.0–10.2)
Georgia	15.8 (14.5–17.1)	8.0 (4.9–11.1)	19.5 (16.9–22.2)	18.8 (16.5–21.1)	9.4 (8.0–10.9)
Hawai‘i	11.6 (10.6–12.7)	11.4 (7.6–15.3)	14.5 (12.4–16.5)	11.8 (10.0–13.6)	7.6 (6.0–9.2)
Idaho	13.6 (12.4–14.9)	9.9 (6.5–13.4)	17.3 (14.8–19.8)	15.9 (13.6–18.3)	7.2 (5.7–8.7)
Illinois	12.7 (11.3–14.1)	9.7 (5.6–13.7)	13.7 (11.3–16.1)	14.8 (12.1–17.6)	9.6 (7.1–12.1)
Indiana	19.4 (18.3–20.5)	11.4 (8.2–14.7)	24.4 (22.1–26.7)	23.2 (21.5–25.0)	11.2 (9.8–12.6)
Iowa	15.8 (14.8–16.7)	10.0 (7.5–12.6)	22.2 (20.3–24.2)	17.7 (16.1–19.2)	7.7 (6.6–8.8)
Kansas	16.6 (15.6–17.6)	10.5 (7.6–13.4)	20.1 (18.1–22.1)	20.7 (18.9–22.4)	9.4 (8.1–10.7)
Kentucky	21.4 (19.7–23.1)	12.3 (7.1–17.5)	26.7 (23.2–30.1)	25.2 (22.4–28.1)	13.0 (10.6–15.4)
Louisiana	18.3 (16.8–19.8)	11.9 (7.1–16.8)	22.0 (18.9–25.1)	22.1 (19.5–24.7)	10.3 (8.4–12.3)
Maine	16.5 (15.3–17.7)	12.3 (7.2–17.5)	24.4 (21.5–27.2)	17.3 (15.5–19.1)	8.9 (7.6–10.1)
Maryland	10.9 (10.1–11.7)	5.2 (3.2–7.2)	14.0 (12.3–15.7)	12.2 (10.9–13.4)	7.0 (6.0–8.1)
Massachusetts	11.1 (10.0–12.2)	6.8 (4.1–9.6)	13.5 (11.2–15.7)	12.8 (11.0–14.6)	7.4 (5.6–9.3)
Michigan	18.4 (17.1–19.7)	10.8 (7.5–14.1)	23.5 (20.8–26.1)	22.4 (20.1–24.7)	9.9 (8.4–11.5)
Minnesota	13.8 (13.2–14.5)	7.8 (5.9–9.7)	18.2 (16.8–19.6)	15.2 (14.1–16.3)	8.5 (7.4–9.5)
Mississippi	20.1 (18.7–21.5)	11.0 (6.6–15.5)	25.9 (23.0–28.8)	23.4 (21.1–25.6)	10.7 (9.0–12.4)
Missouri	17.8 (16.7–18.9)	9.9 (7.0–12.7)	22.8 (20.5–25.1)	20.5 (18.6–22.4)	11.1 (9.5–12.7)
Montana	16.4 (15.2–17.6)	12.3 (8.7–15.8)	23.4 (20.6–26.1)	15.9 (14.0–17.8)	10.2 (8.6–11.9)
Nebraska	13.9 (13.1–14.8)	7.9 (5.7–10.1)	17.7 (15.9–19.5)	17.2 (15.6–18.8)	7.2 (6.2–8.2)
Nevada	14.2 (12.4–16.1)	—[b]	14.9 (11.6–18.2)	17.3 (13.8–20.8)	13.4 (10.0–16.9)
New Hampshire	13.9 (12.6–15.2)	9.6 (4.9–14.3)	18.9 (15.8–22.0)	14.8 (13.0–16.6)	8.6 (6.9–10.4)
New Jersey	10.8 (10.0–11.6)	4.4 (2.7–6.1)	13.8 (12.1–15.5)	12.7 (11.4–14.1)	6.7 (5.6–7.9)
New Mexico	16.1 (14.5–17.6)	9.7 (5.8–13.6)	22.0 (18.5–25.4)	16.6 (14.1–19.1)	10.7 (8.6–12.8)
New York	12.0 (11.2–12.8)	5.5 (3.6–7.3)	14.5 (12.8–16.1)	15.3 (13.9–16.7)	6.8 (5.8–7.8)
North Carolina	16.5 (15.3–17.8)	8.4 (5.5–11.4)	20.3 (17.8–22.8)	19.8 (17.5–22.0)	10.5 (8.6–12.3)
North Dakota	17.4 (15.6–19.1)	16.9 (11.1–22.8)	21.8 (18.2–25.3)	17.8 (15.2–20.4)	9.8 (8.1–11.5)
Ohio	19.3 (18.3–20.2)	10.5 (8.0–12.9)	25.2 (23.1–27.3)	22.6 (21.1–24.2)	11.2 (9.9–12.5)
Oklahoma	19.1 (17.6–20.6)	11.1 (7.1–15.0)	23.2 (20.2–26.2)	22.6 (20.1–25.1)	12.6 (10.6–14.6)
Oregon	13.3 (12.3–14.4)	11.2 (7.6–14.8)	14.8 (12.8–16.8)	15.9 (14.0–17.8)	8.9 (7.0–10.8)

Table 2.26 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Pennsylvania	15.8 (14.5–17.1)	8.0 (4.5–11.6)	21.3 (18.5–24.0)	17.4 (15.3–19.6)	10.2 (8.0–12.4)
Rhode Island	13.5 (12.0–14.9)	—[b]	16.8 (13.7–19.9)	16.2 (13.8–18.5)	8.4 (6.6–10.2)
South Carolina	18.1 (16.5–19.8)	12.2 (7.6–16.8)	21.4 (18.0–24.9)	23.1 (20.2–26.1)	10.0 (7.8–12.1)
South Dakota	17.8 (15.5–20.1)	11.9 (6.1–17.6)	26.1 (20.8–31.4)	17.6 (14.2–20.9)	9.5 (7.2–11.8)
Tennessee	19.5 (17.8–21.2)	13.4 (7.3–19.5)	21.1 (18.1–24.0)	23.8 (20.8–26.8)	14.0 (11.3–16.8)
Texas	13.2 (12.0–14.4)	8.6 (5.7–11.4)	15.2 (12.9–17.6)	15.7 (13.5–17.9)	8.2 (6.3–10.2)
Utah	8.2 (7.4–8.9)	4.9 (3.3–6.4)	10.0 (8.6–11.4)	10.2 (8.7–11.6)	3.4 (2.6–4.3)
Vermont	13.3 (11.9–14.6)	10.7 (5.0–16.3)	18.8 (15.8–21.7)	14.4 (12.5–16.3)	7.1 (5.4–8.7)
Virginia	13.6 (12.7–14.6)	8.4 (5.7–11.0)	16.5 (14.6–18.5)	15.5 (13.8–17.1)	9.4 (7.8–11.1)
Washington	11.5 (10.7–12.2)	6.1 (4.2–8.0)	13.7 (12.3–15.2)	13.3 (12.0–14.6)	7.9 (6.7–9.2)
West Virginia	22.6 (21.2–23.9)	8.5 (4.7–12.4)	31.2 (28.2–34.3)	27.5 (25.2–29.7)	12.7 (11.0–14.4)
Wisconsin	15.5 (14.0–17.0)	7.4 (3.5–11.4)	19.7 (16.4–23.1)	18.3 (15.8–20.8)	10.0 (7.9–12.1)
Wyoming	18.5 (16.7–20.2)	17.2 (10.5–23.9)	24.6 (21.1–28.2)	18.3 (15.7–21.0)	10.5 (8.7–12.4)
Region					
Northeast	12.8 (12.3–13.2)	6.5 (5.4–7.7)	16.3 (15.4–17.3)	14.9 (14.2–15.7)	7.9 (7.2–8.6)
Midwest	16.6 (16.1–17.0)	10.0 (8.8–11.1)	20.8 (19.9–21.6)	19.5 (18.7–20.2)	10.0 (9.4–10.6)
South	15.8 (15.3–16.2)	8.9 (7.9–10.0)	19.2 (18.3–20.1)	18.9 (18.1–19.7)	9.7 (9.1–10.3)
West	10.9 (10.3–11.5)	7.1 (5.7–8.6)	13.0 (11.9–14.1)	12.3 (11.1–13.5)	7.1 (6.2–7.9)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI** = confidence interval.
[a]Current use of cigarettes was defined as having smoked at least 100 cigarettes in one's lifetime and smoking every day or some days at the time of the survey.
[b]Estimate is not presented because of a relative standard error >30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and multiplied by 100.

prevalence of having quit for at least 6 months was otherwise similar across regions.

The proportion of adults who smoked cigarettes and made a quit attempt during the past year was generally higher among young adults (18–24 years of age) than it was among adults in older age groups (Table 2.29). According to data from the 2020 BRFSS, in every state but one (North Dakota), at least 60% of young adults who smoked cigarettes had attempted to quit during the past year, as evidenced by having stopped smoking for 1 day or longer (Table 2.29); estimates ranged from 53.6% (95% CI, 35.7–71.5) in North Dakota to 97.5% (95% CI, 94.2–100.0) in Alabama. Estimates of a past-year quit attempt among young adults who smoke were similar by region, ranging from 74.1% (95% CI, 69.8–78.4) in the Midwest to 82.9% (95% CI, 78.1–87.7) in the Northeast.

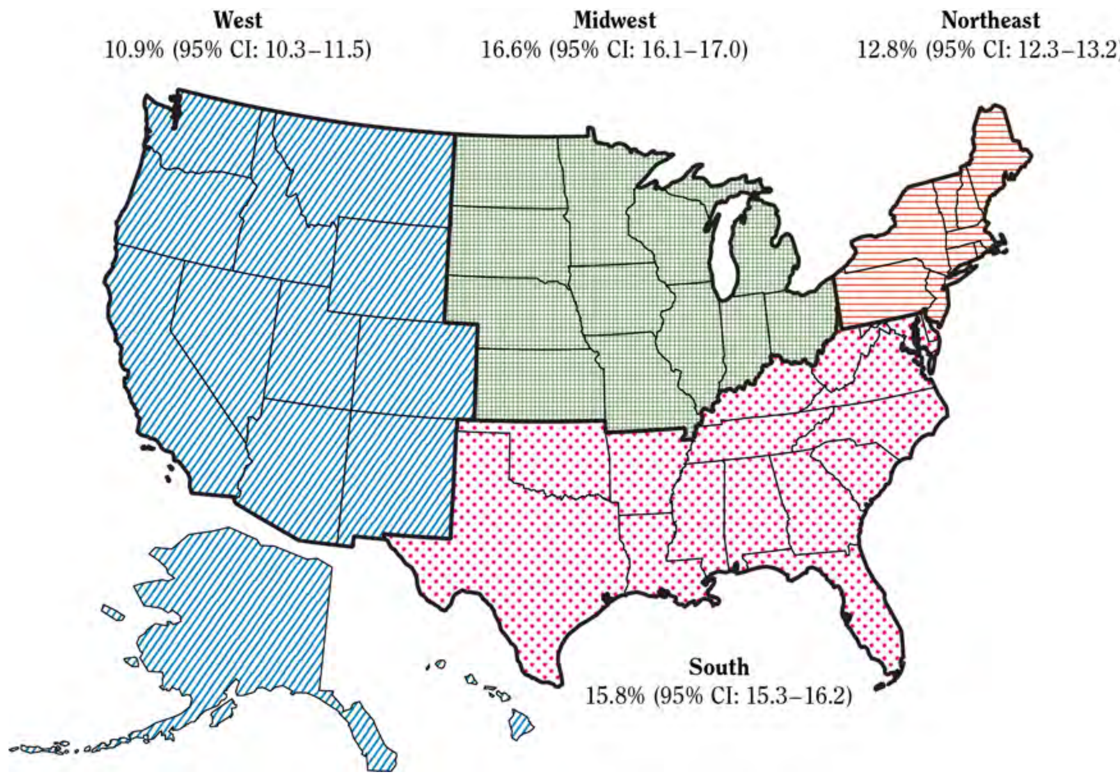
Many estimates of successful quitting for at least 6 months during the past year among young adults in 2020 were suppressed due to a relative standard error greater than or equal to 30.0% (Table 2.30). By region, successful quitting for at least 6 months during the past year among young adults was similar by region, ranging from 7.6% (95% CI, 4.4–10.8) in the Northeast to 10.4% (95% CI, 7.5–13.3) in the South (Table 2.30).

Patterns of the Use of Other Tobacco Products

E-Cigarettes

Youth. For the 42 states with available data, ever and past-30-day use of e-cigarettes among U.S. high school students in 2019 was lowest in Utah (ever use: 30.5%; 95% CI, 26.0–35.5; past-30-day use: 9.7%; 95% CI, 7.3–12.6) and highest in West Virginia (ever use: 62.4%; 95% CI, 57.6–67.0; past-30-day use: 35.7%; 95% CI, 30.7–41.1) (Table 2.31). The prevalence of ever e cigarette use was 9.2 percentage points (Maryland, 39.7%; 95% CI, 38.6–40.9) to 31.9 percentage points (West Virginia, 62.4%; 95% CI, 57.6–67.0) higher in other states (with available data) than it was in Utah. The prevalence of current e-cigarette use was 7.3 percentage points (Georgia,

Figure 2.16 Prevalence of current use of cigarettes[a] among adults, 18 years of age and older, by region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States



Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Current use of cigarettes was defined as having smoked at least 100 cigarettes in one's lifetime and smoking "every day" or "some days" at the time of the survey.

17.0%; 95% CI, 13.9–20.6) to 26 percentage points (West Virginia, 35.7%; 95% CI, 30.7–41.1) higher in other states (with available data) than it was in Utah. Ten states (Hawaii, Maine, Massachusetts, Montana, New Hampshire, New Mexico, North Carolina, North Dakota, Rhode Island, and West Virginia) had a prevalence of past-30-day e-cigarette use above 30%.

For the 43 states with available data, frequent use of e-cigarettes (use on 20 or more days during the past 30 days) among U.S. high school students ranged from 3.3% (95% CI, 2.3–4.7) in Utah to 16.7% (95% CI, 12.3–22.3) in West Virginia. Daily use of e-cigarettes ranged from 2.4% in both California (2.4%; 95% CI, 1.4–4.1) and Utah (2.4%; 95% CI, 1.6–3.8) to 12.6% (95% CI, 9.2–17.0) in West Virginia. The prevalence of frequent e-cigarette use was 0.3 percentage points (California, 3.6%; 95% CI, 2.4–5.4) to 13.4 percentage points (West Virginia, 16.7%; 95% CI, 12.3–22.3) higher in other states (with available data) than it was in Utah. Furthermore, the prevalence of daily e-cigarette use was 0.9 percentage points (Nevada, 3.3%; 95% CI, 1.9–5.5) to 10.2 percentage points (West Virginia, 12.6%; 95% CI, 9.2–17.0) higher in other states (with available data) than it was in Utah and California.

Adults. In 2020, eight states and the District of Columbia did not field the BRFSS optional module for e-cigarettes. In the states with available data, the state-specific prevalence of ever use of e-cigarettes (ever used an e-cigarette or other electronic vaping product, even just one time) among all adults in 2020 ranged from 12.2% (95% CI, 10.6–13.8) in Illinois to 30.4% (95% CI, 28.3–32.4) in Kentucky (Table 2.32). The prevalence of ever e-cigarette use was 6.9 percentage points (Massachusetts, 19.1%; 95% CI, 17.2–21.0) to 18.2 percentage points (Kentucky, 30.4%; 95% CI, 28.3–32.4) higher in other states (with available data) than it was in Illinois. By region, ever use of e-cigarettes among adults was lower in the Northeast (21.4%; 95% CI, 20.7–22.0) than it was in the Midwest (23.8%; 95% CI, 23.2–24.4), South (24.3%; 95% CI, 23.7–25.0) and the West (25.5%; 95% CI, 24.9–26.0).

Table 2.27 Prevalence of daily use of cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	13.2 (12.0–14.5)	6.0 (2.9–9.1)	17.0 (14.4–19.6)	16.0 (13.7–18.4)	7.7 (6.1–9.3)
Alaska	13.5 (11.7–15.3)	—[b]	17.5 (14.0–20.9)	14.8 (11.9–17.7)	7.1 (4.5–9.7)
Arizona	9.0 (8.2–9.8)	2.9 (1.3–4.5)	11.0 (9.3–12.7)	11.3 (9.9–12.8)	6.4 (5.2–7.6)
Arkansas	15.0 (13.6–16.5)	—[b]	19.4 (16.2–22.5)	18.3 (15.8–20.8)	8.7 (7.1–10.3)
California	5.9 (4.9–6.9)	—[b]	6.4 (4.6–8.2)	7.1 (5.2–9.1)	4.5 (3.0–6.0)
Colorado	8.4 (7.8–9.1)	4.6 (3.0–6.1)	10.8 (9.4–12.1)	9.3 (8.2–10.5)	4.9 (4.0–5.9)
Connecticut	8.2 (7.3–9.1)	4.0 (1.9–6.2)	11.5 (9.4–13.6)	9.0 (7.5–10.4)	5.1 (3.7–6.5)
Delaware	10.6 (9.2–12.0)	—[b]	15.1 (11.9–18.4)	12.1 (10.0–14.2)	6.3 (4.1–8.6)
District of Columbia	6.1 (5.0–7.2)	—[b]	5.8 (4.1–7.5)	8.6 (6.6–10.6)	5.4 (3.6–7.3)
Florida	9.4 (8.4–10.4)	2.3 (1.1–3.5)	11.8 (9.5–14.0)	11.6 (9.7–13.6)	6.9 (5.4–8.3)
Georgia	10.8 (9.7–11.9)	4.4 (1.9–6.8)	13.2 (10.9–15.5)	13.7 (11.6–15.8)	6.1 (4.9–7.3)
Hawaiʻi	8.0 (7.1–8.9)	4.8 (2.2–7.3)	9.8 (8.0–11.5)	8.9 (7.3–10.5)	5.8 (4.3–7.2)
Idaho	9.7 (8.6–10.7)	5.0 (2.3–7.6)	11.6 (9.5–13.7)	12.4 (10.4–14.5)	5.7 (4.3–7.1)
Illinois	9.5 (8.3–10.7)	6.5 (3.3–9.7)	9.2 (7.2–11.1)	12.1 (9.6–14.5)	7.8 (5.5–10.2)
Indiana	14.9 (13.9–15.9)	7.9 (5.1–10.7)	18.9 (16.8–21.1)	18.2 (16.5–19.8)	8.5 (7.2–9.8)
Iowa	11.8 (11.0–12.6)	5.4 (3.5–7.3)	16.5 (14.8–18.2)	13.9 (12.4–15.3)	6.2 (5.1–7.2)
Kansas	12.2 (11.3–13.1)	5.9 (3.6–8.2)	14.8 (13.0–16.6)	15.8 (14.2–17.3)	7.2 (6.0–8.3)
Kentucky	16.6 (15.0–18.1)	7.9 (3.5–12.3)	20.5 (17.3–23.7)	20.4 (17.7–23.0)	10.1 (7.8–12.3)
Louisiana	12.6 (11.3–14.0)	6.1 (2.7–9.4)	15.9 (13.1–18.6)	15.1 (12.9–17.4)	7.5 (5.8–9.2)
Maine	13.1 (12.0–14.2)	8.7 (4.2–13.2)	18.4 (15.9–20.9)	14.7 (13.0–16.4)	7.1 (6.0–8.3)
Maryland	7.0 (6.4–7.7)	—[b]	8.9 (7.6–10.2)	8.3 (7.3–9.3)	4.9 (4.1–5.7)
Massachusetts	7.7 (6.8–8.6)	4.3 (2.2–6.4)	9.9 (7.8–12.0)	8.8 (7.4–10.2)	4.9 (3.4–6.4)
Michigan	13.2 (12.1–14.4)	7.1 (4.3–9.9)	16.5 (14.1–18.8)	17.1 (14.9–19.2)	6.7 (5.4–8.0)
Minnesota	9.9 (9.3–10.5)	3.8 (2.4–5.2)	13.1 (11.9–14.3)	11.4 (10.4–12.4)	6.2 (5.3–7.1)
Mississippi	14.0 (12.8–15.2)	6.3 (3.0–9.5)	17.9 (15.4–20.4)	17.2 (15.2–19.2)	6.9 (5.4–8.3)
Missouri	13.8 (12.8–14.8)	7.0 (4.5–9.5)	17.5 (15.3–19.6)	16.2 (14.4–17.9)	8.9 (7.5–10.4)
Montana	12.0 (11.0–13.1)	5.8 (3.4–8.1)	17.3 (14.8–19.7)	12.4 (10.7–14.2)	7.9 (6.4–9.4)
Nebraska	10.1 (9.4–10.9)	3.8 (2.3–5.4)	12.5 (11.0–14.0)	13.7 (12.3–15.1)	5.3 (4.5–6.2)
Nevada	9.2 (7.7–10.7)	—[b]	10.2 (7.4–13.0)	11.3 (8.5–14.1)	8.0 (5.5–10.5)
New Hampshire	10.0 (8.9–11.1)	—[b]	13.5 (10.7–16.2)	11.2 (9.6–12.8)	7.2 (5.5–8.9)
New Jersey	7.1 (6.5–7.8)	—[b]	8.3 (6.9–9.7)	9.3 (8.1–10.5)	5.2 (4.2–6.2)
New Mexico	9.9 (8.7–11.2)	4.3 (1.9–6.8)	13.1 (10.2–15.9)	11.8 (9.5–14.0)	6.3 (4.8–7.8)
New York	8.0 (7.3–8.6)	3.2 (1.7–4.7)	9.3 (8.0–10.6)	10.7 (9.5–11.9)	4.6 (3.7–5.4)
North Carolina	12.6 (11.5–13.7)	4.8 (2.5–7.2)	15.2 (13.0–17.5)	15.2 (13.2–17.2)	8.9 (7.1–10.6)
North Dakota	12.7 (11.2–14.2)	11.7 (6.6–16.9)	15.8 (12.6–18.9)	13.4 (11.1–15.7)	7.2 (5.7–8.8)
Ohio	14.9 (14.0–15.7)	7.0 (4.9–9.1)	20.0 (18.0–21.9)	17.5 (16.1–19.0)	8.4 (7.2–9.5)
Oklahoma	14.0 (12.8–15.3)	5.8 (3.0–8.5)	16.0 (13.5–18.5)	18.6 (16.3–21.0)	9.4 (7.6–11.1)
Oregon	10.0 (9.0–11.0)	6.6 (3.7–9.6)	11.4 (9.6–13.2)	12.0 (10.3–13.8)	7.0 (5.2–8.7)

Table 2.27 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Pennsylvania	11.9 (10.8–13.1)	4.3 (2.0–6.6)	16.4 (13.9–19.0)	13.5 (11.6–15.3)	7.7 (5.6–9.7)
Rhode Island	10.1 (8.7–11.4)	—[b]	12.5 (9.7–15.4)	13.0 (10.8–15.2)	6.0 (4.4–7.6)
South Carolina	13.3 (11.8–14.7)	5.7 (2.4–9.1)	16.2 (13.0–19.3)	18.3 (15.6–21.0)	6.4 (4.7–8.1)
South Dakota	12.5 (10.6–14.5)	—[b]	17.6 (12.9–22.3)	13.1 (10.2–16.0)	7.1 (5.1–9.1)
Tennessee	15.1 (13.6–16.6)	—[b]	16.4 (13.7–19.0)	19.4 (16.5–22.2)	11.2 (8.7–13.7)
Texas	8.3 (7.3–9.2)	4.0 (2.1–6.0)	9.0 (7.1–10.8)	10.6 (8.8–12.5)	5.9 (4.3–7.5)
Utah	5.4 (4.8–5.9)	2.5 (1.3–3.7)	6.2 (5.2–7.3)	7.4 (6.2–8.6)	2.6 (1.8–3.3)
Vermont	9.6 (8.5–10.6)	—[b]	13.3 (10.9–15.7)	11.9 (10.1–13.7)	5.9 (4.3–7.5)
Virginia	9.6 (8.8–10.5)	3.5 (1.8–5.1)	11.0 (9.3–12.6)	12.3 (10.8–13.8)	7.2 (5.7–8.7)
Washington	7.7 (7.1–8.4)	2.6 (1.4–3.8)	8.9 (7.7–10.1)	9.7 (8.5–10.9)	5.7 (4.6–6.7)
West Virginia	18.2 (16.9–19.5)	6.5 (2.9–10.0)	26.3 (23.4–29.3)	21.8 (19.6–23.9)	9.7 (8.1–11.2)
Wisconsin	10.8 (9.5–12.1)	—[b]	12.9 (10.1–15.7)	14.3 (12.0–16.7)	6.7 (5.1–8.3)
Wyoming	13.6 (12.1–15.2)	11.4 (6.0–16.8)	17.8 (14.6–21.0)	14.1 (11.8–16.5)	8.2 (6.6–9.9)
Region					
Northeast	9.0 (8.6–9.4)	3.4 (2.6–4.3)	11.4 (10.5–12.2)	10.9 (10.3–11.6)	5.7 (5.1–6.3)
Midwest	12.3 (12.0–12.7)	6.3 (5.4–7.2)	15.2 (14.5–15.9)	15.2 (14.5–15.9)	7.5 (6.9–8.1)
South	10.9 (10.6–11.3)	4.5 (3.7–5.2)	13.0 (12.3–13.7)	13.8 (13.1–14.4)	7.3 (6.8–7.8)
West	7.4 (6.9–7.9)	3.6 (2.5–4.7)	8.5 (7.5–9.4)	8.9 (7.9–9.9)	5.3 (4.6–6.1)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Daily use of cigarettes was defined as having smoked at least 100 cigarettes in one's lifetime and smoked every day at the time of the survey.
[b]Estimate is not presented because of a relative standard error ≥30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and then multiplied by 100.

Table 2.28 Prevalence of nondaily use of cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	5.2 (4.4–6.1)	—[b]	7.3 (5.4–9.2)	5.4 (4.1–6.8)	2.2 (1.4–3.0)
Alaska	4.5 (3.5–5.5)	—[b]	6.3 (4.2–8.4)	5.0 (3.4–6.6)	1.1 (0.5–1.6)
Arizona	4.1 (3.5–4.7)	4.0 (2.2–5.8)	5.7 (4.4–6.9)	3.8 (2.9–4.6)	2.4 (1.7–3.1)
Arkansas	5.4 (4.5–6.4)	—[b]	6.3 (4.4–8.3)	6.4 (4.8–8.1)	3.0 (2.0–3.9)
California	3.0 (2.3–3.6)	—[b]	4.0 (2.8–5.2)	3.0 (1.7–4.3)	—[b]
Colorado	3.9 (3.5–4.4)	3.5 (2.1–4.8)	5.1 (4.1–6.0)	3.7 (3.0–4.5)	2.4 (1.7–3.2)
Connecticut	3.6 (3.0–4.3)	—[b]	5.2 (3.9–6.5)	3.8 (2.7–5.0)	1.9 (1.1–2.7)
Delaware	4.5 (3.5–5.5)	—[b]	5.8 (3.7–7.9)	4.4 (2.8–6.0)	3.5 (1.9–5.1)
District of Columbia	5.2 (4.1–6.4)	—[b]	5.1 (3.3–6.9)	7.0 (5.2–8.8)	3.4 (2.1–4.8)
Florida	5.3 (4.1–6.4)	3.7 (1.6–5.7)	7.4 (4.6–10.3)	6.7 (4.5–8.9)	1.8 (1.1–2.4)

Table 2.28 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Georgia	5.0 (4.2–5.8)	3.6 (1.6–5.7)	6.4 (4.7–8.1)	5.1 (4.0–6.2)	3.3 (2.4–4.2)
Hawai‘i	3.6 (3.0–4.2)	6.7 (3.7–9.7)	4.7 (3.5–5.8)	2.9 (2.0–3.8)	1.8 (1.1–2.5)
Idaho	4.0 (3.2–4.7)	5.0 (2.6–7.3)	5.7 (4.1–7.2)	3.5 (2.2–4.8)	1.5 (0.8–2.2)
Illinois	3.2 (2.5–4.0)	—[b]	4.6 (3.1–6.0)	2.8 (1.4–4.1)	1.8 (0.8–2.7)
Indiana	4.5 (3.9–5.0)	3.5 (1.7–5.3)	5.4 (4.2–6.7)	5.1 (4.1–6.0)	2.7 (1.9–3.4)
Iowa	4.0 (3.5–4.5)	4.6 (2.9–6.4)	5.7 (4.6–6.9)	3.8 (3.0–4.6)	1.5 (1.1–2.0)
Kansas	4.4 (3.8–5.0)	4.6 (2.7–6.5)	5.3 (4.2–6.4)	4.9 (3.9–5.9)	2.2 (1.6–2.8)
Kentucky	4.8 (3.9–5.7)	—[b]	6.2 (4.4–8.0)	4.9 (3.4–6.3)	2.9 (1.6–4.3)
Louisiana	5.7 (4.7–6.6)	—[b]	6.1 (4.4–7.8)	7.0 (5.3–8.6)	2.8 (1.8–3.9)
Maine	3.4 (2.8–4.1)	—[b]	6.0 (4.2–7.8)	2.6 (1.9–3.3)	1.7 (1.3–2.2)
Maryland	3.8 (3.3–4.4)	3.1 (1.6–4.6)	5.1 (4.0–6.3)	3.9 (3.1–4.7)	2.2 (1.5–2.9)
Massachusetts	3.4 (2.7–4.0)	—[b]	3.6 (2.5–4.6)	4.0 (2.8–5.2)	2.6 (1.4–3.7)
Michigan	5.2 (4.4–5.9)	3.7 (1.8–5.6)	7.0 (5.3–8.7)	5.3 (4.2–6.5)	3.2 (2.3–4.1)
Minnesota	3.9 (3.5–4.3)	4.0 (2.7–5.3)	5.1 (4.4–5.9)	3.8 (3.2–4.4)	2.3 (1.7–2.8)
Mississippi	6.1 (5.2–7.0)	—[b]	8.0 (6.1–9.8)	6.2 (4.8–7.5)	3.8 (2.8–4.9)
Missouri	4.0 (3.4–4.5)	2.8 (1.4–4.3)	5.3 (4.2–6.5)	4.3 (3.3–5.3)	2.1 (1.4–2.9)
Montana	4.4 (3.7–5.1)	6.5 (3.7–9.4)	6.1 (4.5–7.7)	3.5 (2.6–4.4)	2.3 (1.5–3.1)
Nebraska	3.8 (3.3–4.3)	4.1 (2.5–5.8)	5.2 (4.1–6.3)	3.5 (2.7–4.3)	1.9 (1.4–2.4)
Nevada	5.1 (3.9–6.2)	—[b]	4.7 (2.7–6.6)	6.0 (3.7–8.3)	5.4 (2.9–7.9)
New Hampshire	3.9 (3.1–4.6)	—[b]	5.4 (3.7–7.1)	3.6 (2.6–4.6)	1.4 (0.9–2.0)
New Jersey	3.7 (3.2–4.2)	3.5 (2.0–5.1)	5.5 (4.4–6.6)	3.4 (2.7–4.1)	1.5 (0.9–2.1)
New Mexico	6.1 (5.1–7.1)	5.4 (2.3–8.5)	8.9 (6.5–11.3)	4.8 (3.5–6.1)	4.4 (2.8–6.0)
New York	4.0 (3.5–4.5)	2.3 (1.1–3.4)	5.2 (4.1–6.3)	4.6 (3.8–5.4)	2.3 (1.7–2.8)
North Carolina	4.0 (3.3–4.6)	3.6 (1.8–5.5)	5.0 (3.7–6.4)	4.6 (3.4–5.8)	1.6 (1.0–2.2)
North Dakota	4.7 (3.7–5.7)	—[b]	6.0 (3.9–8.1)	4.4 (2.9–5.8)	2.6 (1.6–3.5)
Ohio	4.4 (3.9–4.9)	3.5 (2.1–4.9)	5.2 (4.2–6.3)	5.1 (4.3–5.9)	2.8 (2.1–3.6)
Oklahoma	5.1 (4.1–6.0)	5.3 (2.3–8.3)	7.2 (5.1–9.2)	3.9 (2.8–5.1)	3.2 (2.1–4.3)
Oregon	3.3 (2.8–3.9)	4.5 (2.2–6.8)	3.4 (2.4–4.4)	3.9 (2.9–4.9)	1.9 (1.1–2.7)
Pennsylvania	3.8 (3.2–4.5)	—[b]	4.8 (3.5–6.1)	3.9 (2.7–5.2)	2.5 (1.6–3.4)
Rhode Island	3.4 (2.7–4.1)	—[b]	4.3 (2.7–5.8)	3.2 (2.1–4.2)	2.4 (1.4–3.4)
South Carolina	4.9 (4.0–5.8)	6.5 (3.1–9.8)	5.3 (3.5–7.0)	4.8 (3.4–6.3)	3.6 (2.2–5.0)
South Dakota	5.2 (3.8–6.6)	—[b]	8.5 (5.0–11.9)	4.4 (2.5–6.4)	2.4 (1.3–3.5)
Tennessee	4.4 (3.6–5.2)	6.4 (3.1–9.7)	4.7 (3.2–6.2)	4.4 (3.2–5.7)	2.8 (1.6–4.1)
Texas	4.9 (4.1–5.8)	4.5 (2.4–6.7)	6.3 (4.6–7.9)	5.1 (3.7–6.4)	2.4 (1.3–3.5)
Utah	2.8 (2.3–3.3)	2.4 (1.3–3.4)	3.8 (2.8–4.8)	2.8 (1.9–3.6)	0.8 (0.4–1.3)
Vermont	3.7 (2.8–4.6)	—[b]	5.4 (3.6–7.3)	2.5 (1.7–3.2)	1.2 (0.7–1.6)
Virginia	4.0 (3.4–4.6)	4.9 (2.8–7.0)	5.6 (4.3–6.8)	3.1 (2.4–3.8)	2.3 (1.5–3.1)
Washington	3.7 (3.3–4.2)	3.5 (2.0–5.0)	4.9 (3.9–5.8)	3.6 (2.9–4.3)	2.3 (1.5–3.1)
West Virginia	4.3 (3.7–5.0)	—[b]	4.9 (3.6–6.2)	5.7 (4.6–6.8)	3.0 (2.2–3.9)
Wisconsin	4.7 (3.8–5.6)	—[b]	6.8 (4.6–9.1)	4.0 (2.8–5.1)	3.3 (1.8–4.7)
Wyoming	4.8 (3.8–5.8)	—[b]	6.8 (4.8–8.9)	4.2 (2.7–5.7)	2.3 (1.4–3.2)

Table 2.28 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Region					
Northeast	3.8 (3.5–4.0)	3.1 (2.2–3.9)	5.0 (4.4–5.5)	4.0 (3.6–4.4)	2.2 (1.8–2.5)
Midwest	4.2 (4.0–4.5)	3.6 (3.0–4.3)	5.6 (5.1–6.1)	4.3 (3.9–4.7)	2.5 (2.2–2.8)
South	4.8 (4.5–5.1)	4.5 (3.7–5.2)	6.2 (5.5–6.9)	5.2 (4.7–5.7)	2.4 (2.1–2.7)
West	3.5 (3.2–3.8)	3.5 (2.5–4.6)	4.6 (3.9–5.2)	3.4 (2.8–4.1)	1.7 (1.4–2.1)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Daily use of cigarettes was defined as having smoked at least 100 cigarettes in one's lifetime and smoked every day at the time of the survey.
[b]Estimate is not presented because of a relative standard error ≥30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and then multiplied by 100.

Table 2.29 Prevalence of stopping cigarette smoking for 1 day or longer during the past 12 months[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	68.5 (64.8–72.2)	97.4 (94.2–100.0)	72.5 (66.6–78.4)	60.6 (54.3–66.9)	52.4 (43.8–61.1)
Alaska	64.6 (59.3–69.9)	78.1 (62.4–93.9)	68.3 (60.5–76.2)	62.6 (54.4–70.7)	35.0 (22.3–47.6)
Arizona	62.0 (58.6–65.5)	82.5 (71.5–93.6)	67.6 (62.0–73.2)	52.3 (46.8–57.8)	54.2 (46.5–61.9)
Arkansas	56.9 (52.7–61.1)	71.2 (53.8–88.6)	56.9 (50.0–63.9)	56.8 (50.5–63.1)	47.8 (40.2–55.5)
California	69.4 (64.0–74.9)	76.4 (60.1–92.6)	73.2 (65.4–81.0)	65.3 (55.1–75.5)	59.9 (45.9–73.9)
Colorado	67.3 (64.5–70.1)	84.1 (76.5–91.7)	70.5 (66.4–74.6)	58.4 (53.6–63.3)	59.9 (52.6–67.2)
Connecticut	69.3 (65.5–73.1)	85.0 (71.3–98.6)	71.9 (65.7–78.2)	63.8 (57.7–70.0)	66.4 (57.0–75.8)
Delaware	65.0 (59.7–70.2)	87.2 (73.0–100.0)	63.9 (55.4–72.4)	61.8 (54.1–69.5)	64.2 (50.0–78.5)
District of Columbia	71.0 (65.2–76.8)	70.3 (35.7–100.0)	71.6 (62.8–80.5)	70.4 (62.6–78.2)	70.2 (58.4–82.0)
Florida	62.5 (57.8–67.2)	86.1 (77.0–95.1)	65.5 (57.0–73.9)	55.7 (48.1–63.4)	59.8 (51.4–68.2)
Georgia	65.6 (61.6–69.5)	76.4 (63.4–89.4)	70.5 (63.9–77.1)	59.9 (53.5–66.2)	56.5 (48.8–64.1)
Hawai'i	63.0 (58.8–67.2)	77.6 (66.5–88.8)	66.7 (60.1–73.3)	58.3 (51.0–65.5)	49.3 (39.0–59.7)
Idaho	61.8 (57.6–66.1)	71.2 (58.1–84.3)	69.2 (63.0–75.5)	49.7 (42.2–57.3)	58.4 (48.7–68.2)
Illinois	60.6 (55.3–65.8)	77.6 (61.2–94.1)	67.8 (60.3–75.2)	52.0 (42.7–61.4)	53.3 (40.3–66.3)
Indiana	59.4 (56.5–62.2)	78.7 (68.4–89.0)	63.2 (58.4–68.0)	53.9 (49.7–58.0)	49.5 (43.0–56.1)
Iowa	59.9 (57.1–62.7)	74.4 (64.8–84.0)	62.9 (58.5–67.3)	52.7 (48.2–57.2)	56.1 (49.0–63.3)
Kansas	59.6 (56.6–62.5)	71.2 (59.5–82.9)	61.5 (56.7–66.3)	56.1 (51.6–60.6)	52.3 (45.5–59.1)
Kentucky	55.5 (51.3–59.6)	63.7 (45.0–82.5)	57.5 (50.8–64.3)	52.5 (46.2–58.8)	52.1 (42.4–61.7)
Louisiana	64.2 (60.1–68.3)	78.4 (65.3–91.5)	65.1 (58.3–71.8)	60.0 (53.7–66.2)	60.5 (51.5–69.5)
Maine	57.2 (53.5–60.8)	69.9 (52.7–87.2)	57.6 (51.4–63.7)	56.3 (51.0–61.5)	50.7 (43.9–57.5)
Maryland	64.0 (60.7–67.2)	75.5 (62.1–88.9)	66.5 (61.2–71.8)	63.3 (58.4–68.2)	50.8 (43.6–58.0)
Massachusetts	65.8 (61.5–70.1)	69.2 (52.7–85.6)	67.8 (60.6–75.0)	61.6 (55.0–68.2)	68.8 (59.4–78.2)

Table 2.29 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Michigan	63.1 (59.5–66.6)	72.4 (60.9–83.9)	64.5 (58.6–70.5)	59.2 (53.6–64.9)	63.5 (56.2–70.8)
Minnesota	59.8 (57.5–62.2)	77.6 (68.1–87.1)	63.7 (60.1–67.2)	55.6 (51.9–59.2)	45.6 (39.5–51.8)
Mississippi	66.1 (62.6–69.6)	76.9 (62.5–91.4)	70.2 (64.6–75.8)	61.7 (56.4–67.0)	55.8 (48.1–63.4)
Missouri	60.6 (57.6–63.6)	78.9 (69.0–88.8)	63.6 (58.6–68.5)	56.4 (51.6–61.2)	51.2 (44.1–58.3)
Montana	60.4 (56.8–64.1)	80.4 (71.4–89.4)	66.3 (60.5–72.1)	54.0 (47.8–60.1)	38.2 (30.4–46.0)
Nebraska	61.8 (58.8–64.7)	77.1 (68.2–86.1)	68.4 (63.9–73.0)	52.8 (47.9–57.6)	46.5 (40.0–52.9)
Nevada	62.6 (56.8–68.5)	68.7 (48.0–89.4)	65.0 (55.6–74.5)	63.6 (53.6–73.6)	53.0 (40.1–65.9)
New Hampshire	60.2 (55.5–64.9)	85.4 (65.7–100.0)	60.9 (52.9–68.9)	57.4 (51.0–63.9)	51.2 (40.5–61.9)
New Jersey	68.5 (65.3–71.8)	89.9 (81.4–98.4)	71.3 (65.9–76.7)	64.8 (59.8–69.8)	60.7 (52.9–68.6)
New Mexico	65.4 (60.9–69.9)	74.4 (60.0–88.8)	71.2 (64.2–78.1)	54.1 (46.3–62.0)	64.6 (55.6–73.6)
New York	66.5 (63.7–69.4)	84.7 (76.2–93.3)	70.5 (65.6–75.3)	60.0 (55.6–64.5)	61.8 (55.2–68.4)
North Carolina	60.1 (56.3–63.8)	75.5 (63.2–87.8)	64.1 (58.1–70.1)	56.1 (50.2–62.1)	48.5 (39.7–57.4)
North Dakota	58.7 (53.6–63.8)	53.6 (35.7–71.5)	66.4 (58.6–74.1)	50.7 (42.9–58.4)	50.7 (41.8–59.6)
Ohio	58.9 (56.4–61.4)	71.1 (61.0–81.3)	60.5 (56.3–64.7)	55.3 (51.5–59.1)	56.6 (50.8–62.3)
Oklahoma	60.7 (56.9–64.5)	71.6 (57.7–85.6)	68.5 (62.4–74.7)	53.0 (46.9–59.1)	50.2 (42.3–58.0)
Oregon	59.5 (55.6–63.4)	68.4 (54.2–82.6)	67.2 (61.3–73.0)	51.8 (45.5–58.1)	48.8 (38.3–59.4)
Pennsylvania	60.9 (56.9–64.8)	87.1 (77.8–96.3)	62.8 (56.6–69.1)	54.8 (48.4–61.2)	57.4 (47.4–67.5)
Rhode Island	65.5 (60.6–70.5)	71.7 (44.4–98.9)	69.1 (61.1–77.1)	62.8 (55.7–70.0)	58.6 (48.4–68.8)
South Carolina	61.8 (57.3–66.4)	82.1 (69.2–95.0)	62.5 (54.6–70.5)	55.5 (48.7–62.3)	63.8 (54.8–72.9)
South Dakota	59.8 (53.6–66.1)	84.3 (68.9–99.6)	65.4 (55.6–75.2)	46.3 (36.4–56.2)	48.0 (36.2–59.8)
Tennessee	57.6 (53.1–62.2)	64.8 (41.7–87.8)	62.8 (56.0–69.6)	54.2 (47.2–61.1)	48.3 (38.3–58.4)
Texas	65.8 (61.6–70.0)	77.1 (65.4–88.7)	69.8 (63.2–76.3)	59.1 (52.1–66.1)	57.5 (44.5–70.4)
Utah	67.7 (63.9–71.6)	80.0 (69.9–90.2)	71.8 (66.4–77.2)	57.2 (50.4–63.9)	64.1 (51.2–77.1)
Vermont	62.4 (57.7–67.1)	83.9 (69.8–98.0)	66.1 (59.0–73.1)	54.0 (47.4–60.7)	46.2 (35.4–57.1)
Virginia	65.2 (62.0–68.3)	82.9 (73.4–92.3)	67.5 (62.4–72.7)	57.9 (52.7–63.2)	62.7 (56.0–69.5)
Washington	64.2 (61.2–67.1)	76.3 (65.2–87.3)	69.6 (65.2–74.0)	58.8 (53.9–63.7)	52.3 (44.8–59.8)
West Virginia	57.0 (53.8–60.2)	81.1 (68.2–94.0)	55.5 (50.0–60.9)	55.5 (50.9–60.2)	53.7 (46.9–60.5)
Wisconsin	60.8 (56.1–65.6)	65.2 (45.1–85.3)	66.3 (58.4–74.1)	56.7 (49.6–63.8)	52.7 (42.7–62.8)
Wyoming	59.7 (55.1–64.4)	74.0 (59.1–89.0)	60.9 (53.6–68.3)	54.2 (46.7–61.7)	52.9 (44.1–61.6)
Region					
Northeast	64.8 (63.1–66.4)	82.9 (78.1–87.7)	67.4 (64.7–70.1)	59.5 (57.0–62.1)	60.4 (56.3–64.4)
Midwest	60.4 (59.2–61.7)	74.1 (69.8–78.4)	63.9 (62.0–65.9)	55.3 (53.3–57.4)	54.3 (51.2–57.3)
South	62.9 (61.5–64.2)	78.2 (73.9–82.4)	66.3 (64.0–68.5)	57.4 (55.2–59.6)	55.8 (52.5–59.2)
West	66.0 (63.6–68.3)	76.8 (69.2–84.4)	70.5 (67.1–73.9)	60.1 (55.6–64.7)	56.1 (50.6–61.6)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Includes people who (a) currently smoked cigarettes and stopped smoking for 1 day or longer during the past year because they were trying to quit smoking and (b) quit smoking during the past year.

Table 2.30 Prevalence of quitting cigarette smoking for at least 6 months[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	5.1 (3.3–6.8)	—[b]	5.2 (2.9–7.5)	—[b]	—[b]
Alaska	3.4 (1.5–5.3)	—[b]	—[b]	—[b]	—[b]
Arizona	6.0 (4.3–7.7)	—[b]	5.6 (2.9–8.3)	5.6 (2.9–8.3)	—[b]
Arkansas	4.0 (2.5–5.5)	—[c]	5.9 (2.8–8.9)	—[b]	—[b]
California	8.0 (5.2–10.8)	—[b]	9.5 (5.1–13.9)	—[b]	—[b]
Colorado	8.4 (6.7–10.1)	—[b]	10.0 (7.2–12.8)	6.7 (4.4–9.0)	—[b]
Connecticut	5.3 (3.4–7.1)	—[b]	4.7 (2.2–7.2)	6.3 (2.7–9.9)	—[b]
Delaware	3.6 (1.5–5.7)	—[b]	—[b]	—[b]	—[b]
District of Columbia	7.0 (3.9–10.1)	—[b]	11.0 (5.4–16.6)	—[b]	—[b]
Florida	5.1 (3.3–6.8)	—[b]	6.7 (3.2–10.1)	3.4 (1.5–5.3)	—[b]
Georgia	6.3 (4.3–8.3)	—[b]	8.7 (4.9–12.5)	2.5 (1.3–3.7)	—[b]
Hawai‘i	5.4 (3.6–7.2)	—[b]	4.7 (2.6–6.8)	5.5 (2.3–8.7)	—[b]
Idaho	6.0 (4.0–8.0)	—[b]	7.7 (3.9–11.4)	—[b]	—[b]
Illinois	7.8 (5.1–10.4)	—[b]	9.0 (4.1–13.9)	6.0 (2.6–9.4)	—[b]
Indiana	4.2 (3.0–5.4)	—[b]	4.5 (2.5–6.6)	3.6 (2.1–5.2)	—[b]
Iowa	4.6 (3.4–5.8)	—[b]	4.4 (2.5–6.3)	5.0 (3.1–7.0)	—[b]
Kansas	6.5 (5.0–8.1)	—[b]	9.2 (6.3–12.1)	3.6 (2.0–5.2)	—[b]
Kentucky	5.7 (4.0–7.5)	—[b]	6.5 (3.7–9.4)	3.5 (1.7–5.2)	—[b]
Louisiana	6.1 (3.8–8.3)	—[b]	8.1 (3.8–12.3)	—[b]	—[b]
Maine	7.1 (4.9–9.4)	—[b]	8.8 (4.8–12.7)	3.6 (1.7–5.5)	6.3 (3.1–9.5)
Maryland	5.8 (4.3–7.3)	—[b]	5.7 (3.6–7.9)	4.9 (2.6–7.2)	—[b]
Massachusetts	5.9 (4.2–7.5)	—[b]	8.8 (5.4–12.2)	—[b]	—[b]
Michigan	5.0 (3.6–6.4)	14.6 (6.2–23.0)	4.8 (2.6–7.0)	2.7 (1.3–4.2)	5.9 (2.4–9.3)
Minnesota	6.4 (5.1–7.7)	—[b]	7.3 (5.4–9.2)	4.5 (3.0–6.0)	—[b]
Mississippi	3.3 (2.1–4.5)	—[b]	4.9 (2.5–7.2)	—[b]	—[b]
Missouri	6.1 (4.6–7.6)	—[b]	6.5 (4.1–8.9)	5.8 (3.4–8.3)	—[b]
Montana	6.7 (4.5–8.9)	—[b]	8.7 (4.5–13.0)	4.8 (2.4–7.3)	—[b]
Nebraska	6.3 (4.7–7.9)	—[b]	7.4 (4.7–10.2)	3.7 (1.7–5.6)	3.8 (2.1–5.4)
Nevada	9.8 (5.0–14.7)	—[b]	—[b]	—[b]	—[b]
New Hampshire	5.2 (2.6–7.8)	—[c]	—[b]	—[b]	—[b]
New Jersey	7.1 (5.3–8.9)	—[b]	9.4 (6.1–12.7)	4.2 (2.5–5.9)	—[b]
New Mexico	6.6 (4.3–8.9)	—[b]	6.8 (3.5–10.1)	3.0 (1.3–4.7)	—[b]
New York	6.7 (5.2–8.2)	—[b]	7.9 (5.2–10.6)	5.2 (3.3–7.2)	5.1 (2.7–7.4)
North Carolina	6.8 (4.7–8.9)	—[b]	8.5 (4.5–12.5)	—[b]	—[b]
North Dakota	5.7 (3.2–8.2)	—[b]	—[b]	—[b]	—[b]
Ohio	4.0 (3.0–5.0)	—[b]	4.5 (2.9–6.0)	3.1 (2.0–4.3)	—[b]
Oklahoma	4.3 (2.7–5.8)	—[b]	4.3 (1.9–6.6)	—[b]	—[b]

Table 2.30 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Oregon	8.1 (5.7–10.4)	—[b]	10.9 (6.8–15.0)	—[b]	—[b]
Pennsylvania	6.1 (4.3–8.0)	—[b]	8.0 (4.7–11.4)	4.2 (1.9–6.6)	—[b]
Rhode Island	8.5 (5.2–11.8)	—[b]	11.1 (5.6–16.7)	—[b]	—[b]
South Carolina	5.7 (3.4–8.0)	—[b]	—[b]	—[b]	—[b]
South Dakota	5.3 (2.1–8.4)	—[b]	—[b]	—[b]	—[b]
Tennessee	5.0 (2.5–7.4)	—[b]	8.1 (4.1–12.2)	—[b]	—[b]
Texas	7.2 (4.8–9.6)	—[b]	9.7 (5.2–14.2)	—[b]	—[b]
Utah	10.2 (7.5–12.9)	—[b]	10.9 (7.0–14.9)	7.3 (3.8–10.9)	—[b]
Vermont	6.8 (3.5–10.0)	—[b]	—[b]	—[b]	—[b]
Virginia	7.3 (5.4–9.2)	—[b]	8.7 (5.4–11.9)	2.8 (1.2–4.5)	8.0 (3.6–12.4)
Washington	8.1 (6.4–9.9)	—[b]	10.7 (7.5–13.9)	4.4 (2.7–6.1)	8.3 (4.2–12.3)
West Virginia	5.7 (4.0–7.4)	—[b]	7.0 (4.3–9.8)	—[b]	—[b]
Wisconsin	8.0 (5.2–10.7)	—[c]	11.0 (5.6–16.4)	8.4 (4.4–12.4)	—[b]
Wyoming	7.1 (4.5–9.7)	—[b]	—[b]	8.1 (3.6–12.5)	—[b]
Region					
Northeast	6.4 (5.6–7.2)	7.6 (4.4–10.8)	8.1 (6.7–9.6)	4.6 (3.6–5.6)	5.4 (3.6–7.2)
Midwest	5.7 (5.1–6.2)	8.5 (6.0–11.1)	6.4 (5.4–7.4)	4.4 (3.7–5.2)	4.7 (3.3–6.1)
South	5.9 (5.2–6.6)	10.4 (7.5–13.3)	7.7 (6.4–9.0)	3.2 (2.5–3.9)	4.3 (3.1–5.5)
West	7.7 (6.5–9.0)	9.9 (5.4–14.3)	9.0 (7.0–10.9)	6.4 (4.1–8.8)	5.0 (3.2–6.8)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI** = confidence interval.
[a]Having quit smoking cigarettes for at least 6 months during the past year, among people who currently smoked cigarettes and among those who quit smoking during the past year.
[b]Estimate is not presented because of a relative standard error >30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and multiplied by 100.
[c]Data were not available for this age group in this state.

Table 2.31 Prevalence of the use of electronic vapor products[a] among high school students, by location; national Youth Risk Behavior Survey (YRBS) 2019, United States

Location	Ever use:[b] % (95% CI)	Past-30-day use:[c] % (95% CI)	≥20-days use:[d] % (95% CI)	Daily use:[e] % (95% CI)
Alabama	54.4 (47.7–61.0)	19.4 (15.8–23.6)	7.5 (5.5–10.1)	5.5 (4.1–7.4)
Alaska	45.8 (42.8–48.9)	26.1 (22.6–29.9)	6.8 (4.6–9.9)	4.5 (2.7–7.6)
Arizona	48.4 (43.8–53.0)	17.9 (14.0–22.7)	7.8 (4.6–12.7)	5.7 (3.4–9.3)
Arkansas	51.5 (46.8–56.2)	24.3 (20.5–28.6)	10.1 (7.4–13.8)	8.5 (6.0–11.8)
California	42.3 (36.4–48.4)	18.2 (15.3–21.4)	3.6 (2.4–5.4)	2.4 (1.4–4.1)
Colorado	50.3 (46.2–54.4)	28.9 (24.8–33.4)	9.9 (7.2–13.5)	7.1 (4.9–10.1)
Connecticut	44.8 (40.1–49.7)	27.0 (22.8–31.7)	8.5 (6.1–11.7)	6.1 (4.1–8.9)
Delaware	—[f]	—[f]	—[f]	—[f]
District of Columbia	—[f]	—[f]	—[f]	—[f]
Florida	—[f]	—[f]	—[f]	—[f]

Table 2.31 Continued

Location	Ever use:[b] % (95% CI)	Past-30-day use:[c] % (95% CI)	≥20-days use:[d] % (95% CI)	Daily use:[e] % (95% CI)
Georgia	42.3 (38.5–46.2)	17.0 (13.9–20.6)	5.4 (3.5–8.0)	3.9 (2.6–5.9)
Hawai'i	48.3 (45.1–51.5)	30.6 (27.6–33.8)	10.4 (8.8–12.2)	7.9 (6.8–9.2)
Idaho	48.1 (44.7–51.4)	21.5 (18.9–24.4)	8.5 (6.6–11)	6.3 (4.7–8.5)
Illinois	49.2 (45.9–52.5)	19.9 (17.1–23.0)	8.0 (6.1–10.3)	5.5 (4.1–7.3)
Indiana	—[f]	—[f]	—[f]	—[f]
Iowa	47.5 (44.6–50.5)	20.1 (16.8–23.8)	8.2 (5.3–12.3)	6.4 (4.0–10)
Kansas	48.6 (45.3–52.0)	22.0 (18.9–25.5)	8.1 (6.2–10.6)	5.2 (3.6–7.4)
Kentucky	53.7 (49.6–57.7)	26.1 (22.0–30.5)	11.1 (8.9–13.8)	8.7 (6.9–10.8)
Louisiana	52.0 (46.9–57.1)	22.9 (17.7–29.1)	8.7 (4.4–16.4)	6.6 (3.3–12.9)
Maine	46.3 (44.5–48.0)	30.2 (28.9–31.6)	9.4 (8.3–10.5)	6.3 (5.7–7.0)
Maryland	39.7 (38.6–40.9)	23.0 (22.0–24.1)	5.5 (5.0–6.0)	3.7 (3.3–4.0)
Massachusetts	50.7 (46.7–54.7)	32.2 (28.4–36.3)	11.0 (8.9–13.4)	8.2 (6.8–9.9)
Michigan	49.8 (46.5–53.1)	20.8 (17.2–24.9)	9.9 (7.3–13.4)	7.2 (5.3–9.6)
Minnesota	—[f]	—[f]	—[f]	—[f]
Mississippi	48.3 (43.7–52.8)	21.4 (18.2–25.0)	6.9 (5.2–9.1	4.5 (3.2–6.3)
Missouri	49.6 (43.4–55.8)	20.7 (16.2–25.9)	9.4 (6.6–13.3)	6.9 (4.6–10.3)
Montana	58.3 (55.7–61.0)	30.2 (27.8–32.7)	12.7 (11.2–14.3)	8.7 (7.5–10.1)
Nebraska	49.2 (44.7–53.7)	17.1 (13.6–21.2)	6.5 (4.6–9.0)	5.1 (3.4–7.5)
Nevada	44.5 (40.9–48.2)	24.1 (21.2–27.3)	6.7 (4.1–10.8)	3.3 (1.9–5.5)
New Hampshire	49.8 (48.4–51.2)	33.8 (32.6–35.1)	13.5 (12.7–14.4)	9.5 (8.8–10.2)
New Jersey	44.7 (39.9–49.6)	27.6 (24.0–31.6)	5.7 (3.9–8.3)	3.7 (2.3–5.8)
New Mexico	56.3 (52.7–59.9)	34.0 (30.7–37.5)	7.9 (6.5–9.7)	5.6 (4.4–7.0)
New York	42.7 (40.7–44.8)	22.4 (20.4–24.5)	6.4 (5.2–7.9)	4.6 (3.5–5.9)
North Carolina	52.4 (49.3–55.5)	35.5 (32.5–38.5)	11.1 (8.1–15.0)	8.3 (5.7–12.0)
North Dakota	52.8 (49.3–56.3)	33.1 (29.8–36.7)	12.1 (10.3–14.2)	8.3 (6.8–10.2)
Ohio	47.7 (43.4–52.1)	29.8 (25.7–34.3)	8.0 (5.2–12.2)	5.3 (3.3–8.3)
Oklahoma	57.7 (53.6–61.8)	27.8 (23.7–32.3)	11.4 (9.1–14.2)	8.4 (6.7–10.5)
Oregon	—[f]	—[f]	—[f]	—[f]
Pennsylvania	52.6 (49.9–55.3)	24.4 (21.2–27.9)	10.0 (8.0–12.4)	7.4 (5.8–9.4)
Rhode Island	48.9 (45.3–52.5)	30.1 (25.2–35.5)	10.2 (7.2–14.3)	7.3 (5.3–10.1)
South Carolina	47.3 (41.5–53.2)	21.1 (16.2–27.0)	9.0 (6.2–12.8)	7.0 (4.9–10.0)
South Dakota	50.6 (44.9–56.3)	23.9 (19.5–28.9)	9.2 (7.1–11.7)	5.9 (4.5–7.6)
Tennessee	50.6 (46.2–55.0)	22.1 (17.6–27.3)	7.4 (5.5–9.7)	5.5 (4.0–7.6)
Texas	48.7 (44.9–52.5)	18.7 (15.3–22.6)	6.5 (4.4–9.5)	4.8 (3.2–7.2)
Utah	30.5 (26.0–35.5)	9.7 (7.3–12.6)	3.3 (2.3–4.7)	2.4 (1.6–3.8)
Vermont	49.8 (49.1–50.6)	26.4 (25.7–27.1)	11.3 (10.8–11.9)	8.1 (7.7–8.6)
Virginia	—[f]	19.9 (18.1–21.9)	6.3 (5.2–7.7)	4.2 (3.4–5.2)
Washington	—[f]	—[f]	—[f]	—[f]
West Virginia	62.4 (57.6–67.0)	35.7 (30.7–41.1)	16.7 (12.3–22.3)	12.6 (9.2–17.0)
Wisconsin	45.5 (41.9–49.2)	20.6 (17.0–24.8)	8.5 (6.5–11.1)	5.6 (4.1–7.6)
Wyoming	—[f]	—[f]	—[f]	—[f]

Table 2.31 Continued
Source: CDC (n.d.a).
Notes: **CI =** confidence interval.
[a]Includes use of e-cigarettes, e-cigars, e-pipes, vape pipes, vaping pens, e-hookahs, and hookah pens.
[b]Even one or two puffs.
[c]On at least 1 day during the 30 days before the survey.
[d]On 20 or more days during the 30 days before the survey.
[e]On all 30 days during the 30 days before the survey.
[f]The number of respondents within the subgroup did not meet the minimum reporting threshold or data were not available.

Table 2.32 Prevalence of ever use of e-cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	28.7 (26.9–30.5)	58.3 (51.3–65.3)	40.4 (36.8–43.9)	22.1 (19.5–24.8)	7.9 (6.3–9.5)
Alaska	25.7 (23.4–28.1)	37.3 (28.1–46.5)	37.1 (32.6–41.6)	18.8 (15.5–22.1)	7.4 (5.1–9.8)
Arizona	—[b]	—[b]	—[b]	—[b]	—[b]
Arkansas	28.7 (26.7–30.7)	52.1 (43.4–60.8)	40.2 (36.1–44.3)	23.0 (20.3–25.7)	9.4 (7.8–11.0)
California	—[b]	—[b]	—[b]	—[b]	—[b]
Colorado	—[b]	—[b]	—[b]	—[b]	—[b]
Connecticut	21.0 (19.5–22.4)	46.9 (40.3–53.6)	30.3 (27.4–33.2)	14.9 (13.0–16.9)	4.8 (3.5–6.0)
Delaware	22.2 (20.2–24.3)	39.0 (30.3–47.6)	35.7 (31.2–40.3)	15.7 (13.1–18.2)	6.6 (4.7–8.6)
District of Columbia	—[b]	—[b]	—[b]	—[b]	—[b]
Florida	23.8 (21.8–25.9)	45.6 (37.2–54.1)	36.2 (31.5–40.9)	21.4 (17.8–25.1)	7.4 (5.7–9.1)
Georgia	26.1 (24.4–27.8)	50.6 (43.5–57.7)	36.2 (32.7–39.7)	19.4 (17.1–21.7)	8.0 (6.6–9.4)
Hawai'i	25.2 (23.8–26.6)	47.9 (42.4–53.4)	38.8 (35.9–41.7)	18.2 (16.0–20.3)	6.2 (4.9–7.5)
Idaho	25.5 (23.7–27.2)	49.0 (42.8–55.2)	35.9 (32.5–39.4)	18.0 (15.4–20.7)	7.5 (5.6–9.4)
Illinois	12.2 (10.6–13.8)	32.8 (24.7–40.9)	16.3 (13.3–19.3)	8.3 (6.3–10.4)	2.9 (1.4–4.3)
Indiana	27.5 (26.2–28.8)	46.6 (41.3–51.8)	39.1 (36.4–41.8)	22.4 (20.6–24.2)	7.9 (6.7–9.1)
Iowa	—[b]	—[b]	—[b]	—[b]	—[b]
Kansas	28.6 (26.9–30.3)	51.7 (45.3–58.0)	41.5 (38.1–44.9)	19.9 (17.4–22.3)	7.8 (6.2–9.4)
Kentucky	30.4 (28.3–32.4)	52.8 (44.8–60.9)	45.8 (41.8–49.9)	23.0 (20.0–25.9)	8.7 (6.6–10.9)
Louisiana	—[b]	—[b]	—[b]	—[b]	—[b]
Maine	19.5 (18.1–20.9)	42.1 (35.0–49.1)	33.4 (30.2–36.5)	13.4 (11.8–15.1)	5.1 (4.1–6.0)
Maryland	19.7 (18.6–20.8)	37.6 (32.8–42.5)	29.7 (27.4–32.1)	13.4 (12.1–14.7)	5.4 (4.5–6.3)
Massachusetts	19.1 (17.2–21.0)	44.1 (35.7–52.4)	28.3 (24.2–32.4)	12.2 (9.9–14.5)	4.5 (3.0–5.9)
Michigan	26.6 (24.8–28.4)	55.0 (48.6–61.3)	37.7 (33.9–41.6)	18.8 (16.3–21.3)	7.7 (6.0–9.5)
Minnesota	24.0 (23.1–24.9)	51.7 (47.8–55.5)	35.1 (33.3–36.9)	15.7 (14.5–16.8)	5.4 (4.6–6.2)
Mississippi	23.1 (21.5–24.6)	39.4 (32.8–45.9)	33.6 (30.4–36.7)	18.9 (16.7–21.1)	5.1 (4.0–6.2)
Missouri	27.4 (26.1–28.8)	51.6 (46.6–56.7)	40.3 (37.5–43.1)	21.0 (18.9–23.0)	7.2 (5.9–8.5)
Montana	28.4 (26.9–29.9)	65.2 (59.8–70.6)	41.7 (38.6–44.9)	18.6 (16.6–20.6)	7.9 (6.4–9.4)
Nebraska	24.9 (23.7–26.1)	55.6 (51.5–59.7)	34.6 (32.2–37.0)	16.3 (14.7–17.9)	4.9 (4.1–5.8)

Table 2.32 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Nevada	28.4 (25.6–31.3)	48.9 (38.3–59.5)	39.0 (33.5–44.6)	20.1 (16.0–24.2)	11.8 (7.9–15.6)
New Hampshire	25.2 (23.4–27.0)	55.4 (47.5–63.3)	42.9 (38.9–47.0)	14.9 (13.1–16.7)	6.2 (4.7–7.7)
New Jersey	22.7 (21.5–23.9)	45.3 (40.5–50.1)	33.9 (31.5–36.3)	15.1 (13.6–16.6)	6.4 (5.2–7.5)
New Mexico	29.7 (27.7–31.7)	56.5 (49.4–63.6)	45.2 (41.1–49.4)	19.7 (17.1–22.4)	8.9 (7.1–10.7)
New York	21.0 (19.7–22.2)	42.4 (37.2–47.7)	30.6 (28.0–33.1)	13.8 (12.3–15.3)	5.8 (4.5–7.1)
North Carolina	21.9 (20.4–23.4)	40.3 (34.0–46.5)	30.3 (27.3–33.4)	19.0 (16.6–21.3)	6.7 (5.1–8.2)
North Dakota	25.1 (23.0–27.2)	57.1 (49.2–65.0)	35.9 (31.8–40.0)	14.4 (11.8–16.9)	4.7 (3.5–6.0)
Ohio	28.2 (27.0–29.4)	53.6 (48.9–58.2)	41.1 (38.6–43.5)	21.6 (19.9–23.2)	7.1 (6.0–8.2)
Oklahoma	—[b]	—[b]	—[b]	—[b]	—[b]
Oregon	21.0 (19.6–22.4)	42.7 (37.0–48.5)	30.3 (27.5–33.1)	15.7 (13.7–17.7)	6.6 (4.8–8.3)
Pennsylvania	21.5 (19.9–23.2)	42.7 (35.6–49.7)	35.8 (32.2–39.4)	13.8 (11.8–15.9)	6.0 (4.1–7.8)
Rhode Island	22.9 (20.9–24.8)	49.7 (40.9–58.6)	32.9 (28.9–36.9)	14.9 (12.8–17.0)	6.6 (5.1–8.2)
South Carolina	—[b]	—[b]	—[b]	—[b]	—[b]
South Dakota	23.4 (21.0–25.8)	60.3 (50.9–69.7)	33.3 (28.2–38.5)	15.1 (11.8–18.4)	4.2 (2.8–5.6)
Tennessee	29.8 (27.7–32.0)	59.2 (51.0–67.5)	42.8 (38.6–47.1)	23.0 (20.0–26.0)	10.1 (7.9–12.4)
Texas	21.9 (20.1–23.6)	42.2 (34.8–49.7)	30.5 (27.2–33.9)	15.0 (12.8–17.2)	7.6 (4.8–10.4)
Utah	24.5 (23.4–25.6)	40.6 (37.0–44.2)	32.5 (30.5–34.6)	16.2 (14.5–17.9)	5.1 (4.0–6.1)
Vermont	21.8 (20.0–23.5)	46.6 (38.1–55.1)	34.7 (31.0–38.5)	14.4 (12.6–16.3)	5.3 (3.8–6.7)
Virginia	24.6 (23.2–25.9)	50.4 (44.7–56.1)	37.0 (34.1–39.9)	16.0 (14.2–17.7)	6.0 (4.8–7.1)
Washington	25.5 (24.4–26.5)	49.6 (45.2–54.1)	36.8 (34.6–39.0)	18.2 (16.8–19.7)	8.2 (7.0–9.4)
West Virginia	28.4 (26.8–29.9)	56.3 (49.5–63.2)	42.4 (39.0–45.8)	23.3 (21.1–25.5)	8.1 (6.6–9.6)
Wisconsin	—[b]	—[b]	—[b]	—[b]	—[b]
Wyoming	28.6 (26.4–30.9)	61.0 (51.9–70.1)	41.1 (36.8–45.4)	19.5 (16.6–22.4)	7.1 (5.6–8.6)
Region					
Northeast	21.4 (20.7–22.0)	43.9 (41.1–46.8)	32.5 (31.1–33.9)	14.1 (13.3–14.9)	5.8 (5.1–6.5)
Midwest	23.8 (23.2–24.4)	48.9 (46.6–51.3)	34.1 (32.8–35.3)	17.3 (16.5–18.1)	6.2 (5.6–6.7)
South	24.3 (23.7–25.0)	46.6 (43.9–49.3)	35.1 (33.8–36.4)	18.6 (17.7–19.6)	7.5 (6.7–8.2)
West	25.5 (24.9–26.0)	48.0 (45.9–50.2)	36.4 (35.3–37.6)	18.0 (17.1–18.8)	7.8 (7.1–8.4)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Ever e-cigarette use was defined as having used an e-cigarette or other electronic vaping product, even just one time, in one's entire life.
[b]Eight states (Arizona, California, Colorado, Iowa, Louisiana, Oklahoma, South Carolina, and Wisconsin) and the District of Columbia did not field the 2020 BRFSS optional module for e-cigarettes.

In the states with available data, the state-specific prevalence of current e-cigarette use (uses e-cigarettes or other electronic vaping product every day or some days) among adults in 2020 ranged from 3.4% (95% CI, 2.5–4.2) in Illinois to 7.2% (95% CI, 6.5–7.9) in Utah (Table 2.33). The prevalence of current e-cigarette use was 0.4 percentage points (Maryland, 3.8%; 95% CI, 3.2–4.4) to 3.8 percentage points (Utah, 7.2%; 95% CI, 6.5–7.9) higher in other states (with available data) than it was in Illinois. By region, the prevalence of current e-cigarette use among adults was higher in the West (5.7%; 95% CI, 5.3–6.0) than it was in the Northeast (4.6%; 95% CI, 4.2–4.9) but was otherwise similar by region (Figure 2.17).

Table 2.33 Prevalence of current use of e-cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	6.1 (5.0–7.1)	22.7 (16.6–28.8)	7.4 (5.5–9.3)	2.6 (1.7–3.5)	1.0 (0.5–1.4)
Alaska	5.0 (3.7–6.3)	14.9 (8.6–21.2)	6.0 (3.5–8.5)	2.3 (1.1–3.6)	—[b]
Arizona	—[c]	—[c]	—[c]	—[c]	—[c]
Arkansas	5.7 (4.6–6.8)	13.9 (8.1–19.8)	9.1 (6.7–11.5)	2.6 (1.6–3.6)	1.1 (0.6–1.7)
California	—[c]	—[c]	—[c]	—[c]	—[c]
Colorado	—[c]	—[c]	—[c]	—[c]	—[c]
Connecticut	4.5 (3.8–5.2)	14.6 (10.4–18.8)	5.9 (4.5–7.2)	2.4 (1.7–3.1)	—[b]
Delaware	4.5 (3.5–5.6)	12.2 (6.4–18.0)	7.2 (4.7–9.7)	1.8 (1.0–2.6)	—[b]
District of Columbia	—[c]	—[c]	—[c]	—[c]	—[c]
Florida	5.7 (4.5–6.9)	14.8 (9.1–20.4)	9.7 (6.4–13.0)	3.5 (2.1–4.9)	—[b]
Georgia	5.6 (4.7–6.5)	15.7 (10.9–20.4)	7.9 (6.1–9.7)	2.9 (1.9–3.9)	—[b]
Hawai‘i	5.9 (5.1–6.8)	18.9 (14.5–23.3)	8.8 (7.0–10.6)	2.5 (1.6–3.5)	0.8 (0.4–1.3)
Idaho	6.7 (5.6–7.7)	22.5 (17.3–27.7)	8.2 (6.3–10.2)	3.0 (1.8–4.2)	—[b]
Illinois	3.4 (2.5–4.2)	11.3 (6.3–16.4)	4.5 (2.9–6.0)	1.8 (0.9–2.7)	—[b]
Indiana	5.7 (5.0–6.5)	14.2 (10.6–17.8)	8.5 (6.9–10.1)	3.3 (2.5–4.0)	0.7 (0.4–1.1)
Iowa	—[c]	—[c]	—[c]	—[c]	—[c]
Kansas	6.6 (5.6–7.7)	20.6 (15.4–25.8)	8.0 (6.2–9.9)	3.2 (2.1–4.3)	1.1 (0.5–1.7)
Kentucky	6.7 (5.6–7.9)	16.0 (10.5–21.5)	11.2 (8.6–13.8)	3.4 (2.3–4.4)	—[b]
Louisiana	—[c]	—[c]	—[c]	—[c]	—[c]
Maine	4.3 (3.5–5.1)	14.0 (8.6–19.4)	7.8 (5.9–9.7)	1.6 (1.0–2.1)	0.6 (0.3–0.9)
Maryland	3.8 (3.2–4.4)	9.4 (6.3–12.5)	6.2 (5.0–7.5)	1.9 (1.3–2.4)	—[b]
Massachusetts	4.0 (3.0–5.1)	15.7 (9.0–22.3)	5.0 (3.0–6.9)	1.8 (1.0–2.6)	—[b]
Michigan	6.4 (5.4–7.5)	21.1 (16.1–26.1)	8.6 (6.2–11.0)	2.9 (1.8–3.9)	—[b]
Minnesota	4.9 (4.3–5.4)	18.2 (15.0–21.4)	5.9 (5.0–6.8)	2.0 (1.6–2.4)	0.6 (0.3–0.9)
Mississippi	4.6 (3.8–5.5)	13.5 (9.0–17.9)	6.5 (4.8–8.2)	2.5 (1.7–3.4)	—[b]
Missouri	5.7 (5.0–6.4)	16.1 (12.4–19.7)	8.0 (6.5–9.5)	3.4 (2.5–4.3)	0.7 (0.3–1.2)
Montana	4.9 (4.2–5.7)	21.8 (17.1–26.5)	5.6 (4.1–7.1)	1.5 (0.9–2.1)	0.8 (0.3–1.2)
Nebraska	5.9 (5.2–6.5)	20.9 (17.5–24.3)	6.8 (5.5–8.1)	2.4 (1.7–3.0)	0.8 (0.4–1.2)
Nevada	6.7 (4.9–8.4)	20.8 (11.5–30.2)	9.1 (5.7–12.5)	2.3 (1.1–3.6)	—[b]
New Hampshire	5.5 (4.5–6.5)	19.9 (13.6–26.1)	9.3 (7.0–11.6)	1.5 (0.9–2.0)	—[b]
New Jersey	5.0 (4.3–5.6)	13.1 (10.1–16.0)	7.4 (6.0–8.8)	2.7 (1.9–3.4)	0.8 (0.4–1.2)
New Mexico	5.6 (4.4–6.7)	17.6 (12.1–23.1)	7.8 (5.3–10.3)	2.3 (1.3–3.3)	—[b]
New York	4.1 (3.5–4.7)	10.6 (7.3–13.8)	5.2 (4.1–6.3)	2.7 (1.9–3.5)	1.1 (0.6–1.6)
North Carolina	4.7 (3.9–5.4)	13.9 (9.5–18.2)	5.6 (4.2–7.0)	3.5 (2.5–4.6)	—[b]
North Dakota	4.5 (3.5–5.5)	10.8 (6.2–15.5)	7.2 (5.0–9.4)	1.9 (0.9–2.9)	—[b]
Ohio	6.0 (5.3–6.7)	19.0 (15.4–22.5)	7.8 (6.5–9.2)	3.3 (2.6–4.1)	—[b]
Oklahoma	—[c]	—[c]	—[c]	—[c]	—[c]

Table 2.33 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Oregon	4.5 (3.8–5.2)	14.1 (10.0–18.1)	6.1 (4.7–7.6)	2.7 (1.8–3.6)	0.8 (0.3–1.2)
Pennsylvania	5.3 (4.4–6.2)	15.1 (10.4–19.8)	8.1 (6.1–10.2)	2.8 (1.8–3.7)	—[b]
Rhode Island	4.6 (3.5–5.6)	13.2 (7.5–18.9)	7.2 (4.9–9.5)	1.8 (1.1–2.6)	—[b]
South Carolina	—[c]	—[c]	—[c]	—[c]	—[c]
South Dakota	3.9 (2.8–5.1)	13.8 (6.9–20.7)	4.8 (2.7–6.9)	2.0 (0.9–3.1)	—[b]
Tennessee	6.9 (5.6–8.3)	29.1 (20.0–38.3)	8.0 (5.8–10.2)	3.6 (2.3–4.8)	—[b]
Texas	4.7 (3.8–5.5)	9.4 (5.6–13.3)	6.7 (4.9–8.6)	2.8 (1.9–3.8)	—[b]
Utah	7.2 (6.5–7.9)	17.6 (14.7–20.4)	8.9 (7.6–10.2)	3.0 (2.3–3.8)	—[b]
Vermont	4.0 (3.1–5.0)	12.2 (6.3–18.1)	5.9 (4.0–7.7)	2.2 (1.4–3.1)	—[b]
Virginia	5.2 (4.4–5.9)	14.8 (11.0–18.5)	7.7 (6.0–9.3)	2.4 (1.7–3.2)	—[b]
Washington	5.2 (4.6–5.8)	13.2 (10.5–16.0)	7.5 (6.3–8.7)	3.0 (2.3–3.6)	1.4 (0.8–2.0)
West Virginia	6.3 (5.3–7.3)	23.1 (16.9–29.3)	9.2 (7.2–11.2)	2.7 (1.8–3.5)	0.9 (0.4–1.4)
Wisconsin	—[c]	—[c]	—[c]	—[c]	—[c]
Wyoming	5.9 (4.7–7.1)	18.3 (11.6–25.0)	8.4 (6.0–10.9)	2.4 (1.3–3.5)	—[b]
Region					
Northeast	4.6 (4.2–4.9)	13.0 (11.2–14.8)	6.4 (5.7–7.1)	2.5 (2.1–2.9)	0.9 (0.6–1.1)
Midwest	5.3 (5.0–5.7)	16.9 (15.2–18.6)	7.1 (6.4–7.8)	2.7 (2.4–3.1)	0.7 (0.5–0.8)
South	5.3 (4.9–5.6)	14.4 (12.7–16.1)	7.7 (6.9–8.4)	3.0 (2.6–3.3)	1.1 (0.8–1.3)
West	5.7 (5.3–6.0)	16.7 (15.1–18.4)	7.7 (7.0–8.4)	2.7 (2.4–3.0)	1.1 (0.8–1.3)

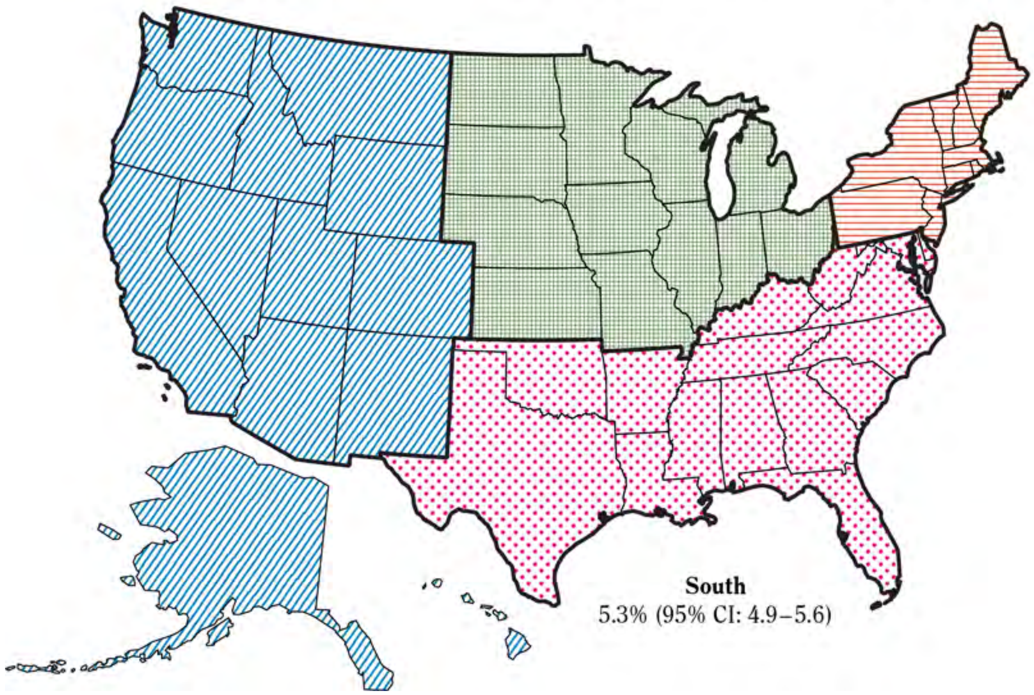
Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Current use of e-cigarettes was defined as having ever used such products and using them every day or some days at the time of the survey.
[b]Estimate is not presented because of a relative standard error >30%.
[c]Eight states (Arizona, California, Colorado, Iowa, Louisiana, Oklahoma, South Carolina, and Wisconsin) and the District of Columbia did not field the 2020 BRFSS optional module for e-cigarettes.

Consistent with earlier findings (Delnevo et al. 2016), young adults had the highest prevalence of ever e-cigarette use among all age groups and across all states with available data. In 2020, the state-specific prevalence of ever use of e-cigarettes among young adults ranged from 32.8% (95% CI, 24.7–40.9) in Illinois to 65.2% (95% CI, 59.8–70.6) in Montana (Table 2.32). The prevalence of ever e-cigarette use among young adults was 4.5 percentage points (Alaska, 37.3%; 95% CI, 28.1–46.5) to 32.4 percentage points (Montana, 65.2%; 95% CI, 59.8–70.6) higher in other states (with available data) than it was in Illinois. By region, ever use of e-cigarettes among young adults ranged from 43.9% (95% CI, 41.1–46.8) in the Northeast to 48.9% (95% CI, 46.6–51.3) in the Midwest.

Among states with available data, the state-specific prevalence of current e-cigarette use among young adults in 2020 ranged from 9.4% in Maryland (95% CI, 6.3–12.5) and Texas (95% CI, 5.6–13.3) to 29.1% (95% CI, 20.0–38.3) in Tennessee (Table 2.33). The prevalence of current e-cigarette use among young adults was 1.2 percentage points (New York, 10.6%; 95% CI, 7.3–13.8) to 19.7 percentage points (Tennessee, 29.1%; 95% CI, 20.0–38.3) higher in other states (with available data) than it was in Maryland and Texas. By region, the prevalence of current e-cigarette use among young adults was lower in the Northeast (13.0%; 95% CI, 11.2–14.8) than it was in the West (16.7%; 95% CI, 15.1–18.4) and the Midwest (16.9%; 95% CI, 15.2–18.6); the prevalence of current e-cigarette use among young adults was 14.4% (95% CI, 12.7–16.1) in the South.

Daily Versus Nondaily Use of E-Cigarettes. Among states with available data, daily use of e-cigarettes among adults in 2020 ranged from 1.2% (95% CI, 0.7–1.8) in Illinois to 3.6% (95% CI, 3.1–4.1) in Utah (Table 2.34). The prevalence of nondaily e-cigarette use was higher than daily use of e-cigarettes among adults in all states.

Figure 2.17 Prevalence of current use of e-cigarettes[a] among adults, 18 years of age and older, by region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States



Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Current use of e-cigarettes was defined as having ever used such products and using them every day or some days at the time of the survey.

Table 2.34 Prevalence of daily use of e-cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2018, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	2.7 (2.0–3.5)	9.6 (4.9–14.2)	3.2 (1.9–4.5)	1.4 (0.8–2.0)	0.6 (0.3–1.0)
Alaska	1.7 (0.9–2.4)	—[b]	—[b]	—[b]	—[b]
Arizona	—[c]	—[c]	—[c]	—[c]	—[c]
Arkansas	2.8 (2.0–3.5)	7.2 (3.2–11.1)	4.2 (2.7–5.8)	1.4 (0.6–2.1)	—[b]
California	—[c]	—[c]	—[c]	—[c]	—[c]
Colorado	—[c]	—[c]	—[c]	—[c]	—[c]
Connecticut	1.8 (1.3–2.3)	6.3 (3.2–9.4)	1.9 (1.2–2.7)	1.2 (0.7–1.7)	—[b]
Delaware	1.8 (1.2–2.5)	—[b]	3.4 (1.9–5.0)	—[b]	—[b]
District of Columbia	—[c]	—[c]	—[c]	—[c]	—[c]
Florida	2.3 (1.6–3.0)	8.0 (3.4–12.6)	2.8 (1.4–4.1)	—[b]	—[b]

Table 2.34 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Georgia	2.5 (1.9–3.1)	6.3 (3.0–9.6)	3.6 (2.4–4.8)	1.4 (0.7–2.1)	—[b]
Hawai‘i	3.4 (2.7–4.1)	9.2 (5.8–12.7)	5.4 (3.9–7.0)	1.6 (0.7–2.5)	—[b]
Idaho	3.4 (2.6–4.1)	12.0 (7.9–16.2)	4.0 (2.6–5.3)	—[b]	—[b]
Illinois	1.2 (0.7–1.8)	—[b]	—[b]	—[b]	—[b]
Indiana	2.8 (2.3–3.3)	7.2 (4.5–10.0)	4.2 (3.0–5.4)	1.5 (1.0–2.0)	—[b]
Iowa	—[c]	—[c]	—[c]	—[c]	—[c]
Kansas	2.9 (2.2–3.5)	7.5 (4.3–10.7)	3.5 (2.3–4.7)	1.7 (0.8–2.6)	—[b]
Kentucky	2.8 (2.1–3.5)	5.7 (2.5–9.0)	5.1 (3.3–6.8)	1.3 (0.7–1.8)	—[b]
Louisiana	—[c]	—[c]	—[c]	—[c]	—[c]
Maine	1.9 (1.3–2.5)	7.9 (3.3–12.4)	2.8 (1.6–3.9)	0.7 (0.3–1.0)	
Maryland	1.7 (1.3–2.0)	3.0 (1.3–4.7)	3.1 (2.1–4.1)	0.8 (0.4–1.1)	—[b]
Massachusetts	1.4 (0.8–2.0)	—[b]	—[b]	—[b]	—[b]
Michigan	3.1 (2.3–3.8)	10.2 (6.5–14.0)	4.1 (2.4–5.9)	1.3 (0.6–2.0)	—[b]
Minnesota	2.2 (1.8–2.5)	6.4 (4.5–8.3)	3.0 (2.3–3.7)	1.0 (0.7–1.2)	—[b]
Mississippi	2.0 (1.4–2.6)	4.8 (2.2–7.4)	2.9 (1.7–4.1)	1.3 (0.6–1.9)	—[b]
Missouri	2.5 (2.0–2.9)	6.4 (4.0–8.8)	3.5 (2.5–4.5)	1.6 (0.9–2.2)	—[b]
Montana	2.0 (1.5–2.4)	7.7 (4.6–10.8)	2.1 (1.2–3.0)	1.0 (0.5–1.5)	—[b]
Nebraska	2.6 (2.1–3.1)	9.9 (7.3–12.5)	2.8 (1.9–3.6)	1.0 (0.5–1.4)	—[b]
Nevada	2.7 (1.5–3.9)	—[b]	—[b]	—[b]	—[b]
New Hampshire	2.5 (1.8–3.2)	8.7 (4.4–13.0)	4.3 (2.7–5.9)	—[b]	—[b]
New Jersey	2.1 (1.7–2.6)	4.1 (2.5–5.7)	3.7 (2.6–4.8)	1.1 (0.5–1.7)	—[b]
New Mexico	1.9 (1.2–2.7)	—[b]	3.3 (1.5–5.1)	0.7 (0.3–1.1)	—[b]
New York	1.8 (1.4–2.2)	5.0 (2.4–7.6)	2.2 (1.5–2.9)	1.1 (0.6–1.7)	—[b]
North Carolina	2.0 (1.5–2.5)	7.0 (3.6–10.4)	2.3 (1.4–3.2)	1.5 (0.8–2.1)	—[b]
North Dakota	2.2 (1.5–2.9)	6.3 (2.6–9.9)	3.1 (1.6–4.6)	—[b]	—[b]
Ohio	2.9 (2.4–3.4)	9.9 (7.1–12.6)	3.5 (2.5–4.6)	1.4 (1.0–1.9)	—[b]
Oklahoma	—[c]	—[c]	—[c]	—[c]	—[c]
Oregon	2.0 (1.5–2.5)	6.5 (3.4–9.6)	2.4 (1.5–3.4)	1.3 (0.8–1.9)	—[b]
Pennsylvania	2.1 (1.6–2.6)	6.9 (3.8–9.9)	2.9 (1.7–4.0)	1.1 (0.5–1.8)	—[b]
Rhode Island	2.1 (1.3–2.8)	—[b]	3.6 (1.9–5.4)	—[b]	—[b]
South Carolina	—[c]	—[c]	—[c]	—[c]	—[c]
South Dakota	1.8 (1.1–2.5)	—[b]	—[b]	—[b]	—[b]
Tennessee	3.4 (2.3–4.5)	—[b]	4.4 (2.6–6.1)	1.8 (0.8–2.7)	—[b]
Texas	2.2 (1.6–2.9)	—[b]	4.2 (2.6–5.7)	1.2 (0.6–1.9)	—[b]
Utah	3.6 (3.1–4.1)	8.1 (6.1–10.1)	4.9 (3.9–5.8)	1.3 (0.8–1.9)	—[b]
Vermont	2.0 (1.2–2.8)	—[b]	2.3 (1.0–3.6)	1.1 (0.5–1.8)	—[b]
Virginia	2.4 (1.8–2.9)	6.1 (3.6–8.7)	3.9 (2.7–5.1)	1.0 (0.5–1.6)	—[b]
Washington	2.4 (2.0–2.7)	5.8 (3.8–7.7)	3.5 (2.6–4.3)	1.3 (0.9–1.8)	—[b]
West Virginia	2.2 (1.6–2.7)	7.0 (3.5–10.6)	3.2 (2.0–4.4)	0.9 (0.4–1.4)	—[b]
Wisconsin	—[c]	—[c]	—[c]	—[c]	—[c]
Wyoming	2.8 (2.0–3.7)	7.8 (3.4–12.2)	4.5 (2.7–6.3)	—[b]	—[b]

Table 2.34 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Region					
Northeast	1.9 (1.7–2.2)	5.6 (4.3–6.9)	2.6 (2.2–3.1)	1.1 (0.8–1.3)	0.4 (0.2–0.6)
Midwest	2.4 (2.2–2.6)	7.9 (6.7–9.2)	3.2 (2.7–3.7)	1.1 (0.9–1.3)	0.3 (0.2–0.4)
South	2.4 (2.1–2.6)	5.7 (4.6–6.8)	3.6 (3.1–4.1)	1.3 (1.1–1.6)	0.6 (0.4–0.8)
West	2.5 (2.3–2.8)	7.2 (6.1–8.2)	3.6 (3.1–4.0)	1.2 (1.0–1.5)	0.5 (0.3–0.6)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Daily use of e-cigarettes was defined as having ever used such products and using them every day at the time of the survey.
[b]Estimate is not presented because of a relative standard error >30%.
[c]Eight states (Arizona, California, Colorado, Iowa, Louisiana, Oklahoma, South Carolina, and Wisconsin) and the District of Columbia did not field the 2020 BRFSS optional module for e-cigarettes.

Among states with available data, the prevalence of nondaily e-cigarette use among adults ranged from 2.0% (95% CI, 1.4–2.6) in Vermont to 4.2% (95% CI, 3.3–5.0) in West Virginia (Table 2.35). The prevalence of daily and nondaily e-cigarette use was similar across regions, and nondaily use of e-cigarettes was higher than daily use in each of the four regions.

Many estimates of daily e-cigarette use among young adults in 2020 were suppressed due to a relative standard error greater than or equal to 30.0%. Available estimates ranged from 3.0% (95% CI, 1.3–4.7) in Maryland to 12.0% (95% CI, 7.9–16.2) in Idaho (Table 2.34). Generally, the prevalence of nondaily e-cigarette use among young adults was higher than the prevalence of daily use (Table 2.35). Among states with available data, the prevalence of nondaily e-cigarette use among young adults ranged from 5.6% (95% CI, 3.4–7.7) in New York to 16.6% (95% CI, 9.7–23.6) in Tennessee (Table 2.35). By region, the prevalence of daily e-cigarette use among young adults ranged from 5.6% (95% CI, 4.3–6.9) in the Northeast to 7.9% (95% CI, 6.7–9.2) in the Midwest, and nondaily use ranged from 7.4% (95% CI, 6.1–8.8) in the Northeast to 9.6% (95% CI, 8.3–10.9) in the West.

Smokeless Tobacco Use

Youth. For the 37 states with available data, past-30-day use of smokeless tobacco (chewing tobacco, snuff, dip, snus, or dissolvable tobacco products) among U.S. high school students in 2019 ranged from 1.7% (95% CI, 1.1–2.6) in Utah to 10.0% (95% CI, 5.8–16.6) in Alaska (Table 2.36). The prevalence of past-30-day smokeless tobacco use was 0.8 percentage points (Arizona, 2.5%; 95% CI, 2.0–3.3) to 8.3 percentage points (Alaska, 10.0%; 95% CI, 5.8–16.6) higher in other states (with available data) than it was in Utah.

Adults. The state-specific prevalence of current smokeless tobacco use (defined has having used chewing tobacco, snuff, or snus every day or some days) among all adults (18 years of age and older) in 2020 ranged from 0.8% (95% CI, 0.5–1.1) in Rhode Island to 8.9% (95% CI, 7.6–10.2) in Wyoming (Table 2.37). The prevalence of current smokeless tobacco use among adults was 0.7 percentage points (Massachusetts, 1.5%; 95% CI, 1.1–2.0) to 8.1 percentage points (Wyoming, 8.9%; 95% CI, 7.9–10.2) higher in other states than it was in Rhode Island. By region, current use of smokeless tobacco among all adults was highest in the South (3.9%; 95% CI, 3.7–4.2) and Midwest (3.7%; 95% CI, 3.5–3.9), followed by the West (2.7%; 95% CI, 2.4–2.9) and the Northeast (2.4%; 95% CI, 2.2–2.6) (Figure 2.18).

For states with available data, the state-specific prevalence of current use of smokeless tobacco among young adults in 2020 ranged from 1.9% (95% CI, 0.9–3.0) in New York to 10.5% (95% CI, 7.4–13.7) in Montana (Table 2.37). The prevalence of current smokeless tobacco use among young adults was 0.1 percentage points (New Jersey, 2.0%; 95% CI, 0.8–3.1) to 8.6 percentage points (Montana, 10.5%; 95% CI, 7.4–13.7) higher in other states (with available data) than it was in New York. By region, the prevalence of current smokeless tobacco use among young adults was similar across all four regions, ranging from 2.7% (95% CI, 1.9–3.5) in the Northeast to 4.1% (95% CI, 3.4–4.8) in the South.

Daily Versus Nondaily Smokeless Tobacco Use. The prevalence of daily use of smokeless tobacco among adults in 2020 ranged from 0.3% (95% CI, 0.1–0.6) in the District of Columbia to 5.8% (95% CI, 4.9–6.6) in West Virginia (Table 2.38); nondaily use of smokeless tobacco ranged from 0.4% (95% CI, 0.2–0.6) in Rhode Island to 3.4% (95% CI, 2.6–4.1) in Oklahoma and Wyoming (Table 2.39). Both daily and nondaily use of smokeless

Table 2.35 Prevalence of nondaily use of e-cigarettes[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	3.3 (2.6–4.1)	13.1 (8.5–17.7)	4.2 (2.7–5.7)	1.2 (0.6–1.9)	—[b]
Alaska	3.3 (2.3–4.4)	11.9 (6.2–17.6)	3.5 (1.6–5.5)	—[b]	—[b]
Arizona	—[c]	—[c]	—[c]	—[c]	—[c]
Arkansas	2.9 (2.1–3.8)	—[b]	4.8 (3.0–6.7)	1.3 (0.6–1.9)	—[b]
California	—[c]	—[c]	—[c]	—[c]	—[c]
Colorado	—[c]	—[c]	—[c]	—[c]	—[c]
Connecticut	2.6 (2.1–3.2)	8.3 (5.3–11.3)	3.9 (2.8–5.0)	1.3 (0.8–1.8)	—[b]
Delaware	2.7 (1.8–3.6)	—[b]	3.8 (1.8–5.8)	1.2 (0.6–1.9)	—[b]
District of Columbia	—[c]	—[c]	—[c]	—[c]	—[c]
Florida	3.4 (2.4–4.3)	6.7 (3.2–10.3)	6.9 (3.9–10.0)	1.8 (1.0–2.6)	—[b]
Georgia	3.1 (2.4–3.8)	9.3 (5.7–13.0)	4.3 (2.9–5.7)	1.5 (0.8–2.2)	—[b]
Hawai‘i	2.6 (2.1–3.1)	9.7 (6.5–12.8)	3.4 (2.5–4.4)	0.9 (0.5–1.4)	—[b]
Idaho	3.3 (2.6–4.0)	10.4 (6.8–14.1)	4.3 (2.8–5.8)	1.6 (0.7–2.5)	—[b]
Illinois	2.1 (1.5–2.7)	5.9 (2.6–9.2)	2.8 (1.6–4.0)	1.5 (0.6–2.3)	—[b]
Indiana	2.9 (2.4–3.5)	6.9 (4.4–9.5)	4.3 (3.2–5.4)	1.8 (1.3–2.3)	—[b]
Iowa	—[c]	—[c]	—[c]	—[c]	—[c]
Kansas	3.8 (2.9–4.6)	13.1 (8.6–17.6)	4.5 (3.0–6.0)	1.5 (0.8–2.2)	—[b]
Kentucky	3.9 (3.0–4.8)	10.3 (5.7–14.9)	6.2 (4.2–8.2)	2.1 (1.2–3.0)	—[b]
Louisiana	—[c]	—[c]	—[c]	—[c]	—[c]
Maine	2.4 (1.8–3.0)	6.1 (2.7–9.4)	5.1 (3.5–6.7)	0.9 (0.5–1.3)	—[b]
Maryland	2.1 (1.7–2.6)	6.3 (3.6–9.0)	3.1 (2.3–3.9)	1.1 (0.7–1.5)	—[b]
Massachusetts	2.7 (1.8–3.6)	10.8 (4.7–17.0)	3.2 (1.8–4.6)	1.1 (0.5–1.8)	—[b]
Michigan	3.4 (2.6–4.2)	10.9 (7.1–14.6)	4.5 (2.8–6.3)	1.6 (0.8–2.4)	—[b]
Minnesota	2.7 (2.3–3.1)	11.8 (9.0–14.5)	2.9 (2.2–3.5)	1.0 (0.8–1.3)	—[b]
Mississippi	2.6 (2.0–3.3)	8.6 (4.9–12.4)	3.6 (2.3–4.8)	1.3 (0.7–1.8)	—[b]
Missouri	3.3 (2.7–3.8)	9.7 (6.7–12.7)	4.5 (3.3–5.7)	1.8 (1.2–2.4)	—[b]
Montana	3.0 (2.4–3.6)	14.1 (10.2–18.0)	3.5 (2.3–4.8)	—[b]	—[b]
Nebraska	3.2 (2.7–3.8)	11.0 (8.5–13.5)	4.0 (3.0–5.0)	1.4 (0.8–2.0)	—[b]
Nevada	4.0 (2.7–5.4)	—[b]	5.7 (3.4–8.0)	—[b]	—[b]
New Hampshire	3.0 (2.2–3.8)	11.1 (6.2–16.1)	5.0 (3.3–6.7)	0.8 (0.3–1.2)	—[b]
New Jersey	2.8 (2.4–3.3)	9.0 (6.4–11.5)	3.7 (2.7–4.6)	1.6 (1.1–2.1)	—[b]
New Mexico	3.6 (2.7–4.5)	13.1 (8.3–17.9)	4.5 (2.7–6.3)	1.6 (0.7–2.6)	—[b]
New York	2.3 (1.8–2.7)	5.6 (3.4–7.7)	3.0 (2.1–3.8)	1.5 (0.9–2.1)	—[b]
North Carolina	2.7 (2.1–3.2)	6.8 (3.9–9.8)	3.3 (2.3–4.4)	2.1 (1.3–2.9)	—[b]
North Dakota	2.3 (1.6–3.0)	—[b]	4.1 (2.5–5.8)	—[b]	—[b]
Ohio	3.1 (2.6–3.6)	9.1 (6.5–11.7)	4.3 (3.3–5.2)	1.9 (1.3–2.5)	—[b]
Oklahoma	—[c]	—[c]	—[c]	—[c]	—[c]
Oregon	2.5 (2.0–3.1)	7.6 (4.7–10.4)	3.7 (2.5–4.8)	1.4 (0.7–2.0)	—[b]

Table 2.35 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Pennsylvania	3.2 (2.5–3.9)	8.2 (4.5–12.0)	5.3 (3.5–7.0)	1.7 (1.0–2.4)	—[b]
Rhode Island	2.5 (1.8–3.3)	7.8 (3.2–12.3)	3.6 (2.1–5.1)	1.2 (0.6–1.9)	—[b]
South Carolina	—[c]	—[c]	—[c]	—[c]	—[c]
South Dakota	2.2 (1.3–3.1)	—[b]	3.0 (1.4–4.6)	—[b]	—[b]
Tennessee	3.5 (2.6–4.4)	16.6 (9.7–23.6)	3.7 (2.3–5.1)	1.8 (1.0–2.6)	—[b]
Texas	2.4 (1.8–3.1)	7.7 (4.0–11.4)	2.6 (1.6–3.5)	1.6 (0.9–2.3)	—[b]
Utah	3.6 (3.1–4.1)	9.5 (7.3–11.7)	4.0 (3.1–4.9)	1.7 (1.1–2.3)	—[b]
Vermont	2.0 (1.4–2.6)	—[b]	3.6 (2.2–4.9)	1.1 (0.5–1.6)	—[b]
Virginia	2.8 (2.2–3.4)	8.6 (5.7–11.6)	3.8 (2.6–5.0)	1.4 (0.8–1.9)	—[b]
Washington	2.8 (2.4–3.3)	7.4 (5.4–9.5)	4.0 (3.2–4.9)	1.6 (1.2–2.1)	0.8 (0.3–1.2)
West Virginia	4.2 (3.3–5.0)	16.1 (10.5–21.7)	6.0 (4.3–7.6)	1.7 (1.1–2.4)	—[b]
Wisconsin	—[c]	—[c]	—[c]	—[c]	—[c]
Wyoming	3.1 (2.2–4.0)	10.5 (5.1–15.9)	3.9 (2.2–5.7)	1.5 (0.6–2.3)	—[b]
Region					
Northeast	2.6 (2.4–2.9)	7.4 (6.1–8.8)	3.8 (3.2–4.3)	1.5 (1.2–1.7)	0.5 (0.3–0.7)
Midwest	2.9 (2.7–3.1)	9.0 (7.8–10.2)	3.9 (3.4–4.4)	1.6 (1.3–1.9)	0.3 (0.2–0.4)
South	2.9 (2.7–3.2)	8.7 (7.3–10.1)	4.1 (3.5–4.7)	1.6 (1.4–1.9)	0.5 (0.3–0.6)
West	3.1 (2.9–3.4)	9.6 (8.3–10.9)	4.1 (3.7–4.6)	1.5 (1.2–1.7)	0.6 (0.4–0.8)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Nondaily use of e-cigarettes was defined as having ever used such products and using them some days at the time of the survey.
[b]Estimate is not presented because of a relative standard error >30%.
[c]Eight states (Arizona, California, Colorado, Iowa, Louisiana, Oklahoma, South Carolina, and Wisconsin) and the District of Columbia did not field the 2020 BRFSS optional module for e-cigarettes.

Table 2.36 Prevalence of smokeless tobacco use[a] among high school students, by location; national Youth Risk Behavior Survey (YRBS) 2019, United States

Location	Past-30-day use:[b] % (95% CI)
Alabama	8.9 (6.5–12.0)
Alaska	10.0 (5.8–16.6)
Arizona	2.5 (2.0–3.3)
Arkansas	7.3 (5.9–9.1)
California	7.6 (3.3–16.5)
Colorado	—[c]
Connecticut	2.6 (1.6–4.2)
Delaware	—[c]
District of Columbia	—[c]
Florida	—[c]
Georgia	5.3 (4.1–6.7)
Hawai‘i	—[c]
Idaho	3.4 (2.3–5.0)

Table 2.36 Continued

Location	Past-30-day use:[b] % (95% CI)
Illinois	4.1 (3.3–5.1)
Indiana	—[c]
Iowa	4.9 (4.0–5.9)
Kansas	4.5 (2.9–7.2)
Kentucky	6.4 (4.7–8.7)
Louisiana	5.8 (4.1–8.2)
Maine	4.0 (3.4–4.6)
Maryland	4.6 (4.1–5.2)
Massachusetts	4.8 (3.4–6.5)
Michigan	2.9 (2.2–3.7)
Minnesota	—[c]
Mississippi	6.5 (5.1–8.2)
Missouri	5.5 (4.0–7.4)
Montana	6.3 (5.3–7.3)
Nebraska	3.6 (2.5–5.1)
Nevada	3.8 (2.9–4.9)
New Hampshire	—[c]
New Jersey	—[c]
New Mexico	5.9 (4.9–7.0)
New York	—[c]
North Carolina	—[c]
North Dakota	4.5 (3.4–5.8)
Ohio	9.9 (4.7–19.6)
Oklahoma	5.7 (4.4–7.5)
Oregon	—[c]
Pennsylvania	3.9 (2.9–5.4)
Rhode Island	2.5 (1.7–3.7)
South Carolina	7.1 (5.3–9.6)
South Dakota	7.1 (5.0–10.1)
Tennessee	8.2 (5.4–12.4)
Texas	3.4 (2.2–5.1)
Utah	1.7 (1.1–2.6)
Vermont	3.5 (3.2–3.8)
Virginia	3.8 (3.0–4.8)
Washington	—[c]
West Virginia	9.5 (7.5–12.0)
Wisconsin	3.3 (2.3–4.6)
Wyoming	—[c]

Source: CDC (n.d.a).
Notes: **CI =** confidence interval.
[a]Includes use of chewing tobacco, snuff, dip, snus, or dissolvable tobacco products.
[b]On at least 1 day during the 30 days before the survey.
[c]The number of respondents within the subgroup did not meet the minimum reporting threshold or data were not available.

Table 2.37 Prevalence of current use of smokeless tobacco products[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	5.7 (4.8–6.6)	4.7 (2.0–7.5)	6.8 (5.0–8.5)	6.3 (4.7–7.8)	3.9 (2.6–5.2)
Alaska	7.2 (5.9–8.5)	7.2 (3.1–11.2)	8.9 (6.2–11.6)	6.6 (4.8–8.4)	4.9 (2.7–7.0)
Arizona	3.0 (2.4–3.5)	4.8 (2.6–7.0)	3.6 (2.6–4.5)	3.1 (2.3–4.0)	1.0 (0.5–1.4)
Arkansas	6.8 (5.7–7.9)	9.5 (4.5–14.5)	6.7 (4.8–8.6)	7.8 (5.9–9.6)	4.2 (3.1–5.4)
California	1.8 (1.3–2.3)	—[b]	2.2 (1.3–3.2)	1.5 (0.7–2.3)	—[b]
Colorado	3.6 (3.1–4.1)	4.0 (2.4–5.5)	4.7 (3.7–5.7)	3.5 (2.8–4.3)	1.5 (1.0–2.0)
Connecticut	1.7 (1.3–2.1)	2.7 (1.1–4.2)	1.9 (1.1–2.7)	1.7 (1.0–2.4)	—[b]
Delaware	2.4 (1.6–3.2)	—[b]	3.6 (1.8–5.3)	1.5 (0.9–2.2)	—[b]
District of Columbia	1.8 (1.1–2.6)	—[b]	2.2 (1.0–3.4)	—[b]	—[b]
Florida	2.3 (1.8–2.8)	2.1 (0.9–3.4)	1.9 (1.1–2.6)	3.7 (2.4–4.9)	1.1 (0.6–1.6)
Georgia	3.6 (2.9–4.3)	—[b]	4.6 (3.1–6.0)	2.9 (2.1–3.8)	2.7 (2.0–3.4)
Hawai‘i	2.3 (1.8–2.8)	—[b]	3.3 (2.2–4.3)	2.1 (1.4–2.9)	1.0 (0.5–1.5)
Idaho	5.2 (4.3–6.0)	5.4 (2.9–7.9)	6.9 (5.1–8.8)	5.3 (3.8–6.8)	2.2 (1.4–2.9)
Illinois	1.8 (1.3–2.4)	—[b]	2.2 (1.0–3.3)	1.9 (1.0–2.8)	—[b]
Indiana	4.6 (4.0–5.2)	3.7 (1.8–5.5)	6.3 (4.9–7.7)	4.6 (3.7–5.5)	2.5 (1.8–3.2)
Iowa	4.4 (3.9–4.9)	5.4 (3.4–7.5)	5.6 (4.6–6.7)	4.6 (3.8–5.4)	1.9 (1.3–2.4)
Kansas	5.2 (4.6–5.8)	4.5 (2.7–6.3)	6.9 (5.8–8.1)	5.6 (4.6–6.5)	2.5 (1.8–3.2)
Kentucky	6.1 (5.1–7.1)	4.2 (1.9–6.5)	8.3 (6.1–10.5)	6.1 (4.5–7.7)	3.9 (2.3–5.5)
Louisiana	5.5 (4.6–6.5)	6.4 (2.6–10.1)	6.4 (4.6–8.2)	6.1 (4.5–7.7)	2.8 (1.7–4.0)
Maine	2.7 (2.1–3.3)	—[b]	4.9 (3.4–6.4)	2.0 (1.3–2.7)	1.2 (0.7–1.7)
Maryland	1.7 (1.3–2.1)	—[b]	2.2 (1.5–3.0)	1.7 (1.0–2.3)	0.7 (0.4–1.0)
Massachusetts	1.5 (1.1–2.0)	—[b]	1.8 (1.0–2.7)	1.3 (0.8–1.7)	—[b]
Michigan	2.9 (2.3–3.4)	—[b]	4.6 (3.3–5.8)	2.5 (1.7–3.3)	1.5 (0.8–2.3)
Minnesota	3.7 (3.3–4.1)	4.3 (3.0–5.7)	4.9 (4.1–5.7)	3.7 (3.1–4.3)	1.6 (1.1–2.1)
Mississippi	7.1 (6.2–8.0)	—[b]	8.0 (6.2–9.7)	8.1 (6.6–9.5)	5.8 (4.6–7.0)
Missouri	4.9 (4.3–5.5)	4.0 (2.3–5.8)	6.7 (5.4–8.1)	5.3 (4.2–6.3)	2.2 (1.5–2.9)
Montana	8.0 (7.2–8.8)	10.5 (7.4–13.7)	10.7 (8.9–12.5)	7.7 (6.3–9.0)	3.8 (2.9–4.8)
Nebraska	5.2 (4.6–5.7)	4.7 (3.3–6.1)	7.7 (6.4–9.0)	5.1 (4.2–5.9)	1.7 (1.2–2.1)
Nevada	3.0 (2.2–3.8)	—[b]	3.2 (1.8–4.6)	3.9 (2.2–5.5)	—[b]
New Hampshire	1.8 (1.3–2.3)	—[b]	2.5 (1.3–3.8)	1.6 (1.0–2.3)	—[b]
New Jersey	1.5 (1.2–1.9)	2.0 (0.8–3.1)	2.2 (1.4–3.0)	1.3 (0.9–1.7)	—[b]
New Mexico	3.6 (2.9–4.3)	—[b]	4.6 (3.1–6.1)	4.1 (2.9–5.4)	2.0 (1.2–2.8)
New York	2.1 (1.8–2.5)	1.9 (0.9–3.0)	2.6 (1.9–3.2)	2.4 (1.7–3.2)	1.1 (0.5–1.6)
North Carolina	3.9 (3.2–4.5)	3.3 (1.5–5.0)	4.8 (3.5–6.1)	4.3 (3.1–5.5)	2.3 (1.4–3.2)
North Dakota	6.3 (5.3–7.3)	6.5 (3.2–9.9)	8.7 (6.5–10.8)	6.3 (4.6–8.0)	2.4 (1.6–3.2)
Ohio	4.2 (3.7–4.6)	3.3 (1.9–4.7)	6.2 (5.1–7.2)	4.1 (3.4–4.9)	1.9 (1.4–2.5)
Oklahoma	7.1 (6.1–8.0)	6.0 (2.9–9.1)	8.5 (6.5–10.5)	7.4 (6.0–8.9)	4.9 (3.7–6.2)
Oregon	3.7 (3.1–4.4)	5.0 (2.5–7.5)	4.5 (3.3–5.7)	3.9 (2.7–5.2)	1.7 (0.9–2.6)

Table 2.37 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Pennsylvania	4.1 (3.5–4.8)	—[b]	5.5 (4.1–6.9)	5.0 (3.8–6.3)	1.5 (0.8–2.3)
Rhode Island	0.8 (0.5–1.1)	—[b]	—[b]	0.8 (0.3–1.3)	—[b]
South Carolina	3.8 (2.9–4.6)	—[b]	4.4 (2.6–6.2)	4.0 (2.6–5.3)	2.1 (1.2–3.0)
South Dakota	5.6 (4.3–6.9)	—[b]	6.5 (4.1–8.9)	6.2 (4.1–8.3)	2.1 (1.1–3.0)
Tennessee	6.6 (5.5–7.7)	10.2 (5.1–15.3)	7.9 (5.8–10.0)	5.2 (3.8–6.7)	4.7 (2.9–6.5)
Texas	3.3 (2.6–3.9)	3.4 (1.6–5.2)	3.3 (2.2–4.5)	4.0 (2.7–5.3)	1.8 (0.9–2.7)
Utah	2.6 (2.2–3.0)	2.3 (1.3–3.3)	3.6 (2.8–4.4)	2.3 (1.7–2.9)	1.1 (0.6–1.6)
Vermont	2.5 (1.9–3.1)	—[b]	4.5 (2.9–6.1)	2.7 (1.6–3.9)	—[b]
Virginia	3.4 (2.9–3.9)	3.3 (1.7–5.0)	4.4 (3.3–5.5)	3.7 (2.8–4.6)	1.5 (1.0–2.0)
Washington	2.6 (2.2–3.0)	2.1 (1.1–3.0)	3.6 (2.8–4.4)	2.8 (2.2–3.5)	1.0 (0.5–1.4)
West Virginia	8.5 (7.5–9.5)	7.0 (2.9–11.1)	11.5 (9.2–13.7)	9.6 (8.0–11.1)	4.5 (3.5–5.6)
Wisconsin	3.8 (3.0–4.5)	—[b]	5.4 (3.8–6.9)	3.3 (2.2–4.3)	2.0 (1.0–3.0)
Wyoming	8.9 (7.6–10.2)	8.2 (3.7–12.6)	13.2 (10.3–16.0)	8.2 (6.3–10.1)	4.2 (2.9–5.5)
Region					
Northeast	2.4 (2.2–2.6)	2.7 (1.9–3.5)	3.1 (2.7–3.5)	2.6 (2.2–3.0)	1.0 (0.7–1.3)
Midwest	3.7 (3.5–3.9)	3.5 (2.9–4.1)	5.1 (4.7–5.6)	3.7 (3.4–4.0)	1.8 (1.6–2.0)
South	3.9 (3.7–4.2)	4.1 (3.4–4.8)	4.5 (4.1–4.9)	4.4 (4.0–4.8)	2.4 (2.1–2.6)
West	2.7 (2.4–2.9)	3.6 (2.5–4.6)	3.3 (2.8–3.8)	2.6 (2.1–3.0)	1.1 (0.8–1.4)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Current use of smokeless tobacco products was defined as having ever used such products and using them every day or some days at the time of the survey.
[b]Estimate is not presented because of a relative standard error ≥30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and then multiplied by 100.

tobacco were similar by region, with daily use ranging from 1.2% (95% CI, 1.0–1.3) in the Northeast to 2.2% (95% CI, 2.1–2.4) in the South, and nondaily use ranging from 1.2% (95% CI, 1.1–1.4) in both the Northeast and the West to 1.7% (95% CI, 1.6–1.9) in the South.

Among young adults, data from 2020 on daily smokeless tobacco use were only available from five states while data on nondaily use were only available for 12 states due to unreliable estimates. In these states, daily use ranged from 0.9% (95% CI, 0.4–1.5) in Ohio to 6.1% (95% CI, 3.6–8.6) in Montana (Table 2.38), and nondaily use ranged from 1.4% (95% CI, 0.7–2.1) in Washington to 4.4% (95% CI, 2.3–6.5) in Montana (Table 2.39). Among young adults, daily use of smokeless tobacco was higher in the South (1.6%; 95% CI, 1.2–2.0) than it was in the Northeast (0.6%; 95% CI, 0.3–0.9) (Table 2.38); daily use of smokeless tobacco was otherwise similar by region. Nondaily use of smokeless tobacco was similar across all four regions, ranging from 2.0% (95% CI, 1.5–2.5) in the West to 2.5% (95% CI, 1.9–3.1) in the South (Table 2.39).

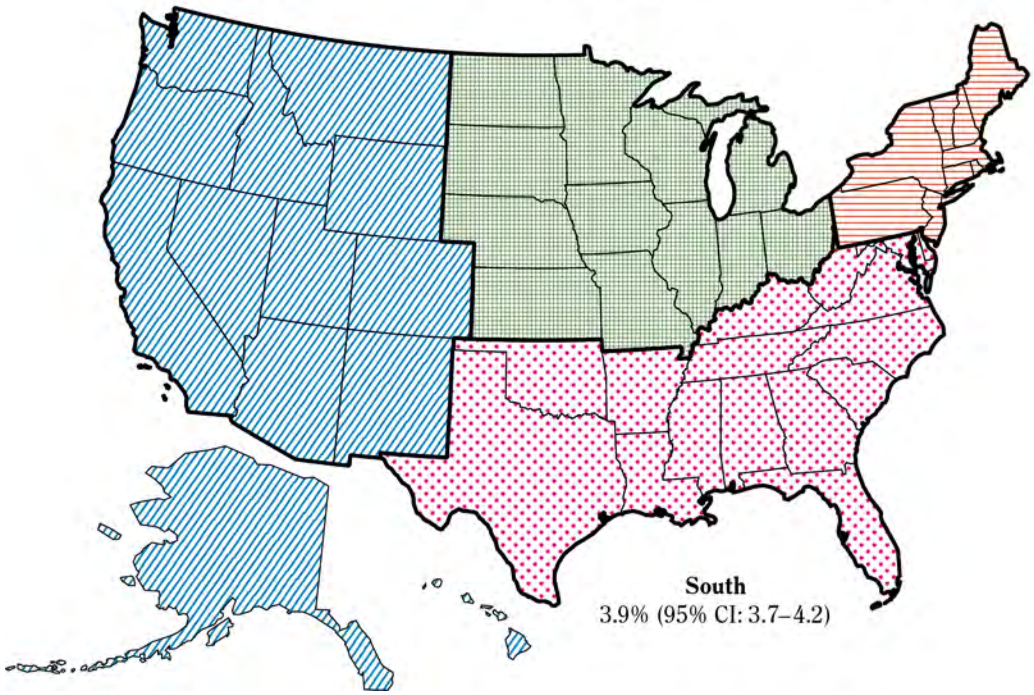
Cigars

Youth. For the 36 states with available data, past-30-day use of cigars among U.S. high school students in 2019 ranged from 1.2% (95% CI, 0.6–2.2) in Utah to 11.7% (95% CI, 8.5–16.0) in Louisiana. The prevalence of past-30-day cigar use among youth was 2.7 percentage points (Connecticut, 3.9%; 95% CI, 3.0–4.9) to 10.5 percentage points (Louisiana, 11.7%; 95% CI, 8.5–16.0) higher in other states (with available data) than it was in Utah (Table 2.40).

Among states with available data, the prevalence of frequent cigar use (use on 20 or more days during the past 30 days) and daily cigar use was lowest in Utah (frequent use: 0.1%; 95% CI, 0.0–0.4; daily use: 0.1%; 95% CI, 0.0–0.4) and highest in Louisiana (frequent use: 2.1%; 95% CI, 1.1–4.1; daily use: 1.8%; 95% CI, 0.9–3.7). In most of the states with available data on cigar use, fewer than 1.0% of youth used cigars daily (Table 2.40).

Adults. State-level data on cigar smoking among adults are not available through the BRFSS.

Figure 2.18 Prevalence of current use of smokeless tobacco products[a] among adults, 18 years of age and older, by region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States



Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Current use of smokeless tobacco products was defined as having ever used such products and using them every day or some days at the time of the survey.

Table 2.38 Prevalence of daily use of smokeless tobacco products[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	3.2 (2.5–3.9)	—[b]	3.5 (2.2–4.8)	4.0 (2.7–5.2)	2.6 (1.5–3.8)
Alaska	4.1 (3.3–5.0)	—[b]	4.2 (2.7–5.8)	5.0 (3.4–6.7)	4.3 (2.3–6.3)
Arizona	1.3 (1.0–1.7)	—[b]	1.3 (0.7–1.9)	2.1 (1.3–2.8)	—[b]
Arkansas	3.8 (3.1–4.6)	—[b]	3.4 (2.1–4.7)	5.9 (4.2–7.5)	2.4 (1.6–3.3)
California	0.9 (0.5–1.3)	—[b]	—[b]	—[b]	—[b]
Colorado	2.3 (1.9–2.7)	—[b]	2.8 (2.0–3.6)	2.8 (2.1–3.5)	0.9 (0.5–1.3)
Connecticut	0.5 (0.3–0.7)	—[b]	—[b]	—[b]	—[b]
Delaware	1.1 (0.7–1.5)	—[b]	—[b]	—[b]	—[b]
District of Columbia	0.3 (0.1–0.6)	—[c]	—[b]	—[b]	—[b]
Florida	1.1 (0.8–1.4)	—[b]	0.7 (0.3–1.0)	1.7 (1.1–2.3)	—[b]

Table 2.38 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Georgia	2.1 (1.5–2.6)	—[b]	3.2 (1.9–4.5)	1.5 (0.9–2.0)	1.2 (0.8–1.6)
Hawai‘i	0.7 (0.4–1.0)	—[b]	—[b]	0.9 (0.5–1.4)	—[b]
Idaho	3.0 (2.4–3.7)	—[b]	3.8 (2.4–5.1)	4.1 (2.8–5.4)	1.1 (0.6–1.7)
Illinois	0.9 (0.5–1.2)	—[b]	—[b]	1.1 (0.5–1.7)	—[b]
Indiana	2.6 (2.1–3.0)	—[b]	3.6 (2.5–4.6)	3.2 (2.4–3.9)	1.3 (0.8–1.8)
Iowa	2.7 (2.3–3.0)	1.7 (0.7–2.6)	3.8 (2.9–4.6)	3.1 (2.5–3.8)	1.2 (0.7–1.6)
Kansas	3.3 (2.9–3.8)	—[b]	4.5 (3.6–5.5)	4.1 (3.2–5.0)	1.5 (0.9–2.1)
Kentucky	4.1 (3.3–4.9)	—[b]	5.4 (3.6–7.1)	4.1 (2.8–5.5)	3.0 (1.7–4.3)
Louisiana	3.5 (2.8–4.3)	—[b]	3.9 (2.5–5.2)	4.5 (3.1–5.9)	2.0 (1.0–3.0)
Maine	1.5 (1.1–1.9)	—[b]	2.7 (1.6–3.9)	1.6 (0.9–2.2)	—[b]
Maryland	0.6 (0.5–0.8)	—[b]	0.6 (0.3–1.0)	0.9 (0.5–1.2)	—[b]
Massachusetts	0.5 (0.3–0.7)	—[b]	—[b]	—[b]	—[c]
Michigan	1.2 (0.9–1.6)	—[b]	1.8 (1.0–2.6)	1.5 (0.9–2.1)	—[b]
Minnesota	2.1 (1.8–2.3)	—[b]	2.9 (2.3–3.5)	2.3 (1.9–2.8)	1.1 (0.7–1.5)
Mississippi	4.7 (3.9–5.4)	—[b]	5.3 (3.8–6.9)	5.4 (4.2–6.7)	4.2 (3.1–5.3)
Missouri	2.9 (2.4–3.4)	—[b]	4.0 (3.0–5.0)	3.2 (2.3–4.0)	1.7 (1.0–2.3)
Montana	5.3 (4.6–6.0)	6.1 (3.6–8.6)	6.8 (5.4–8.3)	5.4 (4.2–6.5)	3.1 (2.2–3.9)
Nebraska	3.1 (2.7–3.5)	1.4 (0.7–2.2)	5.0 (3.9–6.0)	3.4 (2.7–4.1)	0.9 (0.6–1.2)
Nevada	1.4 (0.9–2.0)	—[b]	—[b]	2.2 (0.9–3.6)	—[b]
New Hampshire	0.9 (0.5–1.3)	—[b]	—[b]	1.0 (0.4–1.5)	—[b]
New Jersey	0.6 (0.3–0.8)	—[b]	—[b]	0.6 (0.3–0.8)	—[b]
New Mexico	2.0 (1.6–2.5)	—[b]	2.0 (1.1–2.8)	3.2 (2.1–4.2)	1.1 (0.5–1.7)
New York	1.0 (0.7–1.2)	—[b]	1.0 (0.6–1.4)	1.6 (0.9–2.2)	—[b]
North Carolina	2.1 (1.7–2.6)	—[b]	2.6 (1.6–3.5)	2.6 (1.8–3.5)	1.0 (0.4–1.5)
North Dakota	3.9 (3.1–4.6)	—[b]	5.7 (3.9–7.5)	4.1 (2.8–5.5)	1.7 (1.0–2.4)
Ohio	2.3 (2.0–2.7)	0.9 (0.4–1.5)	3.8 (2.9–4.7)	2.3 (1.8–2.8)	1.0 (0.6–1.5)
Oklahoma	3.7 (3.0–4.4)	—[b]	3.5 (2.3–4.7)	5.2 (3.9–6.4)	2.9 (1.9–4.0)
Oregon	2.2 (1.7–2.7)	—[b]	2.5 (1.6–3.4)	2.8 (1.7–3.9)	—[b]
Pennsylvania	2.4 (1.9–2.9)	—[b]	3.2 (2.1–4.3)	3.1 (2.1–4.1)	—[b]
Rhode Island	0.4 (0.2–0.6)	—[c]	—[b]	—[b]	—[b]
South Carolina	1.9 (1.3–2.6)	—[b]	—[b]	2.0 (1.0–3.1)	1.2 (0.5–1.9)
South Dakota	3.7 (2.6–4.8)	—[b]	3.7 (1.9–5.5)	4.5 (2.7–6.3)	—[b]
Tennessee	3.8 (3.0–4.6)	5.0 (2.4–7.6)	5.0 (3.3–6.7)	3.7 (2.4–4.9)	1.7 (0.9–2.6)
Texas	1.8 (1.3–2.3)	—[b]	2.0 (1.0–2.9)	2.6 (1.7–3.6)	—[b]
Utah	1.2 (1.0–1.5)	—[b]	1.6 (1.1–2.2)	1.3 (0.8–1.8)	0.6 (0.3–0.9)
Vermont	1.6 (1.1–2.1)	—[b]	3.1 (1.7–4.4)	1.9 (0.9–2.9)	—[b]
Virginia	2.1 (1.6–2.5)	—[b]	2.4 (1.6–3.2)	2.7 (1.9–3.5)	0.8 (0.4–1.2)
Washington	1.5 (1.2–1.8)	—[b]	2.1 (1.5–2.8)	1.8 (1.3–2.2)	—[b]
West Virginia	5.8 (4.9–6.6)	—[b]	7.5 (5.6–9.3)	6.7 (5.3–8.0)	3.3 (2.4–4.2)
Wisconsin	2.1 (1.6–2.7)	—[b]	3.1 (1.9–4.4)	2.1 (1.3–3.0)	—[b]
Wyoming	5.5 (4.5–6.5)	—[b]	7.7 (5.4–10.0)	6.5 (4.8–8.3)	2.7 (1.7–3.8)

Table 2.38 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Region					
Northeast	1.2 (1.0–1.3)	0.6 (0.3–0.9)	1.4 (1.1–1.8)	1.5 (1.2–1.8)	0.5 (0.3–0.7)
Midwest	2.0 (1.9–2.2)	1.1 (0.8–1.5)	2.9 (2.6–3.2)	2.3 (2.1–2.5)	1.0 (0.8–1.2)
South	2.2 (2.1–2.4)	1.6 (1.2–2.0)	2.5 (2.2–2.8)	2.7 (2.5–3.0)	1.4 (1.1–1.6)
West	1.4 (1.2–1.6)	1.6 (0.7–2.4)	1.5 (1.2–1.8)	1.7 (1.4–2.1)	0.7 (0.4–1.0)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Daily use of smokeless tobacco products was defined as having ever used such products and using them every day at the time of the survey.
[b]Estimate is not presented because of a relative standard error ≥30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and then multiplied by 100.
[c]Data were not available for this age group in this state.

Table 2.39 Prevalence of nondaily use of smokeless tobacco products[a] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	2.5 (1.9–3.1)	—[b]	3.2 (2.0–4.5)	2.3 (1.4–3.3)	1.3 (0.7–1.9)
Alaska	3.1 (2.1–4.1)	—[b]	4.7 (2.4–6.9)	1.6 (0.7–2.4)	—[b]
Arizona	1.6 (1.3–2.0)	3.4 (1.6–5.3)	2.2 (1.5–3.0)	1.1 (0.7–1.5)	0.6 (0.2–0.9)
Arkansas	3.0 (2.1–3.8)	—[b]	3.3 (1.9–4.7)	1.9 (1.0–2.8)	1.8 (1.0–2.5)
California	0.9 (0.6–1.2)	—[b]	1.5 (0.8–2.2)	—[b]	—[b]
Colorado	1.3 (1.0–1.6)	2.4 (1.2–3.6)	1.9 (1.3–2.5)	0.7 (0.4–1.0)	0.6 (0.3–0.9)
Connecticut	1.2 (0.8–1.6)	—[b]	1.6 (0.8–2.3)	0.9 (0.4–1.4)	—[b]
Delaware	1.3 (0.6–2.0)	—[b]	—[b]	—[b]	—[b]
District of Columbia	1.5 (0.8–2.2)	—[b]	—[b]	—[b]	—[b]
Florida	1.2 (0.8–1.6)	—[b]	1.2 (0.6–1.8)	2.0 (0.9–3.1)	—[b]
Georgia	1.5 (1.2–1.9)	2.3 (1.0–3.6)	1.3 (0.7–2.0)	1.5 (0.9–2.1)	1.6 (1.0–2.2)
Hawai‘i	1.6 (1.1–2.0)	—[b]	2.2 (1.4–3.0)	1.2 (0.6–1.8)	0.8 (0.3–1.3)
Idaho	2.1 (1.6–2.7)	3.6 (1.5–5.7)	3.2 (1.9–4.4)	—[b]	—[b]
Illinois	1.0 (0.5–1.4)	—[b]	—[b]	—[b]	—[b]
Indiana	2.0 (1.5–2.4)	—[b]	2.7 (1.8–3.7)	1.4 (0.9–1.9)	1.2 (0.7–1.7)
Iowa	1.7 (1.4–2.1)	3.8 (2.0–5.6)	1.9 (1.3–2.5)	1.5 (1.0–1.9)	0.7 (0.3–1.1)
Kansas	1.9 (1.5–2.2)	2.8 (1.4–4.3)	2.4 (1.7–3.1)	1.5 (1.0–1.9)	1.0 (0.5–1.5)
Kentucky	2.0 (1.4–2.7)	—[b]	3.0 (1.5–4.5)	2.0 (1.1–2.8)	—[b]
Louisiana	2.0 (1.4–2.6)	—[b]	2.5 (1.3–3.7)	1.6 (0.9–2.3)	—[b]
Maine	1.2 (0.8–1.7)	—[b]	2.1 (1.2–3.1)	—[b]	0.7 (0.3–1.1)
Maryland	1.1 (0.8–1.4)	—[b]	1.6 (0.9–2.2)	—[b]	—[b]
Massachusetts	1.1 (0.7–1.5)	—[b]	—[b]	0.7 (0.4–1.1)	—[b]

Table 2.39 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Michigan	1.6 (1.2–2.1)	—[b]	2.8 (1.8–3.8)	1.1 (0.5–1.6)	—[b]
Minnesota	1.7 (1.4–1.9)	3.5 (2.3–4.7)	2.0 (1.5–2.5)	1.4 (1.1–1.8)	0.5 (0.3–0.8)
Mississippi	2.4 (1.9–3.0)	—[b]	2.6 (1.7–3.6)	2.7 (1.8–3.5)	1.6 (1.0–2.2)
Missouri	2.0 (1.6–2.4)	—[b]	2.8 (1.9–3.6)	2.1 (1.4–2.8)	0.6 (0.2–0.9)
Montana	2.7 (2.2–3.2)	4.4 (2.3–6.5)	3.9 (2.7–5.0)	2.3 (1.5–3.1)	0.8 (0.4–1.1)
Nebraska	2.0 (1.7–2.4)	3.3 (2.1–4.5)	2.7 (1.9–3.6)	1.6 (1.1–2.2)	0.7 (0.4–1.1)
Nevada	1.6 (1.0–2.2)	—[b]	—[b]	—[b]	—[b]
New Hampshire	0.9 (0.6–1.3)	—[b]	—[b]	—[b]	—[b]
New Jersey	1.0 (0.7–1.2)	—[b]	1.3 (0.8–1.8)	0.7 (0.4–1.0)	—[b]
New Mexico	1.6 (1.1–2.1)	—[b]	2.6 (1.4–3.9)	—[b]	—[b]
New York	1.2 (0.9–1.4)	—[b]	1.6 (1.1–2.1)	0.9 (0.5–1.3)	—[b]
North Carolina	1.8 (1.3–2.2)	—[b]	2.2 (1.3–3.1)	1.7 (0.8–2.5)	1.3 (0.6–2.1)
North Dakota	2.5 (1.8–3.2)	—[b]	3.0 (1.7–4.2)	2.1 (1.1–3.2)	0.7 (0.3–1.1)
Ohio	1.8 (1.5–2.2)	2.4 (1.1–3.7)	2.4 (1.7–3.0)	1.8 (1.3–2.3)	0.9 (0.5–1.3)
Oklahoma	3.4 (2.6–4.1)	—[b]	5.0 (3.4–6.7)	2.3 (1.4–3.1)	2.0 (1.2–2.8)
Oregon	1.6 (1.1–2.0)	—[b]	2.0 (1.2–2.8)	1.1 (0.6–1.7)	—[b]
Pennsylvania	1.8 (1.3–2.2)	—[b]	2.3 (1.4–3.2)	1.9 (1.1–2.7)	—[b]
Rhode Island	0.4 (0.2–0.6)	—[b]	—[b]	—[b]	—[b]
South Carolina	1.8 (1.3–2.4)	—[b]	2.4 (1.1–3.7)	2.0 (1.1–2.9)	—[b]
South Dakota	1.9 (1.2–2.6)	—[b]	—[b]	—[b]	—[b]
Tennessee	2.7 (1.9–3.6)	—[b]	2.9 (1.5–4.2)	1.6 (0.8–2.3)	3.0 (1.4–4.6)
Texas	1.5 (1.0–1.9)	—[b]	1.4 (0.8–2.0)	—[b]	—[b]
Utah	1.4 (1.1–1.7)	1.5 (0.7–2.3)	1.9 (1.3–2.6)	1.0 (0.5–1.4)	—[b]
Vermont	0.9 (0.6–1.2)	—[b]	1.4 (0.6–2.2)	—[b]	—[b]
Virginia	1.3 (1.0–1.6)	—[b]	2.0 (1.3–2.7)	1.0 (0.6–1.4)	0.6 (0.3–1.0)
Washington	1.1 (0.9–1.3)	1.4 (0.7–2.1)	1.4 (0.9–1.9)	1.1 (0.7–1.5)	—[b]
West Virginia	2.7 (2.1–3.3)	—[b]	4.0 (2.5–5.4)	2.9 (2.0–3.7)	1.2 (0.7–1.7)
Wisconsin	1.6 (1.2–2.1)	—[b]	2.3 (1.3–3.2)	—[b]	—[b]
Wyoming	3.4 (2.5–4.3)	—[b]	5.5 (3.6–7.4)	1.7 (0.8–2.5)	1.5 (0.7–2.2)
Region					
Northeast	1.2 (1.1–1.4)	2.1 (1.3–2.8)	1.7 (1.3–2.0)	1.1 (0.8–1.3)	0.5 (0.3–0.7)
Midwest	1.6 (1.5–1.8)	2.3 (1.8–2.8)	2.3 (2.0–2.6)	1.4 (1.2–1.6)	0.8 (0.6–0.9)
South	1.7 (1.6–1.9)	2.5 (1.9–3.1)	2.0 (1.7–2.2)	1.6 (1.3–1.9)	1.0 (0.8–1.2)
West	1.2 (1.1–1.4)	2.0 (1.5–2.5)	1.8 (1.4–2.2)	0.8 (0.6–1.1)	0.4 (0.3–0.5)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Nondaily use of smokeless tobacco products was defined having ever used such products and using them some days at the time of the survey.
[b]Estimate is not presented because of a relative standard error ≥30%. Relative standard error is equal to the standard error of a survey estimate divided by the survey estimate and then multiplied by 100.

Table 2.40 Prevalence of cigar use[a] among high school students, by location; national Youth Risk Behavior Survey (YRBS) 2019, United States

Location	Past-30-day use:[b] % (95% CI)	≥20-days use:[c] % (95% CI)	Daily use:[d] % (95% CI)
Alabama	9.5 (7.1–12.6)	1.7 (1.1–2.5)	1.1 (0.7–1.8)
Alaska	4.6 (3.5–6.0)	0.4 (0.2–0.9)	0.2 (0.1–0.4)
Arizona	4.9 (3.5–6.8)	0.5 (0.2–1.1)	0.4 (0.2–0.8)
Arkansas	8.4 (6.8–10.4)	0.9 (0.4–1.8)	0.6 (0.3–1.4)
California	—[e]	—[e]	—[e]
Colorado	—[e]	—[e]	—[e]
Connecticut	3.9 (3.0–4.9)	0.9 (0.6–1.6)	0.8 (0.4–1.7)
Delaware	—[e]	—[e]	—[e]
District of Columbia	—[e]	—[e]	—[e]
Florida	—[e]	—[e]	—[e]
Georgia	5.4 (4.1–7.1)	0.8 (0.5–1.1)	0.6 (0.4–0.8)
Hawai‘i	—[e]	—[e]	—[e]
Idaho	4.1 (3.0–5.5)	0.2 (0.0–0.9)	0.0 (0.0–0.3)
Illinois	6.1 (4.7–7.8)	0.9 (0.5–1.7)	0.6 (0.3–1.2)
Indiana	—[e]	—[e]	—[e]
Iowa	4.4 (3.5–5.4)	0.6 (0.3–1.2)	0.5 (0.2–1.3)
Kansas	5.5 (4.1–7.3)	0.8 (0.4–1.3)	0.6 (0.3–1.2)
Kentucky	7.9 (6.2–10.0)	1.6 (1.0–2.6)	1.5 (0.9–2.4)
Louisiana	11.7 (8.5–16.0)	2.1 (1.1–4.1)	1.8 (0.9–3.7)
Maine	5.0 (4.4–5.7)	0.7 (0.6–0.9)	0.5 (0.4–0.6)
Maryland	6.0 (5.5–6.6)	0.9 (0.8–1.0)	0.6 (0.5–0.8)
Massachusetts	5.1 (3.7–6.8)	0.7 (0.3–1.3)	0.6 (0.3–1.2)
Michigan	5.2 (3.9–6.9)	0.6 (0.3–1.1)	0.3 (0.1–0.6)
Minnesota	—e	—e	—e
Mississippi	9.1 (7.7–10.6)	1.5 (0.9–2.5)	1.0 (0.5–1.9)
Missouri	5.4 (4.3–6.9)	0.4 (0.1–1.2)	0.4 (0.1–1.2)
Montana	7.5 (6.4–8.8)	0.6 (0.4–1.0)	0.5 (0.3–0.9)
Nebraska	4.1 (2.9–5.7)	0.9 (0.4–1.7)	0.6 (0.2–1.5)
Nevada	—[e]	—[e]	—[e]
New Hampshire	—[e]	—[e]	—[e]
New Jersey	—[e]	—[e]	—[e]
New Mexico	8.3 (7.1–9.7)	1.3 (1.0–1.7)	0.8 (0.6–1.2)
New York	6.7 (5.8–7.7)	0.8 (0.6–1.2)	0.6 (0.4–0.9)
North Carolina	—[e]	—[e]	—[e]
North Dakota	5.2 (3.9–7.0)	1.0 (0.5–1.7)	0.6 (0.3–1.3)
Ohio	7.2 (6.3–8.2)	0.5 (0.2–1.0)	0.4 (0.2–0.9)
Oklahoma	6.8 (5.1–8.9)	1.0 (0.5–1.9)	0.8 (0.4–1.6)
Oregon	—[e]	—[e]	—[e]
Pennsylvania	5.9 (4.7–7.3)	0.9 (0.5–1.7)	0.5 (0.2–1.1)
Rhode Island	5.1 (3.7–6.9)	0.7 (0.4–1.5)	0.7 (0.3–1.5)

Table 2.40 Continued

Location	Past-30-day use:[b] % (95% CI)	≥20-days use:[c] % (95% CI)	Daily use:[d] % (95% CI)
South Carolina	9.1 (6.8–12.1)	1.8 (1.0–3.1)	1.6 (0.9–3.0)
South Dakota	7.1 (4.6–10.7)	0.8 (0.3–1.9)	0.4 (0.1–1.0)
Tennessee	9.1 (6.4–12.7)	1.4 (0.8–2.2)	0.9 (0.5–1.6)
Texas	5.7 (4.5–7.2)	0.9 (0.6–1.5)	0.5 (0.2–1.3)
Utah	1.2 (0.6–2.2)	0.1 (0.0–0.4)	0.1 (0.0–0.4)
Vermont	5.8 (5.5–6.2)	0.9 (0.8–1.1)	0.8 (0.6–0.9)
Virginia	4.7 (4.0–5.5)	1.2 (0.8–1.8)	0.9 (0.6–1.5)
Washington	—[e]	—[e]	—[e]
West Virginia	10.9 (8.7–13.4)	1.3 (0.9–2.1)	1.1 (0.8–1.7)
Wisconsin	4.7 (3.3–6.6)	0.5 (0.3–0.8)	0.3 (0.2–0.6)
Wyoming	—[e]	—[e]	—[e]

Source: CDC (n.d.a).
Notes: **CI =** confidence interval.
[a]Includes use of cigars, cigarillos, or little cigars.
[b]On at least 1 day during the 30 days before the survey.
[c]On 20 or more days during the 30 days before the survey.
[d]On all 30 days during the 30 days before the survey.
[e]The number of respondents within the subgroup did not meet the minimum reporting threshold or data were not available.

Patterns of Polytobacco Use

Current polytobacco product use was defined in the BRFSS as concurrent use of at least two out of three tobacco products—cigarettes, smokeless tobacco, and e-cigarettes. Among states with available data, current polytobacco product use among adults in 2020 ranged from 0.7% (95% CI, 0.4–1.0) in Massachusetts to 4.4% in Alaska (95% CI, 3.3–5.6), West Virginia (95% CI, 3.6–5.2), and Wyoming (95% CI, 3.4–5.4) (Table 2.41). The prevalence of current polytobacco product use among adults was 0.8 percentage points (New York, 1.5%; 95% CI, 1.2–1.8) to 3.7 percentage points (Alaska, West Virginia, and Wyoming, 4.4%) higher in other states (with available data) than it was in Massachusetts. By region, use of multiple tobacco products was higher in the South (2.5%; 95% CI, 2.3–2.7) and the Midwest (2.3%; 95% CI, 2.1–2.5) than it was in the Northeast (1.8%; 95% CI, 1.6–2.0) and the West (1.4%; 95% CI, 1.2–1.5).

Among young adults in 2020, many estimates of polytobacco product use were suppressed because of data instability. The remaining estimates from 26 states in 2020 ranged from 2.3% (95% CI, 1.0–3.6) in Maryland to 9.6% (95% CI, 6.4–12.9) in Montana (Table 2.41). The prevalence of current polytobacco product use among young adults was 0.7 percentage points (Florida, 3.0%; 95% CI, 1.3–4.7) to 7.3 percentage points (Montana, 9.6%; 95% CI, 6.4–12.9) higher in other states (with available data) than it was in Maryland. By region, polytobacco use ranged from 2.6% (95% CI, 1.7–3.4) in the West to 4.4% (95% CI, 3.6–5.2) in the South.

Urban and Rural Differences in Tobacco Use

Previous studies have documented the higher prevalence of cigarette and smokeless tobacco use in rural versus urban areas of the United States (Roberts et al. 2016b, 2017; Doogan et al. 2017; Cepeda-Benito et al. 2018; Talbot et al. 2019). The higher prevalence of tobacco use in rural populations is not equally distributed across the nation, nor is it consistent across tobacco products (Roberts et al. 2016b).

Patterns of Ever and Current Use of Cigarettes

Youth

Among youth, the location of their school in an urban or rural county is associated with trends in tobacco use over time. For example, examining data from the NYTS for 2011–2014, Pesko and Robarts (2017) found that the odds of past-30-day use of cigarettes (OR = 1.27; 95% CI, 1.08–1.51) was significantly higher, after adjusting for covariates, among rural youth than it was for urban youth.

Table 2.41 Prevalence of current use[a] of multiple tobacco products[b] among adults, 18 years of age and older, by age group and location and region; Behavioral Risk Factor Surveillance System (BRFSS) 2020, United States

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Location					
Alabama	2.8 (2.2–3.5)	5.8 (2.8–8.7)	4.0 (2.7–5.3)	2.3 (1.4–3.3)	—[c]
Alaska	4.4 (3.3–5.6)	8.6 (3.7–13.6)	6.3 (4.0–8.6)	2.8 (1.4–4.1)	—[c]
Arizona	—[d]	—[d]	—[d]	—[d]	—[d]
Arkansas	4.3 (3.4–5.2)	9.0 (4.2–13.7)	5.9 (4.1–7.7)	3.3 (2.2–4.4)	1.0 (0.5–1.5)
California	—[d]	—[d]	—[d]	—[d]	—[d]
Colorado	—[d]	—[d]	—[d]	—[d]	—[d]
Connecticut	1.8 (1.4–2.2)	3.2 (1.4–5.0)	3.2 (2.2–4.1)	1.2 (0.6–1.7)	—[c]
Delaware	2.1 (1.4–2.7)	—[c]	3.5 (1.8–5.1)	1.3 (0.7–1.9)	—[c]
District of Columbia	—[d]	—[d]	—[d]	—[d]	—[d]
Florida	1.8 (1.4–2.3)	3.0 (1.3–4.7)	2.5 (1.7–3.4)	2.0 (1.0–3.0)	—[c]
Georgia	3.1 (2.4–3.7)	6.3 (3.3–9.2)	4.5 (3.3–5.8)	1.7 (1.1–2.4)	—[c]
Hawai‘i	2.1 (1.7–2.6)	6.5 (3.6–9.3)	3.0 (2.1–4.0)	1.0 (0.5–1.5)	—[c]
Idaho	3.0 (2.4–3.7)	6.1 (3.3–8.9)	4.9 (3.5–6.3)	1.5 (0.7–2.3)	—[c]
Illinois	1.6 (1.1–2.1)	—[c]	1.9 (1.0–2.8)	1.3 (0.6–2.1)	—[c]
Indiana	3.6 (3.0–4.2)	4.6 (2.5–6.8)	5.6 (4.3–6.9)	2.9 (2.2–3.6)	1.1 (0.6–1.6)
Iowa	—[d]	—[d]	—[d]	—[d]	—[d]
Kansas	2.5 (2.1–3.0)	4.1 (2.2–6.0)	3.7 (2.7–4.6)	2.1 (1.4–2.8)	—[c]
Kentucky	4.0 (3.2–4.9)	—[c]	7.3 (5.2–9.3)	3.2 (2.1–4.2)	—[c]
Louisiana	—[d]	—[d]	—[d]	—[d]	—[d]
Maine	2.3 (1.7–2.9)	—[c]	4.5 (3.2–5.9)	1.0 (0.5–1.4)	0.7 (0.3–1.1)
Maryland	1.7 (1.3–2.1)	2.3 (1.0–3.6)	2.7 (1.8–3.6)	1.5 (0.9–2.2)	—[c]
Massachusetts	0.7 (0.4–1.0)	—[c]	1.2 (0.5–1.8)	0.4 (0.1–0.7)c	—[c]
Michigan	1.9 (1.5–2.4)	3.0 (1.5–4.5)	3.4 (2.3–4.5)	1.3 (0.8–1.8)	—[c]
Minnesota	2.5 (2.1–2.8)	5.2 (3.6–6.9)	3.7 (3.0–4.4)	1.6 (1.3–2.0)	0.4 (0.2–0.6)
Mississippi	2.8 (2.2–3.3)	—[c]	4.5 (3.2–5.7)	2.4 (1.6–3.3)	0.7 (0.3–1.2)
Missouri	2.9 (2.4–3.4)	4.6 (2.7–6.6)	4.6 (3.5–5.8)	2.3 (1.6–3.0)	—[c]
Montana	3.5 (2.9–4.2)	9.6 (6.4–12.9)	5.6 (4.1–7.0)	1.3 (0.8–1.8)	0.9 (0.5–1.4)
Nebraska	2.9 (2.4–3.3)	5.9 (4.0–7.8)	4.1 (3.2–5.0)	1.9 (1.3–2.5)	0.6 (0.3–0.8)
Nevada	2.0 (1.4–2.7)	—[c]	3.2 (1.8–4.6)	—[c]	—[c]
New Hampshire	2.4 (1.8–3.0)	—[c]	4.3 (2.8–5.9)	1.3 (0.7–1.9)	—[c]
New Jersey	1.8 (1.4–2.2)	3.1 (1.7–4.5)	3.0 (2.1–3.9)	1.2 (0.7–1.7)	—[c]
New Mexico	2.7 (2.0–3.5)	—[c]	5.0 (3.1–7.0)	1.7 (0.7–2.6)	—[c]
New York	1.5 (1.2–1.8)	—[c]	1.9 (1.4–2.5)	2.1 (1.4–2.7)	0.4 (0.2–0.7)
North Carolina	2.8 (2.3–3.3)	3.6 (1.6–5.6)	3.2 (2.3–4.1)	3.0 (2.1–4.0)	1.4 (0.6–2.2)
North Dakota	3.8 (2.9–4.7)	6.0 (2.7–9.3)	6.0 (4.2–7.9)	2.6 (1.5–3.7)	—[c]
Ohio	3.1 (2.6–3.5)	5.3 (3.5–7.1)	4.7 (3.7–5.6)	2.3 (1.8–2.8)	0.8 (0.4–1.1)
Oklahoma	—[d]	—[d]	—[d]	—[d]	—[d]
Oregon	2.4 (1.8–2.9)	5.4 (2.7–8.1)	3.7 (2.6–4.7)	1.3 (0.7–1.8)	—[c]

Table 2.41 Continued

Location and region	Overall: % (95% CI)	18–24 years of age: % (95% CI)	25–44 years of age: % (95% CI)	45–64 years of age: % (95% CI)	≥65 years of age: % (95% CI)
Pennsylvania	2.7 (2.1–3.3)	—[c]	4.3 (2.9–5.7)	2.1 (1.4–2.9)	—[c]
Rhode Island	2.2 (1.5–2.9)	—[c]	3.1 (1.7–4.4)	1.4 (0.7–2.0)	—[c]
South Carolina	—[d]	—[d]	—[d]	—[d]	—[d]
South Dakota	2.1 (1.4–2.9)	—[c]	4.4 (2.3–6.5)	—[c]	—[c]
Tennessee	3.8 (2.8–4.8)	—[c]	4.5 (3.1–5.9)	2.7 (1.7–3.6)	—[c]
Texas	2.5 (2.0–3.1)	4.5 (2.4–6.6)	2.7 (1.7–3.7)	2.7 (1.7–3.7)	—[c]
Utah	2.7 (2.2–3.1)	4.1 (2.7–5.5)	3.6 (2.7–4.5)	1.9 (1.3–2.4)	—[c]
Vermont	2.0 (1.2–2.7)	—[c]	3.1 (1.8–4.4)	1.0 (0.6–1.5)	—[c]
Virginia	2.4 (1.9–2.9)	3.9 (2.1–5.6)	3.9 (2.8–5.1)	1.7 (1.1–2.3)	—[c]
Washington	2.4 (2.1–2.8)	3.4 (2.0–4.7)	3.8 (3.0–4.7)	1.6 (1.2–2.1)	0.9 (0.4–1.3)
West Virginia	4.4 (3.6–5.2)	—[c]	8.4 (6.5–10.3)	3.3 (2.4–4.2)	0.7 (0.3–1.1)
Wisconsin	—[d]	—[d]	—[d]	—[d]	—[d]
Wyoming	4.4 (3.4–5.4)	7.9 (3.8–12.0)	6.9 (4.8–9.1)	2.8 (1.7–4.0)	—[c]
Region					
Northeast	1.8 (1.6–2.0)	2.7 (1.9–3.5)	2.8 (2.3–3.2)	1.6 (1.3–1.9)	0.4 (0.2–0.5)
Midwest	2.3 (2.1–2.5)	3.8 (3.2–4.4)	3.5 (3.2–3.8)	1.8 (1.5–2.0)	0.6 (0.4–0.7)
South	2.5 (2.3–2.7)	4.4 (3.6–5.2)	3.3 (3.0–3.7)	2.3 (2.0–2.6)	0.6 (0.5–0.7)
West	1.4 (1.2–1.5)	2.6 (1.7–3.4)	2.0 (1.6–2.3)	0.9 (0.6–1.1)	0.3 (0.2–0.5)

Source: BRFSS, Centers for Disease Control and Prevention, public use data, 2020.
Notes: **CI =** confidence interval.
[a]Current use of cigarettes was defined as having smoked 100 cigarettes in a lifetime and smoking every day or some days at the time of the survey. Current use of other tobacco products (smokeless tobacco, e-cigarettes) was defined as having ever used such products and using them every day or some days at the time of the survey.
[b]Includes current use of two or more tobacco products. Data were excluded from adults whose current use status was missing across all three products (i.e., cigarettes, smokeless tobacco, and e-cigarettes).
[c]Estimate is not presented because of a relative standard error >30%.
[d]Eight states (Arizona, California, Colorado, Iowa, Louisiana, Oklahoma, South Carolina, and Wisconsin) and the District of Columbia did not field the 2020 BRFSS optional module for e-cigarettes.

However, during the 3-year period, cigarette use decreased among rural (from 17.5% in 2011 to 6.5% in 2014) and urban youth (from 8.1% in 2011 to 4.9% in 2014) (Pesko and Robarts 2017).

Trend data in other studies show that disparities in tobacco use have remained or widened over time between youth who live in rural areas and those who live in urban areas. One study, using NSDUH data from 2008 to 2016, estimated that the prevalence of smoking did not differ between rural youth and urban youth in 2008–2010, but rural youth had 54% higher odds of past-month cigarette smoking than did urban youth in 2014–2016 (Ziller et al. 2019). Using 20 years of data from the Monitoring the Future Study, another study showed that (a) disparities in ever cigarette use, ever regular cigarette smoking, and current regular cigarette smoking persisted from 1998 to 2018, and (b) the difference in ever cigarette use between rural and urban youth widened from 6.9 percentage points in 1998 to 13.5 percentage points in 2018 (rural: 34.4% vs. urban: 20.9% in 2018) (Kim and Selya 2021).

Adults

The literature generally suggests that the prevalence of smoking cigarettes is higher in rural areas than it is in urban areas (Vander Weg et al. 2011; Doogan et al. 2017; Nighbor et al. 2018; Coughlin et al. 2019; Parker et al. 2022). According to the 2008 BRFSS, the odds of lifetime smoking (having smoked at least 100 cigarettes in one's lifetime) were lower among adults living in suburban and urban areas (suburban: aOR = 0.95; 95% CI, 0.92–0.98; urban: aOR = 0.95; 95% CI, 0.92–0.99) and the odds of current smoking (having smoked every day or some days at the time of the survey) were lower among adults living in suburban and urban areas (suburban: aOR = 0.87; 95% CI, 0.83–0.91; urban: aOR = 0.90; 95% CI, 0.86–0.95) than they were among adults living in rural areas (Vander Weg et al. 2011).

Similarly, a study using 2007–2014 data from the NSDUH showed that in 2007, the odds of current smoking (having smoked at least 100 cigarettes in the lifetime and at least one cigarette during the past 30 days) were higher among adults living in rural areas (OR = 1.30; 95% CI, 1.22–1.38) than they were among adults living in urban areas, but the relationship was not significant after adjusting for age, gender, race, education, income, unemployment, outdoor occupation, marital status, anxiety, depression, health insurance status, smokeless tobacco use, and substance use (Doogan et al. 2017). However, an interaction between time (integer coded from zero [year 2007] to seven [year 2014]) and rural status indicated that the time slope for rural residents differed from that of urban residents. Specifically, the time coefficient suggested there was a 3% decrease in the odds of smoking among urban residents for each year from 2007 to 2014 (OR = 0.97; 95% CI, 0.96–0.98), but the rural trend was not significant in post hoc interaction analyses (OR = 0.99; 95% CI, 0.98–1.00). Furthermore, the adjusted odds of smoking in 2014 were significantly higher among rural residents (aOR = 1.19; 95% CI, 1.11–1.27) than they were among urban residents (Doogan et al. 2017).

Using more recent data from the 2007–2017 NSDUH, Coughlin and colleagues (2019) reported that the urban–rural disparity in current use of cigarettes increased during this period because the prevalence of current cigarette use declined more rapidly in urban areas than it did in rural areas during this period. The odds of cigarette use among people living in urban areas was 15% lower in 2017 (aOR = 0.85; 95% CI: 0.81–0.88) than it was in 2007, and the odds of cigarette use among people living in rural areas was 8% lower in 2017 (aOR = 0.92; 95% CI, 0.85–0.99) than it was in 2007 (Coughlin et al. 2019). Finally, the 2013–2014 wave of the PATH Study revealed that both past-30-day and daily cigarette use were higher among residents of rural areas (past-30-day use: 24.6%; daily use: 18.3%) than they were among residents of urban areas (past-30-day use: 22.0%; daily use: 13.4%) (Roberts et al. 2017).

Patterns of smoking in urban and rural areas vary by region of the United States. According to pooled data from the 2012–2013 NSDUH, differences in urban and rural smoking patterns were not significant in the West and the Midwest. In the Northeast (specifically, in the New England division) and in the South, however, daily smoking was higher among people in rural areas compared with those in urban areas; in the South, the rate of any past-30-day smoking was also higher among people in rural areas than it was among those in urban areas (Roberts et al. 2016b). Notably, in both the West and Midwest, past-30-day use of menthol cigarettes was lower in rural areas than it was in urban areas (Roberts et al. 2016b).

Cigarette Use by Urban and Rural Residence and Sex

Some differences are known to exist in patterns of urban and rural smoking by sex. Rural men, according to the combined 2007–2014 NSDUH, had the highest prevalence of current (30.1%) and daily (21.8%) smoking, followed by rural women (current: 24.8%; daily: 18.9%), urban men (current: 23.9%; daily: 15.0%), and urban women (current: 18.8%; daily: 12.8%) (Cepeda-Benito et al. 2018). Over time, the prevalence of smoking declined among rural men, urban men, and urban women but was flat among rural women; the prevalence of smoking among rural women surpassed that of urban men in 2014 (Cepeda-Benito et al. 2018).

Nighbor and colleagues (2018) analyzed data from the 2007–2016 NSDUH survey to estimate current cigarette use among women of reproductive age (15–44 years of age), including those who were pregnant. Although current cigarette use declined among women overall from 2007 to 2016, the prevalence of cigarette use remained higher among rural women of reproductive age than it was among urban women of reproductive age. The prevalence of cigarette smoking did not decline significantly from 2007 to 2016 among both rural and urban women who were pregnant, but the prevalence of cigarette use was higher among rural women who were pregnant than it was among urban women who were pregnant across this period. However, a statistically significant interaction was observed between residency and pregnancy status: the odds of cigarette smoking were 25% (aOR = 0.75; 95% CI, 0.62–0.92) lower among rural women who were pregnant than they were among rural women who were not pregnant, and the odds of cigarette smoking were 42% (aOR = 0.58; 95% CI, 0.53–0.63) lower among urban women who were pregnant than they were among urban women who were not pregnant, suggesting greater pregnancy-related quitting among urban women (Nighbor et al. 2018).

Patterns of the Use of Other Tobacco Products

Examining pooled data from the NYTS for 2011–2014, Pesko and Robarts (2017) found that, compared with youth living in urban areas, youth living in rural areas had a higher prevalence of smokeless tobacco use (7.0% vs. 2.9%, $p < 0.001$), multiple tobacco product use (10.3% vs. 7.3%, $p < 0.001$), and use of any tobacco product (17.0% vs. 13.1%, $p = 0.006$). However, after adjusting for covariates, only the odds of past-30-day use of smokeless tobacco (OR = 1.51; 95% CI, 1.24–1.83) was significantly higher among rural youth than it was among urban youth. During this 3-year period, cigar and smokeless tobacco use decreased among rural and urban youth. Use of multiple tobacco products increased among urban youth (from 6.9% to 8.9%, p = 0.02), but it declined among rural youth (from 14.5% to 8.3%, p = 0.002). Use of any tobacco product also declined among rural youth but did not change significantly over time among urban youth. While use of e-cigarettes increased among rural and urban youth, this study found that past-30-day use of e-cigarettes grew at a greater rate over this period for urban youth (from 0.9% in 2011 to 8.6% in 2014) compared with rural youth (2.1% in 2011 to 4.3% in 2014) (Pesko and Robarts 2017).

In another study examining data from the NYTS for 2011–2016, Wiggins and colleagues (2020) found no differences in the rate of change in any tobacco product use prevalence measure over time between rural and urban middle or high school students. Furthermore, Noland and colleagues (2018), in their study of NYTS data among youth who in 2014 had smoked conventional cigarettes during the past 30 days, found that those attending an urban school were 86% more likely than their counterparts in rural schools to have also used e-cigarettes during the past 30 days, but among youth who did not smoke, the likelihood of using e-cigarettes did not differ between youth in urban schools and those attending rural schools.

Similar to cigarette smoking, use of smokeless tobacco tends to be higher among people living in rural areas than among those living in urban areas. BRFSS data from 2008 revealed that the odds of ever trying smokeless tobacco were lower among adults living in suburban (aOR = 0.72; 95% CI, 0.64–0.80) and urban (aOR = 0.59; 95% CI, 0.52–0.66) areas than they were among adults living in rural areas; this was also true for current use (every day or some days) of smokeless tobacco (Vander Weg et al. 2011). Data from the NSDUH further show this relationship. Among individuals 12 years of age and older, a higher prevalence of smokeless tobacco use was observed in rural areas compared with urban areas across all four regions of the United States and in almost all nine statistical divisions in the United States (Roberts et al. 2016b). According to the PATH Study, past-30-day use of smokeless tobacco was three times more prevalent among adults in rural areas than it was in urban areas (6.3% vs. 2.1%) (Roberts et al. 2017).

According to an analysis of pooled data from the 2012–2013 NSDUH, past-30-day use of cigars was lower among residents in rural areas than it was among those in urban areas in the Midwest (particularly in the West North Central division of the Midwest, which includes Iowa, Kansas, Minnesota, Missouri, North Dakota, Nebraska, and South Dakota) and in the South (particularly the South Atlantic division of the South, which includes Delaware, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia), but pipe use did not differ by urban or rural areas in these two divisions (Roberts et al. 2016b). The PATH Study found that in 2013–2014, cigarillo and hookah smoking, along with dual use or polyuse of emerging tobacco products (e-cigarettes, cigarillos, or hookah), were all more prevalent among people in urban areas than they were among those in rural areas, but use of e-cigarettes, cigars, or pipes did not differ significantly across urban or rural areas (Roberts et al. 2017). Another study found no differences in use of noncigarette tobacco products (cigars, pipes, bidis, kreteks, or other) by rural or urban residence (Vander Weg et al. 2011).

According to data from the 2014–2015 TUS-CPS that were analyzed by Mumford and colleagues (2019), rural residents in the United States had a higher prevalence of ever use of e-cigarettes (rural: 9.4% vs. urban: 7.0%) and current use of e-cigarettes (rural: 2.8% vs. urban: 2.1%) compared with urban residents. Mumford and colleagues (2019) also examined urban–rural differences in e-cigarette use across the 10 regions designated by USDHHS; the largest urban–rural difference in ever use of e-cigarettes was observed in Region 2 (New York-New Jersey), in which 10.4% of rural residents and 5.0% of urban residents reported having ever used e-cigarettes. Furthermore, adjusted results indicated that current use of e-cigarettes was less likely among rural residents than it was among urban residents across northern and western parts of the United States (New England, East North Central, Heartland, North Central Mountain, Northwest, and Southwest Pacific regions) (aOR range = 0.61–0.79), but no significant differences were observed in the use of e-cigarettes between urban and rural residents in several regions (Mumford et al. 2019).

Patterns of Smoking Cessation

Using NSDUH data from 2010 to 2020, Parker and colleagues (2022) examined trends in quit ratios among people who smoked cigarettes and lived in rural and urban areas. In 2020, the prevalence of current cigarette smoking was higher among residents in rural areas (19.2%; 95% CI, 16.9%–21.7%) than it was among those in urban areas (14.4%; 95% CI, 13.3%–15.5%), but quit ratios were similar in rural (52.9%; 95% CI, 48.3–57.4) and urban (53.9%; 95% CI, 51.4–56.5) areas. Although quit ratios increased over time from 2010 to 2020, the adjusted odds of quitting across all years were lower among people who lived in rural areas than they were among those who lived in urban areas (aOR = 0.93; 95% CI, 0.89–0.98).

Disparities in Exposure to Secondhand Tobacco Smoke

Millions of nonsmoking people in the United States are exposed to secondhand tobacco smoke (CDC 2010). Disparities in exposure to secondhand tobacco smoke were highlighted in the 1998 Surgeon General's report, *Tobacco Use Among U.S. Racial/Ethnic Minority Groups–African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics* (USDHHS 1998); the 2006 Surgeon General's report, *The Health Consequences of Involuntary Exposure to Tobacco Smoke* (USDHHS 2006); and in NCI Tobacco Control Monograph 22, *A Socioecological Approach to Addressing Tobacco-Related Health Disparities* (NCI 2017). The 2006 Surgeon General's report concluded that no amount of exposure to secondhand tobacco smoke is safe (USDHHS 2006). According to these reports, nonsmoking people from lower SES backgrounds are disproportionately affected by exposure to secondhand tobacco smoke. However, from 1988 to 2014, exposure to secondhand tobacco smoke declined across age, racial and ethnic, and income groups (Tsai et al. 2018).

Exposure to secondhand tobacco smoke occurs in many settings: at home, in vehicles, in the workplace, and in other public places. The number of state and local comprehensive smokefree or clean indoor air policies and laws that prohibit smoking in all indoor public places and worksites, including restaurants and bars, has grown in the United States (Table 2.42) (see Chapter 7). As of January 2023, 62.5% of the total U.S. population is covered by 100% smokefree indoor air policies in bars, restaurants, and worksites (American Nonsmokers' Rights Foundation 2023). However, some regions have lagged behind in adopting such policies (Hafez et al. 2019). In addition, these policies do not cover all populations equally (Gonzalez et al. 2013). Smokefree policies have the potential to be equity-producing for some populations. For example, among adults who smoke cigarettes, those who work in the accommodation and food services sector report lower levels of educational attainment and lower levels of income than those who work in other job sectors (Table 2.43) and thus, policies restricting smoking in restaurants and bars may be particularly important to protecting these workers from exposure to secondhand tobacco smoke.

Exposure to Secondhand Tobacco Smoke in Homes

The home is the main setting in which youth are exposed to secondhand tobacco smoke and is also a major source of exposure to secondhand tobacco smoke among nonsmoking adults (Yao et al. 2016). Although

Table 2.42 Status of smokefree indoor air restrictions in private worksites, restaurants, and bars in the United States and U.S. territories as of June 30, 2021

Location	Private worksites	Restaurants	Bars
Alabama	Designated areas	None	None
Alaska	No provision	Designated areas	No provision
American Samoa	Banned	Banned	Banned
Arizona	Banned	Banned	Banned
Arkansas	Banned	Designated Areas	None
California	Banned	Banned	Banned
Colorado	Banned	Banned	Banned
Connecticut	Separate ventilated areas	Separate ventilated areas	Separate ventilated areas
Delaware	Banned	Banned	Banned
District of Columbia	Banned	Banned	Banned
Florida	Banned	Banned	None
Georgia	Designated areas	Designated areas	Designated areas
Guam	Designated smoking area	Banned	Banned
Hawai‘i	Banned	Banned	Banned
Idaho	Designated areas	Banned	None
Illinois	Banned	Banned	Banned

Table 2.42 Continued

Location	Private worksites	Restaurants	Bars
Indiana	Banned	Banned	None
Iowa	Banned	Banned	Banned
Kansas	Banned	Banned	Banned
Kentucky	No provision	No provision	No provision
Louisiana	Banned	Banned	None
Maine	Banned	Banned	Banned
Marshall Islands	Banned	Banned	Banned
Maryland	Banned	Banned	Banned
Massachusetts	Banned	Banned	Banned
Michigan	Banned	Banned	Banned
Minnesota	Banned	Banned	Banned
Mississippi	No provision	No provision	No provision
Missouri	Designated areas	Designated areas	Designated areas
Montana	Banned	Banned	Banned
Nebraska	Banned	Banned	Banned
Nevada	Banned	Banned	None
New Hampshire	Designated areas	Banned	No provision
New Jersey	Banned	Banned	Banned
New Mexico	Banned	Banned	Banned
New York	Banned	Banned	Banned
North Carolina	No provision	Banned	Banned
North Dakota	Banned	Banned	Banned
Northern Mariana Islands	Banned	Banned	No provision
Ohio	Banned	Banned	Banned
Oklahoma	Designated areas	Separate ventilated areas	None
Oregon	Banned	Banned	Banned
Palau	Banned	Designated smoking area	Designated smoking area
Pennsylvania	Banned	Separate ventilated areas	None
Puerto Rico	Banned	Banned	Banned
Rhode Island	Banned	Banned	Banned
South Carolina	No provision	No provision	No provision
South Dakota	Banned	Banned	Banned
Tennessee	Banned	Designated Areas	None
Texas	No provision	No provision	No provision
Utah	Banned	Banned	Banned
Vermont	Banned	Banned	Banned
Virgin Islands (U.S.)	Banned	Banned	Banned
Virginia	No provision	Separate ventilated areas	Separate ventilated areas
Washington	Banned	Banned	Banned
West Virginia	No provision	No provision	No provision
Wisconsin	Banned	Banned	Banned
Wyoming	No provision	No provision	No provision

Source: CDC (2023b).

Table 2.43 Characteristics of adults, 18 years of age and older, who smoked cigarettes, by industry sector; National Health Interview Survey (NHIS) 2020–2021, United States

Characteristics	People who work in the accommodation and food services sector: % (95% CI)	People who work in all other industry sectors: % (95% CI)	p-value[a]
Total	15.6 (13.6–17.7)	11.3 (10.9–11.8)	<0.001
Education			
< High school diploma	9.9 (5.7–14.0	6.3 (5.3–7.3))	0.103
High school diploma/GED	36.2 (29.0–43.4)	29.9 (28.0–31.8)	0.094
> High school diploma	53.5 (46.1–61.0)	63.6 (61.6–65.6)	0.010
Poverty status[b]			
Poor	19.7 (13.5–25.8)	9.9 (8.6–11.1)	<0.002
Near poor	28.3 (22.2–34.3)	22.9 (21.2–24.7)	0.100
Not poor	52.1 (44.8–59.3)	67.2 (65.1–69.3)	<0.001
Frequency of smoking			
Every day	78.1 (72.4–83.8)	72.3 (70.4–74.1)	0.054
Some days	21.9 (16.2–27.5	27.7 (25.9–29.6	0.054
Number of cigarettes smoked per day			
≤12	66.0 (58.2–73.9)	56.2 (53.7–58.7)	0.019
>12	34.0 (26.1–41.8)	43.8 (41.3–46.3)	0.019
Attempted to quit smoking[c]			
Yes	52.8 (43.3–62.3)	49.9 (47.1–52.7)	0.568
No	47.2 (37.7–56.7)	50.1 (47.3–52.9)	0.568
Self-rated physical health[d]			
Excellent/good	89.0 (85.4–92.9)	87.8 (86.5–89.1)	0.573
Poor/fair	11.0 (7.1–15.0)	12.2 (10.9–13.5)	0.573
Regularly having feelings of anxiety[e]			
Yes	73.5 (67.5–79.5)	71.3 (69.4–73.3)	0.501
No	26.5 (20.5–32.5)	28.7 (26.7–30.6)	0.501
Regularly having feelings of depression[f]			
Yes	59.5 (52.6–66.4)	49.7 (47.6–51.8)	0.007
No	40.5 (33.6–47.3)	50.3 (48.2–52.4)	0.007

Source: NHIS, National Center for Health Statistics, public use data, 2020–2021.

Notes: The 2021 NHIS public use data are the most recent to report industry/occupation information. This information was not included in the 2019 NHIS public use data. **CI =** confidence interval; **GED =** General Educational Development (certificate or diploma).

[a]Two-tailed t-tests were used to determine statistically significant differences in characteristics of people who smoked cigarettes in the accommodations and food service industry and people who smoked cigarettes in all other industries, combined. More information is available at Schiller (2011).

[b]Poverty status was based on family income and family size using poverty thresholds, as defined by the U.S. Census Bureau, for the previous calendar year. Poor was defined as being below the poverty threshold. Near poor was defined as a family income between 100% and 199% of the poverty threshold. Not poor was defined as a family income at least 200% of the poverty threshold. More information is available at National Center for Health Statistics (2009).

[c]Attempted to quit smoking was based on responses to the question, "During the past 12 months, have you stopped smoking for more than 1 day because you were trying to quit smoking?" This variable is based on data for only the year 2020.

[d]Physical health was based on responses to the question, "Would you say your health in general is excellent, very good, good, fair, or poor?"

[e]Answers to the following questions were used to assess regularly having feelings of anxiety: "How often do you feel worried, nervous or anxious? Would you say daily, weekly, monthly, a few times a year, or never?" and "Thinking about the last time you felt worried, nervous or anxious, how would you describe the level of these feelings? Would you say a little, a lot, or somewhere in between?"

[f]Answers to the following questions were used to assess regularly having feelings of depression: "How often do you feel depressed? Would you say daily, weekly, monthly, a few times a year, or never?" and "Thinking about the last time you felt depressed, how would you describe the level of these feelings? Would you say a little, a lot, or somewhere in between?"

an increasing proportion of the population is covered by smokefree laws, millions of people who do not smoke continue to be exposed to secondhand tobacco smoke in private areas, such as homes and vehicles, that are not covered by such laws (King et al. 2014b). Using data from the 2011–2018 NYTS, Walton and colleagues (2020) estimated that self-reported exposure to secondhand tobacco smoke inside the home declined from 26.8% in 2011 to 20.9% in 2018 ($p < 0.001$) among U.S. middle and high school students. However, in 2019, 25.3% (95% CI, 23.4–27.3) of U.S. middle and high school students (an estimated 6.7 million students) reported that someone had smoked tobacco products inside their respective homes while they were present during the past 7 days (Walton et al. 2020).

King and colleagues (2014b) found that the greatest proportion of smokefree rules in the home occurred in households with no adults who smoked; the same pattern also emerged in the 2018–2019 data from TUS-CPS (Table 2.44). The prevalence of smokefree rules in homes with adults who did not smoke during 2018–2019 ranged from 89.3% (95% CI, 87.4–91.2) in Kentucky to 96.7% (95% CI, 95.8–97.6) in Idaho (Table 2.44). For households with at least one adult who smoked, the prevalence of smokefree rules in homes was lower than that in homes with adults who did not smoke. However, the prevalence of smokefree rules in homes with at least one person who smoked rose dramatically over time, from 9.6% (95% CI, 8.8–10.4) during 1992–1993 to 57.8% (95% CI, 56.8–58.8) during 2018–2019. By state, the prevalence of smokefree rules in homes in 2018–2019 with at least one adult who smoked ranged from 39.1% (95% CI, 34.0–44.3) in Kentucky to 80.8% (95% CI, 73.7–87.9) in Utah (Table 2.44). In all households, the prevalence of smokefree rules increased from 43.0% (95% CI, 42.1–43.9) during 1992–1993 to 89.1% (95% CI, 88.9–89.4) during 2018–2019 (Table 2.44).

One-quarter of the U.S. population, roughly 80 million people, resides in multi-unit housing, including apartment buildings (King et al. 2013a). An estimated 7 million of these people live in subsidized housing (U.S. Department of Housing and Urban Development n.d.). On February 2, 2017, the U.S. Department of Housing and Urban Development promulgated a final rule requiring public housing authorities to adopt smokefree policies (Federal Register 2016). The rule, which went into effect on July 30, 2018, requires more than 3,000 public housing authorities across the country to restrict smoking in all indoor areas and within 25 feet of buildings. However, this policy does not apply to all forms of subsidized, multi-unit housing, including Section 8.

One measure to evaluate the implementation of smokefree policies is the proportion of multi-unit housing residents exposed to incursions of secondhand tobacco smoke into their homes from nearby units or shared areas. Data on real-time transfer between smoking and smokefree units confirm that measurable units of PM2.5 (particulate matter 2.5) are detectable in adjacent smokefree units: 10.2 micrograms per cubic meter of air ($\mu g/m^3$) in adjacent smokefree units, 18.9 $\mu g/m^3$ in hallways, and 29.4 $\mu g/m^3$ in smoke-permitted units (King et al. 2013a). A 2013 study using a random sample of U.S. multi-unit housing residents with children in the home and without smoking in the home determined that 25.2% of residents had experienced a recent incursion of secondhand tobacco smoke into their homes (Wilson et al. 2017).

Exposure to Secondhand Tobacco Smoke in Vehicles

As of January 31, 2023, nine states (Arkansas, California, Illinois, Louisiana, Maine, Oregon, Utah, Vermont, and Virginia), Guam, the Northern Mariana Islands, and Puerto Rico had passed laws prohibiting smoking in personal vehicles when children are present (CDC 2023c). Using nationally representative data from the 2009–2010 and 2013–2014 National Adult Tobacco Survey, Kruger and colleagues (2016) estimated that from 2009–2010 to 2013–2014, the percentage of adults with 100% smokefree vehicle rules increased from 73.6% to 79.5% ($p < 0.05$). Using data from the 2011–2018 NYTS, Walton and colleagues (2020) estimated that self-reported exposure to secondhand tobacco smoke inside vehicles declined from 30.2% in 2011 to 19.8% in 2018 among U.S. middle and high school students. However, in 2019, 23.3% (95% CI, 21.4–25.4) of U.S. middle and high school students (an estimated 6.1 million students) reported that someone had smoked tobacco products inside a vehicle while they were present during the past 7 days (Walton et al. 2020).

Exposure to Secondhand Tobacco Smoke in Correctional Settings

An estimated 2.1 million people were incarcerated in the United States in 2019 (Minton et al. 2021). An estimated 50% of state and federal inmates in 2004 currently smoked cigarettes (Binswanger et al. 2009; Kennedy et al. 2016). In a national study, adults who were incarcerated were more likely to have relatively lower levels of educational attainment and income and to have mental health and other chronic health issues compared with adults who were not incarcerated (James and Glaze 2006). These factors are independently associated with tobacco use, putting adults who are incarcerated at high risk of tobacco use.

Table 2.44 Percentage of households with a smokefree home rule,[a] by location and smoking status of an adult living in the household;[b] Tobacco Use Supplement to the Current Population Survey (TUS-CPS) 1992–1993 and 2018–2019, United States

	All households: % (95% CI)		Households with adults who did not smoke: % (95% CI)		Household with at least one adult who did smoke: % (95% CI)	
Location	1992–1993	2018–2019c	1992–1993	2018–2019[c]	1992–1993	2018–2019c
Alabama	38.7 (34.0–43.4)	85.2 (82.5–87.9)	54.1 (48.4–59.8)	93.3 (91.4–95.2)	6.7 (5.1–8.3)	45.2 (40.1–50.3)
Alaska	50.8 (46.9–54.7)	91.1 (89.5–92.7)	68.0 (63.8–72.1)	94.9 (93.5–96.3)	14.1 (8.3–19.8)	71.6 (64.5–78.6)
Arizona	54.1 (50.6–57.5)	92.5 (91.2–93.9)	68.2 (63.4–73.0)	95.8 (94.6–97.0)	17.2 (14.6–19.8)	67.7 (60.8–74.7)
Arkansas	33.1 (29.9–36.2)	84.9 (82.8–87.0)	46.7 (42.3–51.1)	91.6 (89.9–93.2)	5.3 (3.3–7.3)	51.5 (45.3–57.8)
California	59.0 (57.3–60.7)	92.9 (92.3–93.6)	71.6 (70.1–73.1)	94.8 (94.2–95.3)	19.0 (16.6–21.3)	73.3 (69.3–77.2)
Colorado	47.8 (44.8–50.8)	91.3 (89.5–93.1)	62.9 (59.3–66.6)	94.8 (93.6–96.0)	10.2 (6.6–13.8)	61.9 (52.7–71.1)
Connecticut	44.7 (42.2–47.2)	90.5 (88.6–92.4)	58.4 (54.6–62.3)	94.0 (92.3–95.6)	11.7 (8.8–14.7)	60.1 (51.0–69.1)
Delaware	40.0 (36.7–43.3)	89.6 (87.4–91.8)	52.2 (48.8–55.5)	93.0 (91.0–94.9)	9.9 (5.2–14.6)	63.8 (54.8–72.8)
District of Columbia	41.3 (37.6–43.3)	88.3 (86.8–89.8)	52.8 (48.5–57.0)	93.3 (92.2–94.5)	5.5 (1.6–9.5)	49.6 (43.0–56.3)
Florida	50.1 (48.2–51.9)	91.7 (90.9–92.5)	64.8 (62.8–66.7)	95.2 (94.6–95.9)	13.2 (10.6–15.7)	64.8 (59.9–69.7)
Georgia	41.4 (38.4–44.3)	88.1 (86.5–89.6)	55.1 (51.2–59.0)	93.3 (92.2–94.4)	7.9 (4.9–10.9)	53.4 (46.0–60.8)
Hawai‘i	51.2 (47.1–55.4)	88.0 (85.7–90.3)	64.6 (59.5–69.7)	90.2 (87.9–92.6)	12.7 (8.6–16.7)	68.3 (59.4–77.2)
Idaho	50.0 (45.1–54.9)	93.6 (92.2–94.9)	66.1 (60.5–71.7)	96.7 (95.8–97.6)	11.5 (8.9–14.1)	70.5 (64.4–76.5)
Illinois	38.5 (35.6–41.5)	88.5 (87.3–89.7)	51.3 (48.3–54.2)	94.1 (93.1–95.2)	7.2 (4.9–9.5)	51.9 (46.1–57.7)
Indiana	33.9 (30.9–36.9)	83.9 (81.2–86.6)	47.6 (43.4–51.8)	91.4 (89.7–93.1)	7.8 (4.5–11.1)	46.8 (39.2–54.5)
Iowa	35.9 (33.1–38.8)	87.8 (85.8–89.8)	48.0 (44.4–51.6)	93.3 (91.6–95.1)	5.6 (3.7–7.4)	60.3 (52.7–67.9)
Kansas	39.6 (36.0–43.2)	87.3 (85.3–89.4)	54.9 (51.6–58.2)	92.3 (90.6–93.9)	4.9 (3.2–6.7)	57.0 (50.4–63.7)
Kentucky	25.6 (21.4–29.8)	79.0 (76.4–81.6)	39.2 (33.3–45.0)	89.3 (87.4–91.2)	3.6 (2.3–5.0)	39.1 (34.0–44.3)
Louisiana	37.0 (33.3–40.7)	86.8 (85.2–88.4)	47.8 (44.1–51.5)	93.1 (91.8–94.5)	11.6 (7.1–16.1)	54.3 (47.9–60.7)
Maine	39.5 (34.6–44.4)	86.8 (84.7–88.9)	57.5 (51.7–63.4)	93.1 (91.3–95.0)	8.1 (5.1–11.1)	57.8 (48.9–66.8)
Maryland	42.4 (38.9–45.8)	91.7 (90.0–93.4)	56.7 (53.2–60.2)	94.5 (93.0–96.0)	6.3 (3.1–9.5)	68.7 (61.2–76.2)
Massachusetts	40.2 (38.1–42.3)	91.0 (89.4–92.5)	51.2 (49.1–53.2)	94.0 (92.6–95.3)	10.0 (7.8–12.2)	63.6 (56.0–71.1)
Michigan	35.0 (33.1–36.9)	84.4 (82.6–86.1)	49.1 (46.8–51.3)	91.6 (90.0–93.1)	6.1 (4.9–7.3)	47.5 (41.8–53.1)
Minnesota	39.6 (37.8–41.4)	91.4 (89.4–93.4)	53.8 (50.9–56.6)	95.1 (93.5–96.6)	7.8 (5.2–10.3)	68.3 (62.9–73.6)
Mississippi	40.9 (37.1–44.7)	82.8 (81.4–84.2)	53.9 (49.1–58.6)	91.2 (90.1–92.3)	9.1 (6.3–12.0)	48.0 (41.7–54.2)
Missouri	34.1 (30.1–38.1)	83.8 (82.3–85.3)	46.0 (41.7–50.4)	91.2 (89.7–92.7)	7.6 (4.4–10.8)	44.1 (36.6–51.6)
Montana	42.8 (38.8–46.7)	91.6 (90.2–93.0)	56.8 (53.1–60.5)	96.0 (95.0–97.0)	7.4 (5.3–9.4)	67.2 (61.4–73.0)
Nebraska	40.0 (36.3–43.7)	90.7 (88.8–92.6)	52.2 (47.6–56.8)	94.4 (92.9–96.0)	8.6 (6.7–10.6)	70.1 (63.4–76.8)
Nevada	45.5 (42.5–48.4)	90.3 (88.7–91.9)	62.5 (59.4–65.6)	93.7 (92.2–95.2)	10.3 (6.8–13.7)	70.2 (63.5–76.8)

Table 2.44 Continued

	All households: % (95% CI)		Households with adults who did not smoke: % (95% CI)		Household with at least one adult who did smoke: % (95% CI)	
Location	**1992–1993**	**2018–2019c**	**1992–1993**	**2018–2019[c]**	**1992–1993**	**2018–2019c**
New Hampshire	38.3 (34.7–42.0)	91.3 (89.6–93.0)	51.5 (47.4–55.6)	95.0 (93.5–96.6)	7.3 (3.9–10.8)	68.9 (62.9–75.0)
New Jersey	45.5 (43.2–47.7)	90.1 (88.4–91.8)	58.3 (56.3–60.3)	93.0 (91.6–94.5)	10.1 (8.5–11.7)	58.7 (50.3–67.2)
New Mexico	45.4 (40.8–50.0)	88.4 (86.3–90.5)	58.8 (53.1–64.6)	93.3 (91.5–95.0)	11.4 (5.3–17.5)	55.4 (49.5–61.3)
New York	41.4 (39.6–43.2)	87.7 (86.5–88.9)	53.7 (52.2–55.2)	92.2 (91.2–93.2)	8.1 (6.2–10.0)	49.5 (44.7–54.3)
North Carolina	34.1 (32.3–35.9)	87.8 (86.0–89.5)	46.2 (44.1–48.4)	94.0 (92.9–95.1)	8.6 (7.2–10.0)	51.7 (45.2–58.2)
North Dakota	40.9 (36.8–45.0)	88.9 (86.8–91.1)	53.0 (48.4–57.6)	93.8 (91.8–95.8)	8.3 (6.1–10.5)	66.1 (57.7–74.6)
Ohio	35.0 (33.5–36.5)	82.0 (80.6–83.4)	47.9 (46.0–49.8)	90.9 (89.6–92.2)	6.0 (4.7–7.2)	41.2 (36.8–45.6)
Oklahoma	39.1 (35.0–43.1)	85.4 (83.6–87.2)	55.2 (50.6–59.7)	92.4 (91.0–93.7)	6.0 (4.6–7.5)	54.0 (46.9–61.1)
Oregon	49.8 (45.8–53.8)	93.7 (92.1–95.3)	64.5 (60.3–68.6)	96.1 (95.0–97.1)	13.1 (7.9–18.4)	78.4 (71.7–85.1)
Pennsylvania	39.6 (37.9–41.3)	87.3 (85.7–88.9)	52.7 (50.8–54.5)	92.7 (91.2–94.2)	7.9 (6.3–9.6)	57.5 (52.1–62.9)
Rhode Island	38.9 (34.1–43.8)	91.2 (89.3–93.0)	52.6 (46.7–58.5)	93.1 (91.3–94.9)	6.6 (3.8–9.4)	72.4 (62.7–82.2)
South Carolina	39.9 (37.3–42.5)	88.1 (86.1–90.1)	54.3 (51.0–57.7)	94.2 (92.5–96.0)	7.4 (5.4–9.4)	52.0 (44.7–59.4)
South Dakota	36.7 (34.1–39.2)	89.3 (87.3–91.4)	50.0 (47.1–52.9)	93.9 (92.5–95.3)	5.2 (3.4–7.1)	68.3 (59.9–76.7)
Tennessee	33.9 (30.5–37.3)	85.6 (84.2–87.1)	48.8 (44.6–53.1)	93.5 (92.4–94.5)	4.6 (3.6–5.5)	48.6 (42.4–54.7)
Texas	46.3 (43.6–49.0)	91.6 (90.8–92.5)	60.3 (57.6–63.0)	94.7 (94.1–95.3)	10.6 (8.5–12.6)	65.7 (61.0–70.4)
Utah	69.4 (65.5–73.2)	94.5 (92.8–96.1)	82.8 (80.4–85.2)	95.7 (94.3–97.1)	20.9 (13.1–28.7)	80.8 (73.7–87.9)
Vermont	39.0 (35.3–42.7)	91.4 (90.1–92.7)	54.6 (50.3–58.9)	95.7 (94.7–96.8)	8.3 (4.6–11.9)	60.2 (53.0–67.3)
Virginia	39.0 (35.9–42.1)	90.5 (88.6–92.4)	53.8 (49.5–58.0)	94.4 (93.2–95.7)	7.4 (5.1–9.7)	58.1 (50.9–65.3)
Washington	54.3 (50.4–58.3)	93.2 (91.6–94.7)	69.5 (65.0–74.0)	95.9 (94.9–96.9)	16.9 (13.4–20.4)	71.2 (63.5–78.9)
West Virginia	27.9 (24.0–31.8)	78.3 (76.3–80.3)	41.8 (36.9–46.7)	90.0 (88.9–91.2)	4.0 (2.8–5.2)	42.6 (38.3–47.0)
Wisconsin	36.5 (33.3–39.6)	89.3 (88.0–90.7)	50.4 (47.4–53.3)	94.0 (93.0–95.1)	5.9 (4.3–7.6)	64.0 (58.1–69.9)
Wyoming	38.5 (34.5–42.4)	90.2 (88.4–91.9)	52.8 (48.6–57.1)	94.8 (93.6–96.0)	6.2 (4.1–8.2)	65.9 (59.7–72.1)
Overall	43.0 (42.1–43.9)	89.1 (88.9–89.4)	56.7 (55.9–57.5)	93.7 (93.5–94.0)	9.6 (8.8–10.4)	57.8 (56.8–58.8)

Source: Data for TUS-CPS 1992–1993 were published in King and colleagues (2014, p. 767); TUS-CPS, public use data, 2018–2019.

Notes: **CI =** confidence interval.

[a]Households were considered to have had a smokefree home rule if all adult respondents, 18 years of age and older, in the household reported that no one was allowed to smoke anywhere inside the home at any time.

[b]Households were considered to have had at least one adult who smoked if at least one adult resident, 18 years of age or older, reported having smoked at least 100 cigarettes in their lifetime and smoking "every day" or "some days" at the time of the survey.

[c]Results of TUS-CPS 2018–2019 were limited to interviewed self-respondents who were 18 years of age and older and living in civilian households (N = 137,471). Statistically significant increases, both overall and in all states ($p < 0.05$), were observed from 1992–1993 to 2018–2019.

Few smokefree policies were established in prisons and jails before the 1980s, but by 2007, an estimated 87% of U.S. prisons and jails prohibited indoor smoking at their facilities (Kauffman et al. 2008). Effective January 2015, the Federal Bureau of Prisons (BOP) prohibited smoking of tobacco in any form in and on the grounds of BOP institutions and offices, allowing BOP staff and visitors to smoke only in designated outdoor areas (Federal Bureau of Prisons 2015).

In their review of smokefree policies in correctional facilities, Kennedy and colleagues (2015) concluded that concerns remain about consistent implementation and enforcement practices for smokefree policies in individual prisons and jails. However, when enforced, such policies can dramatically reduce exposure to secondhand tobacco smoke among inmates, visitors, and staff. For example, Proescholdbell and colleagues (2008) measured levels of PM2.5 in indoor areas of prisons in North Carolina before and after implementation of a statewide law in 2006 requiring all indoor prison areas to be smokefree for prisoners, staff, and visitors. They found that indoor PM2.5 concentrations declined 77% after implementation—from an average of 93.11 μg/m^3 in locations that allowed smoking to an average of 21.82 μg/m^3 in these locations after the tobacco use policy was in effect. After excluding a site with known noncompliance with the statewide policy, results demonstrated a 91% reduction in mean PM2.5 concentrations before and after policy implementation.

Exposure to Secondhand Tobacco Smoke by Age and Race and Ethnicity

In their examination of data from the 2000 and 2010 NHIS, Yao and colleagues (2016) found that self-reported exposure to secondhand tobacco smoke decreased for all racial and ethnic groups from 2000 to 2010, but sociodemographic differences remained for some groups over time. For example, non-Hispanic Black adults and youth were more likely to be exposed to secondhand tobacco smoke than their non-Hispanic White counterparts in 2010 (Yao et al. 2016).

Based on available laboratory limits of detection and research, exposure to secondhand tobacco smoke has historically been defined using a serum (blood) cotinine concentration range from the limit of detection of 0.05 to 10 nanograms of cotinine per milliliter of serum (ng/mL) (Tsai et al. 2021). Cotinine is a metabolite of nicotine and is widely used as a biomarker of nicotine exposure. As such, cotinine cannot distinguish between nicotine exposure from different sources, such as from exposure to secondhand tobacco smoke or from other tobacco products, such as e-cigarettes. Serum cotinine concentrations greater than 10 ng/mL are associated with recent active smoking. Tobacco biomarkers have also been used locally in surveillance efforts to identify populations at risk of high exposure to secondhand tobacco smoke (Benowitz et al. 2009; Chang et al. 2021). Data on exposure to secondhand tobacco smoke reported by Tsai and colleagues (2018) corroborated the finding that non-Hispanic Black people who do not smoke have a higher prevalence of having a serum cotinine concentration of 0.05–10 ng/mL compared with Mexican American people who do not smoke and non-Hispanic White people who do not smoke (Tables 2.45 and 2.46).

According to NHANES data from 1988 to 2018, the percentage of people who did not smoke and had serum cotinine levels 0.05–10 ng/mL decreased among children 3–19 years of age; adults 20 years of age and older; and people who identified as non-Hispanic White, non-Hispanic Black, and Mexican American (Figures 2.19 and 2.20). However, these declines were more pronounced from 1988 to 2010; since 2011–2012, the data suggest that little progress has been made in reducing exposure to secondhand tobacco smoke. From 1988 to 2018, declines varied across populations, thus indicating a disparity in exposure to secondhand tobacco smoke among people who did not smoke. By age, NHANES data on serum cotinine levels from 1988–1991 to 2017–2018 revealed that declines in exposure to secondhand tobacco smoke were greater among adults 20 years of age and older (declined by 66.2 percentage points; from 87.4% in 1988–1991 to 21.2% in 2017–2018) than they were among children and adolescents 3–19 years of age (declined by 51.9 percentage points; from 87.6% in 1988–1991 to 35.7% in 2017–2018) (Table 2.45). The absolute disparity in exposure to secondhand tobacco smoke between adults and children and adolescents increased from 1988 to 1991 (children and adolescents' exposure was 0.2 percentage points higher than that of adults) to 2017–2018 (children and adolescents' exposure was 14.5 percentage points higher than that of adults).

By race and ethnicity, NHANES data on serum cotinine levels for 1988–1991 and 2017–2018 revealed that declines in exposure to secondhand tobacco smoke were greater among non-Hispanic White (from 86.9% in 1988–1991 to 22.0% in 2017–2018) and Mexican American (from 83.8% in 1988–1991 to 16.6% in 2017–2018) people who did not smoke than they were among non-Hispanic Black people who did not smoke (from 94.4% in 1988–1991 to 48.0% in 2017–2018) (Table 2.45). Between 1988–1991 and 2017–2018, the absolute disparity in exposure to secondhand tobacco smoke among non-Hispanic Black people who did not smoke increased compared with Mexican American

Table 2.45 Percentage of people who did not smoke[a] and had serum cotinine levels 0.05–10 ng/mL, by selected demographic characteristics; National Health and Nutrition Examination Survey (NHANES) 1988–2018, United States

A. 1988–2006

Characteristics	1988–1991:[b] % (95% CI)	1991–1994:[b] % (95% CI)	1999–2000: % (95% CI)	2001–2002: % (95% CI)	2003–2004: % (95% CI)	2005–2006: % (95% CI)
Age group (in years)						
3–19	87.6 (83.9–91.3)	82.1 (77.8–86.4)	64.1 (57.5–70.3)	51.7 (42.8–60.5)	61.8 (54.0–69.0)	48.3 (43.4–53.1)
≥20	87.4 (85.3–89.6)	79.0 (75.2–82.8)	48.0 (42.7–53.4)	37.8 (31.9–44.1)	42.4 (35.3–49.9)	35.8 (32.5–39.2)
Race and ethnicity[c]						
Non-Hispanic White	86.9 (83.8–90.0)	78.9 (74.8–83.0)	49.6 (42.5–56.7)	36.3 (29.8–43.4)	46.1 (37.1–55.4)	36.6 (32.5–40.9)
Non-Hispanic Black	94.4 (91.4–97.4)	92.7 (91.0–94.3)	74.2 (70.1–77.9)	71.8 (66.4–76.7)	68.2 (59.4–75.9)	60.2 (52.9–67.0)
Mexican American	83.8 (76.7–90.9)	70.1 (64.1–76.2)	44.3 (37.5–51.2)	39.9 (30.8–49.7)	34.8 (26.8–43.9)	33.8 (26.9–41.5)
Poverty status						
Below the poverty level[d]	91.4 (87.2–95.7)	86.2 (81.9–90.4)	71.6 (64.3–78.0)	60.2 (46.7–72.4)	64.0 (55.3–71.9)	62.7 (56.9–68.2)
At or above the poverty level	86.6 (83.7–89.6)	78.7 (74.8–82.7)	48.8 (42.9–54.8)	38.4 (33.1–44.1)	45.0 (38.1–52.1)	35.9 (32.8–39.1)
Unspecified	89.9 (85.5–94.4)	80.6 (70.5–90.8)	53.5 (48.4–58.5)	44.1 (33.2–55.6)	50.6 (36.8–64.2)	42.0 (29.8–55.3)
Education (≥25 years of age)						
≤Grade 11	86.0 (83.1–89.0)	78.7 (74.6–82.9)	53.9 (48.7–58.9)	50.8 (44.3–57.3)	48.8 (43.0–54.7)	43.0 (36.8–49.4)
High school diploma or equivalent	91.4 (88.3–94.5)	82.0 (77.8–86.1)	51.6 (44.5–58.6)	46.1 (37.5–54.9)	50.1 (39.9–60.2)	41.8 (35.2–48.7)
Some college or associate degree	84.7 (81.0–88.5)	77.7 (71.3–84.1)	48.2 (40.9–55.6)	33.7 (26.4–41.9)	42.7 (32.6–53.5)	37.1 (32.2–42.3)
≥College diploma	83.8 (78.1–89.5)	73.2 (68.0–78.4)	35.2 (27.9–43.3)	25.3 (19.5–32.0)	29.8 (23.6–36.7)	23.8 (19.6–28.5)

B. 2007–2018

Characteristics	2007–2008: % (95% CI)	2009–2010: % (95% CI)	2011–2012: % (95% CI)	2013–2014: % (95% CI)	2015–2016: % (95% CI)	2017–2018: % (95% CI)
Age group (in years)						
3–19	50.2 (43.2–57.3)	38.9 (34.1–43.9)	37.3 (32.2–42.7)	35.0 (28.7–41.8)	35.3 (31.0–39.8)	35.7 (32.0–39.6)
≥20	36.7 (32.1–41.4)	27.3 (24.5–30.2)	21.2 (18.8–23.9)	22.0 (18.4–26.1)	21.1 (17.7–24.9)	21.2 (18.1–24.6)
Race and ethnicity[c]						
Non-Hispanic White	40.1 (32.5–48.2)	27.5 (24.0–31.3)	21.8 (18.9–25.0)	21.4 (16.1–27.8)	22.3 (17.7–27.7)	22.0 (18.6–25.9)
Non-Hispanic Black	55.9 (50.6–61.2)	55.3 (47.6–62.8)	46.7 (38.4–55.1)	50.3 (44.8–55.8)	45.7 (40.0–51.5)	48.0 (41.5–54.6)
Mexican American	28.5 (23.4–34.2)	24.8 (20.6–29.6)	23.8 (17.2–31.9)	20.0 (16.1–24.6)	20.6 (16.7–25.2)	16.6 (12.5–21.8)

Table 2.45 Continued

Characteristics	2007–2008: % (95% CI)	2009–2010: % (95% CI)	2011–2012: % (95% CI)	2013–2014: % (95% CI)	2015–2016: % (95% CI)	2017–2018: % (95% CI)
Poverty status						
Below the poverty level[d]	60.5 (54.9–65.9)	50.1 (45.1–55.1)	43.1 (37.6–48.8)	47.9 (42.2–53.7)	41.0 (33.5–49.0)	44.9 (38.4–51.5)
At or above the poverty level	36.9 (31.5–42.6)	27.0 (23.7–30.5)	21.2 (18.9–23.6)	21.2 (17.4–25.7)	21.5 (17.8–25.7)	21.4 (18.9–24.0)
Unspecified	39.6 (31.2–48.7)	30.4 (24.6–37.0)	31.3 (22.7–41.5)	23.3 (17.6–30.1)	28.9 (24.0–34.3)	26.6 (20.5–33.7)
Education (≥25 years of age)						
≤Grade 11	45.1 (39.3–50.9)	38.4 (33.3–43.8)	27.6 (23.9–31.7)	30.7 (25.4–36.5)	25.5 (18.5–33.9)	26.8 (21.2–33.2)
High school diploma or equivalent	41.4 (33.5–49.9)	33.3 (30.2–36.6)	27.5 (21.9–34.0)	28.8 (21.7–37.0)	31.4 (26.8–36.4)	24.9 (19.2–31.6)
Some college or associate degree	37.6 (31.2–44.4)	25.2 (20.5–30.7)	21.2 (17.8–24.9)	23.5 (19.2–28.5)	24.3 (19.4–29.9)	24.3 (20.0–29.2)
≥College diploma	22.0 (17.6–27.1)	15.5 (11.6–20.4)	11.8 (9.1–14.4)	10.8 (8.1–14.3)	8.9 (6.6–11.8)	11.1 (8.5–14.4)

Source: NHANES, National Center for Health Statistics, public use data, 1988–2018.

Notes: **CI =** confidence interval; **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.

[a]People who did not smoke were defined by specific age groups as follows: children 3–11 years of age with serum cotinine ≤10 ng/mL; adolescents 12–19 years of age with serum cotinine ≤10 ng/mL and who did not report smoking during the past 30 days or using any nicotine-containing products during the past 5 days at the MEC interview; and adults 20 years of age and older with serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at the MEC interview.

[b]Serum cotinine levels were available for NHANES III participants 4 years of age and older.

[c]Data by race and ethnicity were limited to the three racial and Hispanic origin groups available across all survey cycles: people who were non-Hispanic White, non-Hispanic Black, or Mexican American.

[d]Income-to-poverty ratio <1.0.

Table 2.46 Percentage of people who did not smoke[a] and had serum cotinine levels 0.05–10 ng/mL, by age group and race and Hispanic origin;[b] National Health and Nutrition Examination Survey (NHANES) 1988–2018, United States

A. 1988–2006

	1988–1991:[c] % (95% CI)	1991–1994:[c] % (95% CI)	1999–2000: % (95% CI)	2001–2002: % (95% CI)	2003–2004: % (95% CI)	2005–2006: % (95% CI)
3–19 years of age						
Non-Hispanic White	86.2 (80.6–91.8)	81.6 (76.3–87.0)	62.3 (51.7–71.8)	47.4 (36.0–59.1)	63.5 (52.8–73.0)	47.5 (41.7–53.4)
Non-Hispanic Black	95.1 (91.0–99.2)	94.9 (92.6–97.1)	83.3 (79.2–86.7)	80.5 (75.5–84.7)	78.4 (69.3–85.4)	69.8 (63.6–75.3)
Mexican American	84.8 (78.0–91.6)	71.3 (65.7–77.0)	48.7 (41.1–56.3)	43.4 (34.7–52.5)	39.4 (30.9–48.5)	33.0 (24.2–43.2)
≥20 years of age						
Non-Hispanic White	87.1 (84.5–89.6)	78.0 (73.3–82.6)	45.6 (39.1–52.1)	32.8 (26.5–39.8)	40.6 (31.9–50.0)	33.2 (29.3–37.4)
Non-Hispanic Black	94.0 (91.4–96.6)	91.2 (89.4–92.9)	68.7 (62.8–74.0)	66.4 (60.2–72.1)	61.6 (52.4–70.0)	55.4 (47.5–63.1)
Mexican American	83.2 (75.7–90.6)	69.4 (62.6–76.2)	41.2 (34.3–48.5)	37.6 (27.4–49.0)	31.9 (23.7–41.3)	34.2 (27.9–41.2)

B. 2007–2018

	2007–2008: % (95% CI)	2009–2010: % (95% CI)	2011–2012: % (95% CI)	2013–2014: % (95% CI)	2015–2016: % (95% CI)	2017–2018: % (95% CI)
3–19 years of age						
Non-Hispanic White	53.5 (42.3–64.5)	37.4 (31.9–43.3)	36.6 (31.3–42.4)	34.0 (23.9–45.8)	34.2 (26.4–43.0)	38.5 (32.6–44.7)
Non-Hispanic Black	62.5 (53.5–70.7)	64.9 (56.0–73.0)	61.1 (50.3–70.9)	60.9 (51.5–69.6)	61.1 (53.5–68.2)	58.6 (49.9–66.9)
Mexican American	29.4 (21.4–39.1)	25.2 (21.7–29.1)	23.6 (15.9–33.6)	21.4 (15.6–28.6)	27.1 (20.8–34.4)	20.7 (14.4–28.8)
≥20 years of age						
Non-Hispanic White	36.3 (29.6–43.5)	25.0 (21.5–28.7)	17.9 (14.3–22.1)	18.1 (13.8–23.3)	19.3 (15.0–24.6)	18.0 (14.7–22.0)
Non-Hispanic Black	52.2 (46.6–57.8)	50.5 (42.4–58.5)	39.4 (32.9–46.3)	45.5 (40.4–50.8)	38.8 (33.5–44.3)	43.3 (37.0–49.9)
Mexican American	28.0 (23.5–32.9)	24.5 (19.5–30.4)	23.9 (17.4–31.9)	19.2 (15.3–23.7)	16.9 (13.9–20.5)	14.3 (10.5–19.1)

Source: NHANES, National Center for Health Statistics, public use data, 1988–2018.

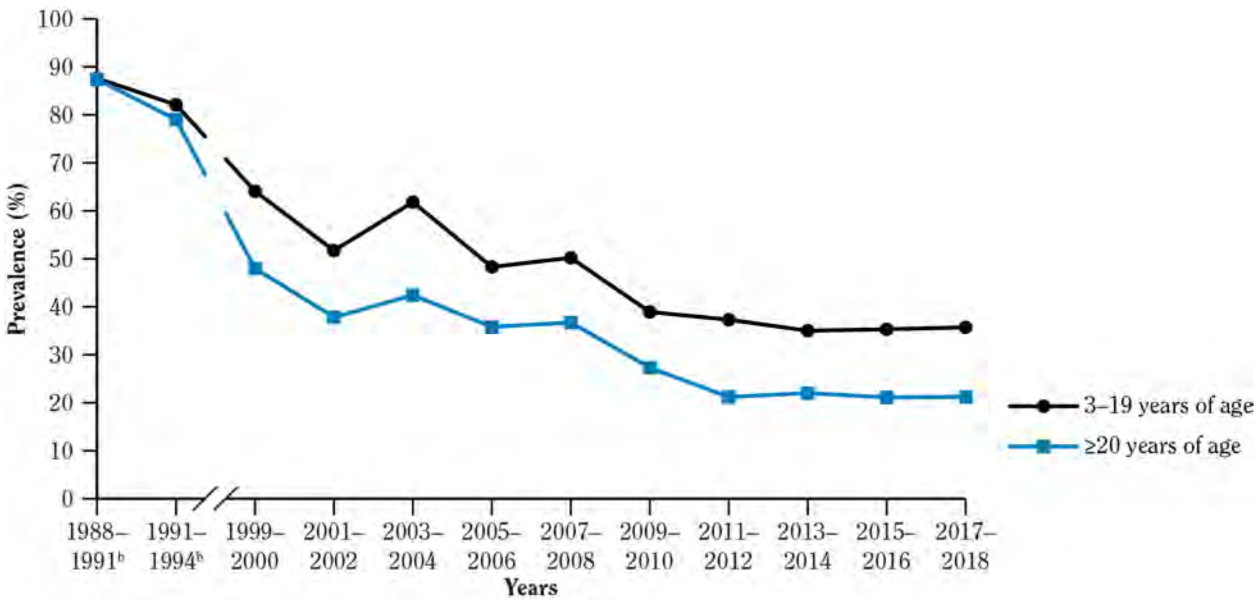
Notes: **CI =** confidence interval; **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.

[a]People who did not smoke were defined by specific age groups as follows: children 3–11 years of age with serum cotinine ≤10 ng/mL; adolescents 12–19 years of age with serum cotinine ≤10 ng/mL and who did not report smoking during the past 30 days or using any nicotine-containing products during the past 5 days at the MEC interview; and adults 20 years of age and older with serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at the MEC interview.

[b]Data by race and ethnicity were limited to the three racial and Hispanic origin groups available across all survey cycles: people who were non-Hispanic White, non-Hispanic Black, or Mexican American.

[c]Serum cotinine levels were available for NHANES III participants 4 years of age and older.

Figure 2.19 Trends in the prevalence of people who did not smoke[a] and had serum cotinine levels 0.05–0.10 ng/mL, by age group; National Health and Nutrition Examination Survey (NHANES) 1988–1994 and 1999–2018, United States



Source: NHANES, National Center for Health Statistics, public use data, 1988–2018.
Notes: **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.
[a]People who did not smoke were defined by specific age groups as follows: children 3–11 years of age with serum cotinine ≤10 ng/mL; adolescents 12–19 years of age with serum cotinine ≤10 ng/mL and who did not report smoking during the past 30 days or using any nicotine-containing products during the past 5 days at the MEC interview; and adults 20 years of age and older with serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at the MEC interview.
[b]Serum cotinine levels were available for NHANES III participants 4 years of age and older.

(by 20.8 percentage points) and White (by 18.5 percentage points) people who did not smoke. During 2017–2018, exposure to secondhand tobacco smoke was more than two times higher among non-Hispanic Black people who did not smoke than it was among non-Hispanic White and Mexican American people who did not smoke.

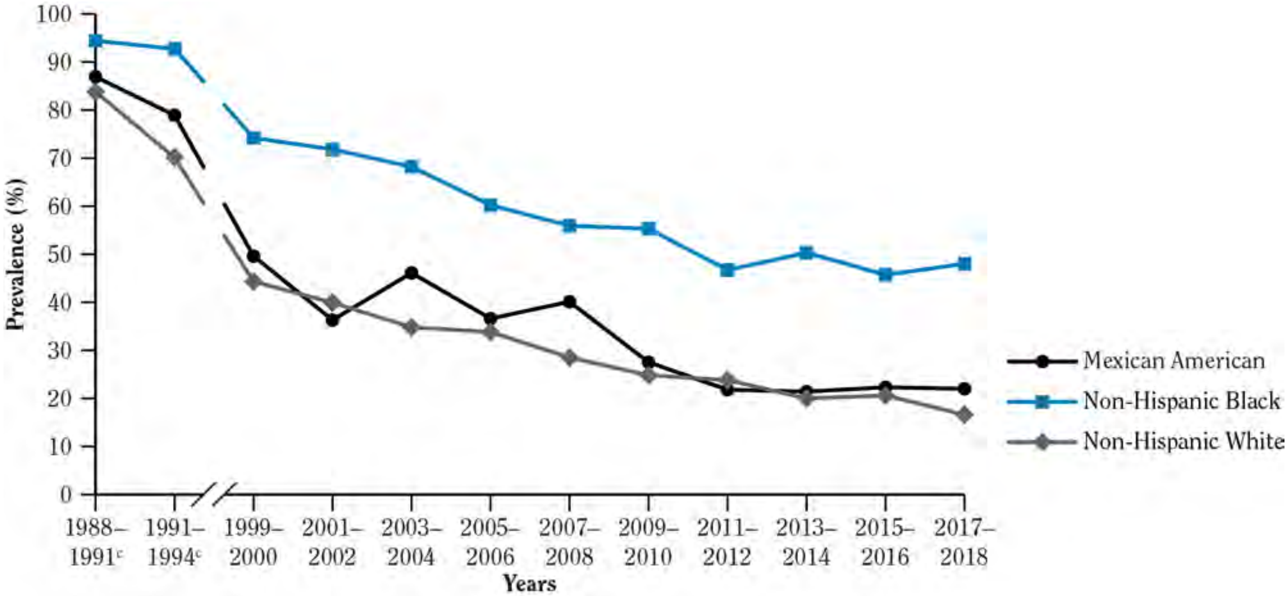
When examining exposure to secondhand tobacco smoke by race and ethnicity and age, more non-Hispanic White and non-Hispanic Black children 3–19 years of age were exposed to secondhand tobacco smoke than their counterparts 20 years of age and older (Table 2.46). Exposure to secondhand tobacco smoke did not differ by age group among Mexican American people.

Among people who did not smoke, self-reported exposure to secondhand tobacco smoke at a job during the past 7 days (among adults 20 years and older) during 2017–2018 was higher among Mexican American people (12.1%; 95% CI, 9.3–15.5) than it was among non-Hispanic White (5.3%; 95% CI, 3.5–8.2) and non-Hispanic Black (4.6%; 95% CI, 2.9–7.2) people (Table 2.47). Agaku and colleagues (2019) found that in both 2000 and 2010, Hispanic and non-Hispanic Asian youth were less likely than non-Hispanic White youth to be exposed to secondhand tobacco smoke at home. This finding is consistent with findings from King and colleagues (2013b), who noted that smokefree rules were present most often in Hispanic (87.7%) and non-Hispanic Asian (90.6%) households.

Advanced laboratory techniques in recent years have lowered the lower limit of serum cotinine detection from the initial limit of 0.05 ng/mL to a new limit of 0.015 ng/mL (CDC 2005; Pirkle et al. 2006). As such, questions have arisen about whether the current established definitions of exposure to secondhand tobacco smoke (0.05–10 ng/mL) should be re-evaluated (Tsai et al. 2021). Changes in the definition of exposure to secondhand tobacco smoke among the U.S. population using the lower limit of detection could have implications for trends and prevalence estimates (Tsai et al. 2018).

Using data from the 2011–2018 NHANES, Tsai and colleagues (2018) examined the implications of redefining exposure to secondhand tobacco smoke to include serum cotinine values from 0.015 to 10 ng/mL. This expanded definition more than doubled the estimated proportion of people in the United States exposed to secondhand tobacco

Figure 2.20 Trends in the prevalence of people who did not smoke[a] and had serum cotinine levels 0.05–0.10 ng/mL, by race and ethnicity;[b] National Health and Nutrition Examination Survey (NHANES) 1988–1994 and 1999–2018, United States



Source: NHANES, National Center for Health Statistics, public use data, 1988–2018.
Notes: **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.
[a]People who did not smoke were defined by specific age groups as follows: children 3–11 years of age with serum cotinine ≤10 ng/mL; adolescents 12–19 years of age with serum cotinine ≤10 ng/mL and who did not report smoking during the past 30 days or using any nicotine-containing products during the past 5 days at the MEC interview; and adults 20 years of age and older with serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at the MEC interview.
[b]Data by race and ethnicity were limited to the three racial and Hispanic origin groups available across all survey cycles: people who were non-Hispanic White, non-Hispanic Black, or Mexican American.
[c]Serum cotinine levels were available for NHANES III participants 4 years of age and older.

smoke. The percentage of people 3 years of age and older who did not smoke and had levels of serum cotinine in the existing range (0.05–10 ng/mL) was similar during 2011–2012 (25.3%) and 2017–2018 (24.6%). However, using the expanded definition, the percentage of people who did not smoke and were exposed to secondhand tobacco smoke (serum cotinine 0.015–10 ng/mL) declined from 2011–2012 (58.3%) to 2017–2018 (52.3%), which suggests a reduction in exposure to secondhand tobacco smoke at the population level, especially among those experiencing lower levels of exposure (Tsai et al. 2018).

Exposure to Secondhand Tobacco Smoke by Age and Level of Income

Disparities in exposure to secondhand tobacco smoke persisted by poverty level from 1988 to 2018 (Table 2.45 and Figure 2.21). According to NHANES data, the magnitude of the decline in exposure to secondhand tobacco smoke, assessed using serum cotinine levels, was greater among people who lived at or above the poverty level and did not smoke (from 86.6% during 1988–1991 to 21.4% during 2017–2018) than it was among their counterparts who lived below the poverty level and did not smoke (from 91.4% during 1988–1991 to 44.9% during 2017–2018). Relative to people who lived at or above the poverty level, exposure to secondhand tobacco smoke was more than two times higher among people who lived below the poverty level during 2017–2018.

Children

During 2013–2014, an estimated 14 million children 3–11 years of age in the United States were exposed to secondhand tobacco smoke (Tsai et al. 2018). Compared with adults, children are at an elevated risk of exposure to secondhand tobacco smoke because of their increased intake of air relative to their body weights (Tonkin et al. 2009). According to data for 2000 and 2010 from the NHIS, exposure to secondhand tobacco smoke in the home declined

Table 2.47 Prevalence of self-reported exposure to secondhand tobacco smoke during the past 7 days[a] among people who did not smoke,[b] by age group, race and Hispanic origin, and indoor settings; National Health and Nutrition Examination Survey (NHANES) 2017–2018, United States

Age and race and Hispanic origin	Inside own household: % (95% CI)	At job: % (95% CI)	In a restaurant: % (95% CI)	In a bar: % (95% CI)	In a car: % (95% CI)	In other's home: % (95% CI)	In other indoor area: % (95% CI)	Any of these indoor settings: % (95% CI)
Overall	4.1 (2.7–6.2)	6.3 (4.6–8.7)	2.2 (1.6–3.0)	3.1 (1.9–4.9)	7.6 (5.9–9.8)	3.8 (3.1–4.7)	4.2 (2.9–6.0)	19.2 (15.6–23.4)
Age group (in years)								
3–19	6.9 (4.9–9.7)	—[c]	—[c]	—[c]	10.5 (8.0–13.7)	4.2 (2.8–6.2)	3.0 (1.9–4.8)	18.2 (14.5–22.5)
≥20	3.2 (2.0–5.2)	6.4 (4.6–8.8)	2.5 (1.7–3.6)	3.1 (1.9–5.0)	6.7 (5.2–8.7)	3.7 (2.9–4.7)	4.6 (3.1–6.6)	19.5 (15.6–24.1)
Race and Hispanic origin[d]								
Non-Hispanic White	3.8 (2.1–6.7)	5.3 (3.5–8.2)	—[c]	—[c]	7.5 (5.3–10.4)	3.9 (2.9–5.3)	4.5 (2.9–6.8)	17.8 (13.7–22.9)
Non-Hispanic Black	8.1 (6.0–10.8)	4.6 (2.9–7.2)	—[c]	—[c]	10.8 (9.0–12.9)	6.8 (5.1–9.1)	4.7 (3.3–6.7)	25.9 (21.7–30.5)
Mexican American	4.4 (2.4–7.8)	12.1 (9.3–15.5)	—[c]	—[c]	6.1 (4.2–8.7)	3.0 (2.0–4.5)	—[c]	19.2 (16.1–22.8)

Source: NHANES, National Center for Health Statistics, public use data, 2017–2018.

Notes: **CI =** confidence interval; **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.

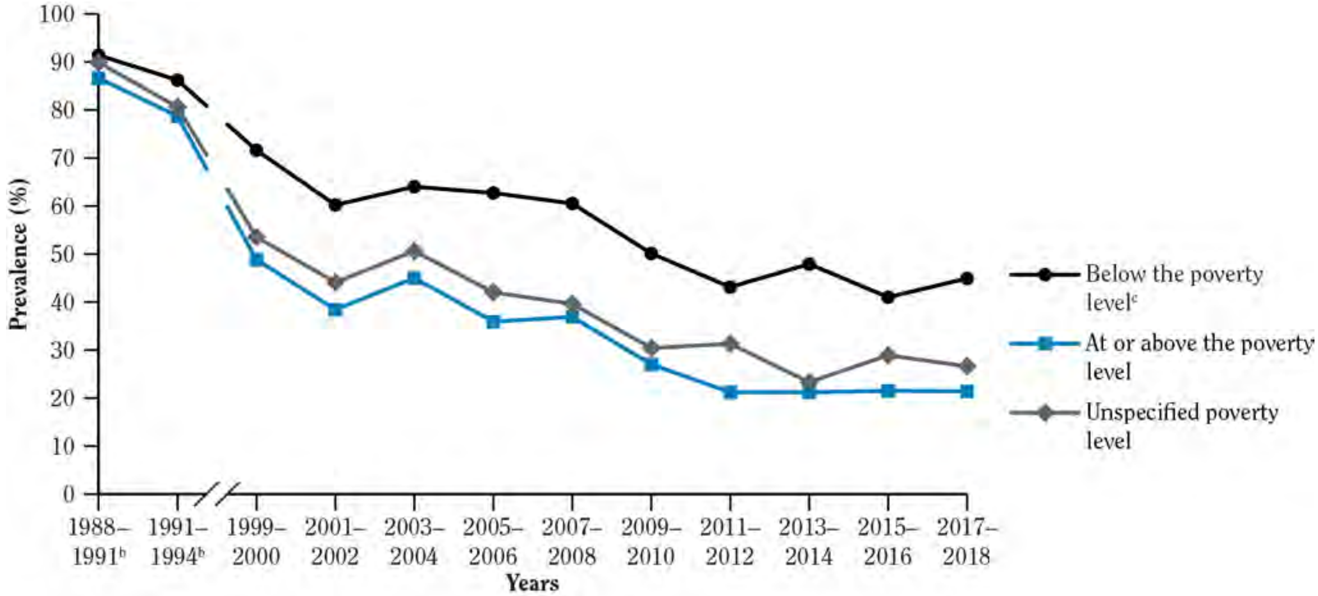
[a]Self-reported exposure to secondhand tobacco smoke inside one's own home was assessed by the question, "During the past 7 days . . . on how many days did (anyone who lives here) smoke tobacco inside this home?" Exposure to secondhand tobacco smoke at a job was assessed among people, 12 years of age and older, who reported working at a job or business outside of the home. For each site (restaurant, bar, car, in other's home, in other indoor area, at a job), self-reported exposure to secondhand tobacco smoke was assessed among respondents who indicated they had spent time in that location during the past 7 days. Exposure in "any of these indoor settings" is a calculated variable and indicative of self-reported exposure to secondhand tobacco smoke in one or more indoor settings.

[b]People who did not smoke were defined by specific age groups as follows: children 3–11 years of age with serum cotinine ≤10 ng/mL; adolescents 12–19 years of age with serum cotinine ≤10 ng/mL and who did not report smoking during the past 30 days or using any nicotine-containing products during the past 5 days at the MEC interview; and adults 20 years of age and older with serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at MEC interview.

[c]Unstable estimate is not presented because of a small sample size and relative standard error >0.3.

[d]Data were limited to the three racial and Hispanic origin groups available: people who were non-Hispanic White, non-Hispanic Black, and Mexican American.

Figure 2.21 Trends in the prevalence of people who did not smoke[a] and had serum cotinine levels 0.05–0.10 ng/mL, by poverty status; National Health and Nutrition Examination Survey (NHANES) 1988–1994 and 1999–2018, United States



Source: NHANES, National Center for Health Statistics, public use data, 1988–2018.
Notes: **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.
[a]People who did not smoke were defined by specific age groups as follows: children 3–11 years of age with serum cotinine ≤10 ng/mL; adolescents 12–19 years of age with serum cotinine ≤10 ng/mL and who did not report smoking during the past 30 days or using any nicotine-containing products during the past 5 days at the MEC interview; and adults 20 years of age and older with serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at the MEC interview.
[b]Serum cotinine levels were available for NHANES III participants 4 years of age and older.
[c]Income-to-poverty ratio <1.0.

over 10 years from 24.7% in 2000 to 8.2% in 2010 among youth less than 18 years of age (as reported by a knowledgeable adult in the household, usually a parent) and from 12.1% in 2000 to 4.4% in 2010 among adults (Yao et al. 2016). In 2010, no differences were found, overall, between youth whose parents had a high level of educational attainment (some college or higher) and those whose parents did not have a high level of educational attainment (high school graduate or less); and no differences were observed, overall, between youth or adults with a high level of family income and those with lower levels (middle or low) of family income. In 2010, levels of exposure to secondhand tobacco smoke were higher among youth in the Midwest and the South than they were among youth in other regions of the United States.

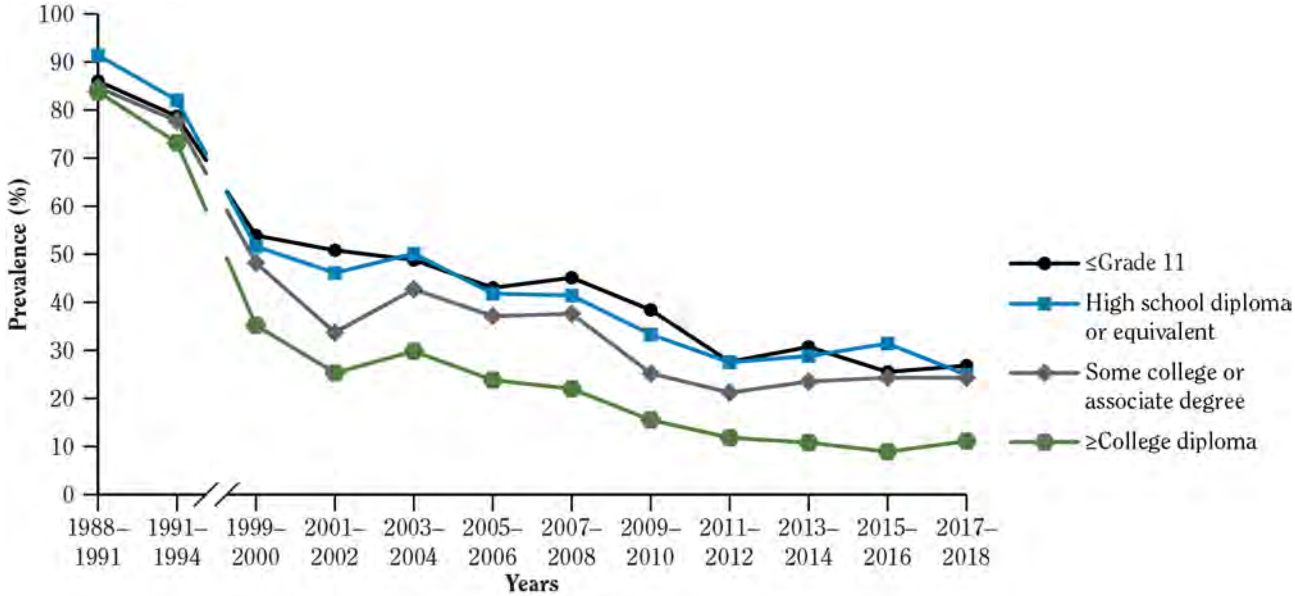
Adults

In terms of education level among adults 25 years of age and older, lesser declines in exposure to secondhand tobacco smoke were observed during the period from 1988–1991 to 2017–2018 among people who did not smoke who had achieved lower levels of educational attainment (Table 2.45 and Figure 2.22). According to 2017–2018 NHANES data, exposure to secondhand tobacco smoke was similar among people who did not smoke and had achieved less than a high school education (26.8%), a high school diploma or equivalent (24.9%), or some college or an associate degree (24.3%). However, exposure to secondhand tobacco smoke was significantly lower among people who did not smoke and had a college diploma or higher level of educational attainment (11.1%) compared with people who did not smoke who achieved lower levels of educational attainment (Table 2.45).

Exposure to Secondhand Tobacco Smoke By Sexual Orientation

There is some evidence of disparities in exposure to secondhand tobacco by sexual orientation. For example, Cochran and colleagues (2013), using 2003–2010 NHANES data, found that exposure to secondhand tobacco

Figure 2.22 Trends in the prevalence of adults, 25 years of age and older, who did not smoke[a] and had serum cotinine levels 0.05–0.10 ng/mL, by level of educational attainment; National Health and Nutrition Examination Survey (NHANES) 1988–1994 and 1999–2018, United States



Source: NHANES, National Center for Health Statistics, public use data, 1988–2018.
Notes: **MEC =** Mobile Examination Center; **ng/mL =** nanograms per milliliter.
[a]Adults who did not smoke were defined as people who had serum cotinine ≤10 ng/mL and who did not report currently smoking or using any nicotine-containing products during the past 5 days at the MEC interview.

smoke—as indicated by serum cotinine levels greater than or equal to 0.05 ng/mL—differed by sexual orientation among women 20–59 years of age. Specifically, exposure to secondhand tobacco smoke was higher among nonsmoking women who identified as lesbian (56.2%) or who reported a lifetime experience with a same-gender partner (in absence of identifying as gay, lesbian, or bisexual) (47.7%) than among those who identified as exclusively heterosexual (33.0%; p<0.001). Among men, no significant difference in exposure to secondhand tobacco smoke by sexual orientation was observed.

Compared with women who identified as exclusively heterosexual, bisexual women were significantly more likely to self-report exposure to secondhand tobacco smoke at home (aOR = 3.96; 95% CI, 1.67–9.39) and at home or at work (aOR = 2.11; 95% CI, 1.12–3.97) (Cochran et al. 2013). Employed women who identified as lesbian were more likely to self-report exposure to secondhand tobacco smoke in the workplace (aOR = 2.96; 95% CI, 1.22–7.21) and employed men who identified as gay were less likely to report exposure to secondhand tobacco smoke in the workplace (aOR = 0.16; 95% CI, 0.03–0.91) than were their counterparts who identified as exclusively heterosexual (Cochran et al. 2013). In contrast, King and colleagues (2014a), using data from the 2009–2010 National Adult Tobacco Survey, reported no significant difference in the prevalence of self-reported exposure to secondhand smoke in the workplace among nonsmoking adults who identified as lesbian, gay, bisexual, transgender (LGBT) (25.7%; 95% CI, 20.4–31.7) or among those who identified as heterosexual (20.2%; 95% CI, 19.4–21.1).

Max and colleagues (2016) assessed, from the 2003–2012 California Health Interview Survey, differences in self-reported exposure to secondhand tobacco smoke (on 1 or more days per week) in the homes of nonsmoking adults, 18–70 years of age, in California by sexual orientation. Lesbian or bisexual women (aOR = 1.72; 95% CI, 1.19–2.49) and gay or bisexual men (aOR = 2.35; 95% CI, 1.72–3.21) were significantly more likely than women and men who identified as heterosexual, respectively, to report exposure to secondhand tobacco smoke in their homes. In time trend analyses, the decline in the odds of exposure to secondhand tobacco smoke in the home was larger among gay or bisexual men (11% per year) than it was among heterosexual men (6% per year). Similar declines were observed among heterosexual and lesbian or bisexual women, with adjusted odds declining by an average of 10% each year in both population groups. Despite these declines, exposure to secondhand tobacco smoke in the home remained higher among gay, lesbian, and bisexual men and women than among heterosexual men and women from 2003 to 2012 (Max et al. 2016).

Summary of the Evidence and Implications

The 1998 Surgeon General's report concluded that "[t]obacco use varies within and among racial/ethnic groups; among adults, American Indians and Alaska Natives have the highest prevalence of tobacco use, and African American and Southeast Asian men also have a high prevalence of smoking. Asian American and Hispanic women have the lowest prevalence" (USDHHS 1998, p. 6). Importantly, all of these populations have made considerable progress in lowering the prevalence of cigarette smoking since the 1998 report; from 1994–1995 to 2018, the prevalence of current cigarette smoking declined by 13.4 percentage points among American Indian and Alaska Native people (from 36.0% to 22.6%), by 11.9 percentage points among Black people (from 26.5% to 14.6%), by 11.4 percentage points among White people (from 26.4% to 15.0%), by 8.2 percentage points among Hispanic people (from 18.0% to 9.8%), and by 7.1 percentage points among Asian American and Pacific Islander people (from 14.2% to 7.1%) (USDHHS 1998).

Many of the disparities in tobacco use described in the 1998 report persist. For example, American Indian and Alaska Native people and Black men continue to have a higher prevalence of cigarette smoking, while Asian and Hispanic women continue to have a lower prevalence of cigarette smoking (Tables 2.2 and 2.7). Notably, the scope of the current report has expanded beyond the four racial and ethnic groups described in the 1998 report by analyzing tobacco use patterns among additional categories of race and ethnicity, as well as by sexual orientation and gender identity, occupation, and geographic setting; those at various levels of SES and educational attainment; and those with various mental health conditions or substance use disorders.

Despite much progress in reducing overall tobacco use over time, an estimated 47.1 million adults were current users of a tobacco product in 2020, 30.8 million of whom smoked cigarettes, 8.6 million smoked cigars, 5.7 million used smokeless tobacco, and 9.1 million used e-cigarettes (Cornelius et al. 2022). This chapter documents some of the uneven progress, key patterns, and trends in tobacco product use and exposure to secondhand tobacco smoke among several population groups in the United States. Continued action should be taken to address the disparities described in this chapter, including the implementation of comprehensive tobacco prevention and control programs and policies that address the diverse array of tobacco and nicotine products. Recent gains in measurement have allowed for understanding patterns of tobacco use among some population groups, but surveillance and intervention research data remain limited for many groups known to be at high risk for tobacco use, exposure to secondhand tobacco smoke, and targeted marketing. Further efforts are warranted to assess structural and social determinants of health across the lifespan, disaggregate data, and oversample disparate populations. Actions should go beyond estimating population-level results to include examinations of the effects of strategies for reducing disparities and advancing health equity (Rose et al. 2020).

Conclusions

1. Racial and ethnic disparities in cigarette smoking have persisted since 2000, with prevalence remaining highest among American Indian and Alaska Native adults. Frequency, type, and amount of tobacco use; long-term cessation success; and patterns of use across the life course also differ by race and ethnicity. Within aggregate racial and ethnic groupings, disparities in tobacco use vary by ethnic group, nativity, and acculturation in the United States.

2. Disparities in cigarette smoking by educational attainment have widened in the past 50 years; the prevalence of smoking is substantially higher among people without college diplomas than it is among those with college diplomas.

3. The prevalence of tobacco use is higher among adults living in poverty than it is among adults living at or above the poverty level. Disparities in cigarette smoking by poverty status have persisted over four decades, and these differences remain when looking at the prevalence of smoking by poverty status and other demographic characteristics, including sex, race, ethnicity, and sexual orientation.

4. The prevalence of tobacco use is higher overall among youth and adults who identify as gay, lesbian, and bisexual than it is among youth and adults who identify as heterosexual, but the prevalence of tobacco use varies by different populations, such as gay, lesbian, or bisexual populations, and by

specific tobacco products. Increased availability and improvements in the measures to assess sexual orientation and gender identity in federal, state, and local surveillance systems will assist efforts to better address disparities among these populations.

5. The prevalence of ever and current smoking is higher among manual labor and service workers than it is among workers in other occupational groups. Conversely, the prevalence of cigarette smoking cessation is lower among manual labor and service workers than it is among workers in other occupational groups. Accommodation and food service, construction, and mining are the occupation groups with the highest prevalence of current cigarette smoking. These settings may warrant greater support for smoking cessation interventions.

6. The prevalence of tobacco use is generally higher in the South and Midwest than it is in other regions of the United States. Additionally, the prevalence of cigarette and smokeless tobacco use is higher among people living in rural areas than it is among people living in urban areas.

7. People living with any mental health condition or substance use disorder are at increased risk of tobacco use. The intersection of mental health, substance use, and sociodemographic characteristics—such as age, sex, race and ethnicity, sexual orientation, and socioeconomic status—adds to the risk of tobacco use.

8. Despite progress in the adoption of smokefree policies, the prevalence of exposure to secondhand tobacco smoke remains disproportionately high among (a) children compared with adults, (b) nonsmoking African American youth and adults compared with nonsmoking White or Mexican American youth and adults, (c) families in lower income groups compared with families in higher income groups, and (d) adults without college diplomas compared with adults with college diplomas. The magnitude of these disparities has increased since 2000.

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Appendix 2.1: Sources of Data

Primary data analyzed and summarized in this chapter come from cross-sectional data obtained through seven national surveillance systems: the Youth Risk Behavior Surveillance System (YRBSS), the National Youth Tobacco Survey (NYTS), the National Survey on Drug Use and Health (NSDUH), the National Health Interview Survey (NHIS), the Tobacco Use Supplement to the Current Population Survey (TUS-CPS), the Behavioral Risk Factor Surveillance System (BRFSS), and the National Health and Nutrition Examination Survey (NHANES) (Table 2.1). Analyses were conducted on weighted data accounting for the complex sampling design. These systems are described in the following sections.

Youth Risk Behavior Surveillance System

Developed in 1990 by the Centers for Disease Control and Prevention (CDC), the Youth Risk Behavior Surveillance System (YRBSS) monitors priority health risk behaviors. In addition to the surveys that are conducted by state, local, territorial, and tribal health and education agencies, there is a national YRBS (Youth Risk Behavior Survey) conducted by CDC. The current report includes data from the national YRBS only, which has a sampling frame of all public and private school students in Grades 9–12 in the 50 states and the District of Columbia. A three-stage cluster sample design is used to sample (1) large-sized counties or groups of smaller adjacent counties, (2) public and private schools with a probability proportional to the schools' enrollment, and (3) one or two randomly selected classes in each grade. Examples of classes include homerooms; classes of a required discipline, such as English or social studies; and all classes meeting during a required period, such as second period. All students in a sampled class are eligible to participate. Oversampling is used to achieve sufficiently large subsamples of Black and Hispanic students to enable separate analyses of these populations. Schools that decline to participate in the original sample are not replaced.

Students complete self-administered, paper-and-pencil questionnaires and record their answers directly in the questionnaire booklet or on a separate computer-scannable answer sheet (CDC 2013). Local procedures are followed to obtain the permission of parents. Trained personnel administer the questionnaires to students in their classrooms for the national survey and for most state and local surveys. The participation of students is both voluntary and anonymous (CDC 2013). In 2019, 13,677 students in Grades 9–12 participated in the national YRBS. The overall response rate was 60.3%, which is the product of the school-level response rate (49.9%) and the student-level response rate (80.3%) (Table 2.1).

National Youth Tobacco Survey

The National Youth Tobacco Survey (NYTS) is a nationally representative, school-based, self-administered survey of U.S. middle school students (Grades 6–8) and high school students (Grades 9–12). The NYTS was first administered in 1999 and has been administered annually since 2011. It is currently funded by the CDC and the U.S. Food and Drug Administration (FDA). The NYTS transitioned to an electronic survey administration in 2019. It provides national data on long-term, intermediate, and short-term indicators key to the design, implementation, and evaluation of comprehensive tobacco prevention and control programs. The NYTS also serves as a baseline for comparing progress toward meeting selected *Healthy People 2030* goals for reducing tobacco use among youth (CDC n.d.c). Items measured as part of the NYTS survey include ever and past-30-day use of a variety of tobacco products and correlates of tobacco use such as demographics, minors' access to tobacco, and exposure to secondhand tobacco smoke. In 2020, 14,531 students in Grades 6–12 participated in the NYTS. The overall response rate was 49.9%, which is the product of the school-level response rate (49.9%) and the student-level response rate (87.4%) (Table 2.1). However, data collection for the 2020 NYTS ended early because of school-related closures and other emergency protocols related to the COVID-19 pandemic (Office on Smoking and Health 2020).

National Survey on Drug Use and Health

The National Survey on Drug Use and Health (NSDUH) is an annual survey of the civilian, noninstitutionalized population of the United States 12 years of age and older. Before 2002, this survey, which has been conducted by the federal government since 1971, was called the National Household Survey on Drug Abuse. The NSDUH is the primary source of statistical information on the use of illegal drugs by the U.S. population; face-to-face interviews are used to collect confidential data from a representative sample of the population at their place of residence. The survey is sponsored by the Substance Abuse and Mental Health Services Administration (SAMHSA), an agency within the U.S. Department of Health and Human Services (USDHHS), and is planned and managed by SAMHSA's Center for Behavioral Health Statistics and Quality (SAMHSA 2009b).

Since 1999, SAMHSA has implemented major improvements in the methods used in this survey (SAMHSA 2009a). Data are collected using computer-assisted interviewing, and respondents are given a US$30 incentive payment for participation. The samples in the 2005–2013 NSDUHs were allocated equally between three age groups: 12–17 years of age, 18–25 years of age, and 26 years of age and older. Starting in 2014 and continuing through 2019, the allocation of the NSDUH sample was 25% for adolescents (12–17 years of age), 25% for young adults (18–25 years of age), and 50% for adults (26 years of age and older). The sample of adults was further divided into three subgroups: 26–34 years of age (15%), 35–49 years of age (20%), and 50 years of age and older (15%) (SAMHSA 2020). The NSDUH sampling frame includes civilian residents of noninstitutional group quarters (e.g., shelters, rooming houses, dormitories, and group homes), residents of each state and the District of Columbia, and civilians living on military bases. People excluded from the universe were those with no fixed household address (e.g., homeless transients not in shelters), active-duty military personnel, and residents of institutional group quarters (e.g., jails, prisons, or hospitals). The NSDUH employed a state-based design with an independent, multistage area probability sample within each state and Washington, D.C. The eight states with the largest populations (California, Florida, Illinois, Michigan, New York, Ohio, Pennsylvania, and Texas), which together account for about one-half of the total U.S. population 12 years of age and older, were designated as large-sample states and had varying target samples between 2,400 and 4,560 respondents. For the remaining 42 states and Washington, D.C., the target sample ranged from 960 to 1,500 respondents per state (SAMHSA 2020). Combining data over multiple survey years allows for direct estimates for all states. In 2019, the NSDUH had a weighted screening response rate of 70.5% and a weighted interview response rate of 64.9% (Table 2.1). A total of 67,625 people were included in the main sample of the 2019 restricted-use dataset. NSDUH public use files with 56,136 people included from the 2019 sample are available for download and online analysis (http://www.samhsa.gov).

National Health Interview Survey

The National Health Interview Survey (NHIS), a multipurpose household survey conducted by the National Center for Health Statistics of CDC, is the principal source of information on the health of the civilian, noninstitutionalized population of the United States. The NHIS has been conducted continuously since 1957. Questions on smoking have been included in selected survey years since 1965, and detailed items allowing classification by race and ethnicity have been included since 1978. Detailed questions on tobacco use are included in a Cancer Control Supplement to the NHIS, which started in 1987 and was subsequently conducted in 1992, 2000, 2005, 2010, and 2015. In 2019, the content and structure of the NHIS were updated. The redesigned questionnaire includes four components: the annual core, rotating core, sponsored content, and emerging topics. Questions about cigarette and e-cigarette use are asked every year as part of the annual core. Questions about noncigarette tobacco product use also are asked annually as part of content sponsored by FDA. Remaining questions on smoking history and cessation are included in the rotating core; beginning in 2020, these questions are included every other year on the NHIS (CDC n.d.b).

The current sampling plan follows an area probability design that permits the representative sampling of households and noninstitutional group living quarters in all 50 states and the District of Columbia. From each household, one sample adult and one sample child (younger than 18 years of age) are randomly selected to complete a more detailed interview about their health. Interviews are conducted in person but follow-up may be conducted by telephone when necessary. Questions on tobacco use are only asked among sample adults. In 2021, 29,482 adults (18 years of age and older) participated in the NHIS (response rate = 50.9%) (National Center for Health Statistics 2022). More detailed information is available at https://www.cdc.gov/nchs/nhis/index.htm.

Tobacco Use Supplement to the Current Population Survey

The Tobacco Use Supplement to the Current Population Survey (TUS-CPS) is a National Cancer Institute (NCI)-sponsored survey of tobacco use that has been administered as part of the U.S. Census Bureau's Current Population Survey about every 3 to 4 years since 1992–1993 (since 2000, surveys were conducted for 2001–2002, 2003, 2006–2007, 2010–2011, 2014–2015, and 2018–2019). In each cycle, the TUS-CPS collects nationally representative data from about 240,000 adults (data collected between 1992 and 2006 also included youth 15–17 years of age). About two-thirds of respondents complete the questionnaire by telephone, and responses for the remaining one-third are obtained through in-person interviews. In the 2018–2019 TUS-CPS, 137,471 respondents were interviewed; the average response rate was 57.6% for the 2018–2019 cycle (Table 2.1). More detailed information about the TUS-CPS is available from NCI (n.d.).

Behavioral Risk Factor Surveillance System

In 1984, CDC initiated the state-based Behavioral Risk Factor Surveillance System (BRFSS). This cross-sectional, random-digit-dial telephone survey is conducted monthly by state health departments over landline and cellular telephones (included since 2011) using a standardized questionnaire and technical and methodologic assistance provided by CDC. The BRFSS is used to collect data among U.S. adults 18 years of age and older regarding their risk behaviors and preventive health practices that can affect their health status. Data from respondents are forwarded to CDC to be aggregated for each state, returned with standard tabulations, and published at year's end by each state. In 2011, the BRFSS adopted new methods, including the addition of households with cellular telephones to its sample, and used new methods of weighting to adjust survey data for differences between the demographic characteristics of respondents and the survey population (CDC 2012). As a result of these methodologic changes, data after 2011 cannot be compared with the years before 2011. In 2020, more than 400,000 interviews were conducted with respondents from all 50 states, the District of Columbia, and participating U.S. territories and other geographic areas. The median response rate was 47.9%. For this Surgeon General's report, data have been weighted to reflect the age, race and ethnicity, and sex distribution in each participating state. CDC (n.d.a) offers detailed information about the BRFSS.

National Health and Nutrition Examination Survey

Beginning in 1988, researchers have used serum cotinine measurements to assess exposure to secondhand tobacco smoke in the United States within the National Health and Nutrition Examination Survey (NHANES). The NHANES is conducted by CDC's National Center for Health Statistics (NCHS) and is designed to examine a nationally representative sample of the U.S. civilian (noninstitutionalized) population based on a complex, stratified, multistage probability cluster sampling design (see http://www.cdc.gov/nchs/nhanes.htm). The protocols include a home interview followed by a health examination in a mobile examination center, where blood samples are drawn for serum cotinine analysis. NHANES III, conducted from 1988 to 1994, was the first national survey of exposure to secondhand tobacco smoke in the entire U.S. population 4–74 years of age. There were two phases: Phase 1 from 1988 to 1991, and Phase 2 from 1991 to 1994. There were no further studies between 1995 and 1998. In 1999, NCHS resumed NHANES on a continuous basis and released public use data for a nationally representative sample every 2 years. This continuous NHANES (1999 to present) also began to draw blood samples for serum cotinine analyses from participants 3 years of age and older.

All analyses were performed on mobile examination center weighted data to provide nationally representative estimates. Researchers have reported serum cotinine levels in people who did not smoke from the NHANES for Phase 1 and Phase 2 of NHANES III, NHANES 1999–2000, NHANES 2001–2002, and 1988–2014 (Pirkle et al. 1996, 2006; Homa et al. 2015; Tsai et al. 2018). Researchers have reported additional data on serum cotinine levels in people who did not smoke from NHANES 1999–2010 in the *Fourth National Report on Human Exposure to Environmental Chemicals* (CDC 2015). Trend data are reported for participants 4 years of age and older during NHANES III 1988–1994 and 3 years of age and older during NHANES 1999–2014 (Pirkle et al. 2006; Homa et al. 2015; Tsai et al. 2018). Factors that affect nicotine metabolism, such as age, race, and the level of exposure to secondhand tobacco smoke, also influence cotinine levels (Caraballo et al. 1998; Mannino et al. 2001). Because cotinine levels reflect exposures that occurred within 2 to 3 days, they represent patterns of usual exposure (Jarvis et al. 1987; Benowitz 1996; Jaakkola and Jaakkola 1997).

Studies have documented NHANES-obtained serum cotinine levels in both children and adults who did not smoke (Pirkle et al. 1996, 2006; CDC 2001, 2003, 2005; Homa et al. 2015; Tsai et al. 2018). To maintain comparability among survey intervals, nonsmoking adults were defined in these studies as people whose serum cotinine concentrations were 10 nanograms per milliliter (ng/mL) or less and who did not report currently smoking during a household interview or using any nicotine-containing product within the preceding 5 days at a mobile examination center interview. In NHANES III, the laboratory limit of detection was 0.050 ng/mL. Laboratory methods have continued to improve, however, and the detection limit was recently lowered to 0.015 ng/mL (CDC 2005; Pirkle et al. 2006). Additionally, researchers have categorized serum cotinine concentrations by age, race, and ethnicity. The racial and ethnic categories used are non-Hispanic White, non-Hispanic Black, Mexican American, and "Other," and they are self-reported. The category of "Other" was included in these reports in mean and percentile estimates for the total population but because of small samples, people of "Other" races were not included in the estimates for geometric means (CDC 2005; Pirkle et al. 2006). In the 2017–2018 NHANES, 9,254 interviews were obtained, and 8,704 examinations were performed. The response rates were 51.9% for the interview sample and 48.8% for the examination sample (Table 2.1).

Methodologic Limitations

The literature on tobacco control acknowledges four main categories of methodologic limitations with regard to health disparities: (1) nongeneralizability, (2) noncomparability, (3) problems with sample size and aggregation, and (4) nonreporting (USDHHS 1998; NCI 2017). These and other methodologic limitations and challenges remain relevant today, as discussed here.

Within populations, including racial and ethnic groups, aggregate data can mask meaningful disparities in smoking behaviors. When national data cannot be disaggregated for such populations, trend data cannot be reported. This constraint often makes it difficult to report health disparities by sex, racial and ethnic group, and sexual orientation or to stratify health disparities indicators of SES, such as poverty level, educational attainment level, and occupation. In some cases, surveillance data are limited for groups known to be at high risk of tobacco use—such as the lesbian, gay, bisexual, transgender, queer, or intersex (LGBTQI+) community. National surveys are based on civilian household-based populations, so people experiencing homelessness, incarceration, or in a transient population are not included.

When group-specific data are reported, confidence intervals may be wide, which suggests that if the survey were conducted again with a different sample, estimates for the population parameter estimate may be different. Even when appropriate sampling methods are used, the results may have diminished reliability. In some cases, regional survey data will yield better estimates for certain aggregated and disaggregated groups and will reflect more stable estimates of tobacco use patterns.

Surveys often do not account for contextual factors, including socioecological factors, that may contribute to disparities in tobacco use and related disease outcomes. Intrapersonal-, interpersonal-, community/neighborhood-, and societal/policy-level factors continue to help explain the disparities that exist between racial and ethnic groups (Turner and Avison 2003) and are further explored in Chapter 4.

Studies may not collect data on all aspects of tobacco use that are important or unique to specific groups (e.g., menthol vs. nonmenthol cigarette use), or collect adequate data among specific populations (e.g., by sexual orientation and gender identity). As national surveys have begun to collect data on emerging tobacco products, including e-cigarettes, challenges have arisen because of the rapidly changing terms for new tobacco products, which in turn may lead to underestimation or misclassification of the use of tobacco products. Although national surveys are broadening their focus beyond conventional cigarettes, not all national surveys collect data on such products, distinguish by product, or monitor flavors used (or preferred) by different racial and ethnic or socioeconomic groups.

Finally, due to the COVID-19 pandemic, usual data collection procedures for some of the data sources reported in this chapter were interrupted beginning in March 2020. NHIS data collection was switched from in-person visits to telephone-only data collection from March to June 2020; thereafter, limited in-person visits resumed through December 2020. These changes resulted in potential loss of coverage and lower response rates; in response, some of the 2020 NHIS sample was replaced with a reinterview of respondents who completed the 2019 interview. These methodologic changes resulted in new procedures to conduct cross-sectional, pooled, and longitudinal data analyses (National Center for Health Statistics 2021). The NYTS, which previously collected data in person from students in schools, ended data collection procedures early (in March 2020) due to widespread school closures associated with the COVID-19 pandemic (Office on Smoking and Health 2020). A nonresponse analysis and subsequent adjustments to the weighting process were completed for 2020 data. The 2021 NYTS was administered online to allow eligible students to complete the survey at home or at school due to continued COVID-19 protocols in schools (Office on Smoking and Health 2021). As such, the data from the 2021 NYTS may not be comparable to results from previous surveys that were conducted primarily in person on school campuses. These methodologic changes to the NHIS and NYTS may have resulted in comparability issues across survey years. The BRFSS was previously conducted as a telephone-only survey (CDC 2021), so no changes in methodology were made as a result of the COVID-19 pandemic. However, the COVID-19 pandemic may also have had an impact on behavioral and lifestyle factors, including tobacco use, the direction of which is mixed (Nindenshuti and Caire-Juvera 2023).

Appendix 2.2: Measures of Tobacco Use

Validity of Measures of Tobacco Product Use Among Youth

All data on tobacco product use among youth that are presented in this report are based on retrospective, self-reported responses to questionnaires. Because of the retrospective nature of data collection, and because tobacco use is viewed by many as a socially undesirable behavior, there is a risk of inaccurate responses. Because it was not feasible to verify the self-reported data included here, researchers should interpret these data with some degree of caution and an understanding of possible sources of inaccuracy. Many factors can affect the validity of self-reported data—factors that can be categorized as cognitive or situational. Cognitive processes that affect responses include comprehension of the question, retrieval of relevant information from memory, decision making about the adequacy of the information retrieved, and the generation of a response (Brener et al. 2003). Each of these processes can contribute to errors in responses and, subsequently, to problems with validity.

Situational factors that affect the validity of self-reported data refer to characteristics of the external environment in which the survey is being conducted. These include the setting (i.e., school or home based), the method (i.e., self-administered questionnaire or in-person interview), the social desirability of the behavior being reported, and the perception of privacy and/or confidentiality of responses (USDHHS 1994; Brener et al. 2003).

Many studies have found that youth report a higher number of sensitive behaviors when a survey is completed in a school setting rather than in their homes (Gfroerer et al. 1997; Hedges and Jarvis 1998; Kann et al. 2002). For example, Kann and colleagues (2002) compared the school-based national Youth Risk Behavior Survey (YRBS) with the household-based YRBS supplement to the National Health Interview Survey (NHIS). The study found that the school-based survey produced a significantly higher reporting of many sensitive behaviors, such as driving after drinking alcohol, binge drinking, and currently using cannabis and cocaine. In addition, four measures of various stages of the smoking uptake process were higher in the school-based survey but estimates of current cigarette use and frequent cigarette use, while elevated in the school-based survey, were not significantly different from estimates generated in the household-based survey. Few differences in nonsensitive behaviors were observed.

Two other studies (Gfroerer et al. 1997; Brener et al. 2003) indicated that although self-reported estimates of current use of alcohol and illicit drugs were higher in the school-based versus household-based surveys, estimates of current cigarette smoking were quite similar across settings. All three of these studies (i.e., Gfroerer et al. 1997; Kann et al. 2002; Brener et al. 2003) used self-administered rather than interviewer-administered interviews or questionnaires. Regardless, the provision of privacy that school surveys feature is important, especially if tobacco use, including e-cigarettes, becomes more socially unacceptable over time. Notably, household-based surveys are relatively more likely to include youth who drop out of school or are frequently absent from school, who are more likely to smoke.

Self-administered methods of data collection have generally produced higher reporting of sensitive behaviors, including tobacco use, than have interviewer-administered methods (Turner et al. 1992; Aquilino 1994; Brittingham et al. 1998). For example, Turner and colleagues (1992) found that the prevalence of current smoking among 12- to 17-year-olds based on reports in the self-administered version of the National Survey on Drug Use and Health (NSDUH) home-based survey was considerably higher (by 10–30%) than it was using the interviewer-administered version. The absence of personal interaction with an interviewer on self-administered surveys may reduce the reporting biases associated with perceived privacy and the social desirability of a behavior (Brener et al. 2003).

In conclusion, the factors described previously may affect the point estimates of smoking prevalence, but if these factors remain stable over the years, they should not affect the trends seen over time.

Validity of Measures of Tobacco Use Among Adults

All data on tobacco use among adults that were presented in this report were based on retrospective self-reported responses to questionnaires. Biochemical validation studies suggest that data on self-reported cigarette smoking are generally valid, except in certain situations, such as in conjunction with intense smoking cessation programs or with certain populations, such as pregnant women or adolescents in the presence of a parent (Velicer et al. 1992; Kendrick et al. 1995; USDHHS 2012). Misclassification may also be more common among people who intermittently smoke because they have lower biomarker levels of nicotine compared with people who smoke regularly or currently. However, Gutiérrez-Torres and colleagues (2021) reported a positive correlation between cotinine measures and number of days smoking and number of cigarettes smoked per month among nondaily smokers, indicating validity of self-reported smoking behaviors among people who intermittently smoke. Additionally, people who smoke may misreport the number of cigarettes smoked per day because of digit preference (preference for multiples of 10) (Klesges et al. 1995). Regardless, a meta-analysis of 26 validation studies (Patrick et al. 1994) and community data (Wong et al. 2012) found that self-reported smoking status is generally accurate compared with biomarker assessment. One study on self-reported smoking among youth also showed comparable validity across African American, Hispanic, and White adolescents (Wills and Cleary 1997). It should be noted here that much of the research literature on the validity of self-reported data is restricted to cigarette smoking—cigars, smokeless tobacco, and other tobacco or nicotine products are rarely addressed. As such, a discussion of the factors that may affect validity is warranted so that the data presented in the present report are interpreted with some caution and an understanding of possible sources of inaccuracy. Clearly, many factors can affect the validity of self-reported data, such as response biases and methodologic features of surveys.

Methodologic differences in survey administration—including but not limited to timing, the order of questions, sampling, data collection mode (e.g., computer-assisted personal interviewing vs. computer-assisted telephone interviewing), participation rates, and operational definitions—can affect prevalence estimates of tobacco use (Ryan et al. 2012). The NHIS and NSDUH both use computer-assisted personal interviewing, which is done in the home. The NSDUH differs from the NHIS, however, with respect to the operational definition of cigarette smoking (Delnevo and Bauer 2009). The NHIS defines current smoking among adults as smoking at least 100 cigarettes during one's lifetime and smoking every day or on some days. In contrast, the NSDUH defines current smoking for youth, young adults, and adults as smoking part or all of a cigarette during the past 30 days. The Substance Abuse and Mental Health Services Administration, which sponsors the NSDUH, does not use the 100 cigarettes-in-a-lifetime threshold when making estimates of the prevalence of cigarette smoking from NSDUH data. This likely contributes to the consistently higher estimates from the NSDUH noted in this report (see "Measures of Tobacco Use" section) (Ryan et al. 2012). Tables in this chapter continue the criteria described previously for youth and young adults. To help with comparisons with the NHIS, data in selected tables on all adults 18 years of age and older use the 100-cigarette threshold, as noted in the footnotes to the tables. Ryan and colleagues (2012) discuss these differences in the definitions of current smoking and how they could affect smoking estimates, particularly in some subpopulations. However, with the use of a modified NSDUH definition for current smoking that incorporated the 100-cigarettes-in-a-lifetime threshold, Ryan and colleagues (2012) observed that a notable number of subpopulation estimates (e.g., for 26–34 years of age, Asian people, and Hispanic people) became comparable between the NSDUH and NHIS surveys for the year 2008.

Ryan and colleagues (2012) also noted other methodologic differences between the surveys beyond the current smoking definition that may contribute to the consistently higher estimates in the NSDUH, including survey mode, setting, context, and incentives. The NSDUH interview mode as of 2019 was strictly in person using computer-assisted personal interviewing, which is thought to provide respondents with an enhanced sense of privacy. Although the NHIS is designed to be administered in person by the interviewer, some interviews are completed by telephone. Ryan and colleagues (2012) also noted that the context of the survey and question placement could be a factor contributing to higher self-reporting of smoking in the NSDUH. Within the NHIS context, smoking may be viewed as one of the most serious health behaviors about which respondents are asked. Within the NSDUH, in contrast, the survey content focuses almost entirely on substance use behaviors, both licit and illicit, and respondents may perceive smoking to be one of the more socially acceptable behaviors about which they are asked. Finally, since 2002, the NSDUH has been paying respondents a $30 incentive upon completion of the survey, while participation in the NHIS remains uncompensated. Although these factors may affect the point estimates of various tobacco use indicators, if the factors remain stable over the years, they should not affect the trends seen over time within a given survey. Still, direct comparisons of point estimates across surveys are not advised because of methodologic differences between them. Instead, readers should consider consistency in patterns across years for the same survey.

Measures of Tobacco Use

Measures of tobacco use differ slightly among surveys and by the target population. For each tobacco use measure, the definitions used in the various surveys are summarized here.

Current Cigarette Smoking: Youth

The YRBS defines current smoking among students as having smoked cigarettes on at least 1 day during the 30 days before the survey. In contrast, the NSDUH asks whether the respondent has smoked "part or all of a cigarette" during the past 30 days.

Current Cigarette Smoking: Adults

In the NHIS from 1965 to 1991, current smoking was defined as having smoked at least 100 cigarettes and answering "yes" to the question "Do you smoke cigarettes now?" Beginning in 1992, the NHIS assessed whether respondents smoked every day, some days, or not at all. Current smoking was defined as having smoked every day or some days. In contrast, the NSDUH defines current cigarette smoking as having smoked all or part of a cigarette during the past 30 days. The 100-cigarettes-in-a-lifetime threshold is not traditionally used by the NSDUH in reporting the prevalence of current cigarette smoking. This difference, in part, contributes to the consistently higher estimates from NSDUH data than from other surveys. In any event, the 100-cigarettes-in-a-lifetime threshold question was collected and used in the present report when giving estimates of prevalence for adults.

Intermittent and Daily Cigarette Smoking

In the NSDUH, daily smoking was defined as having smoked every day during the past 30 days, and intermittent smoking was defined as having smoked on 1–29 days. In the NHIS, daily smoking was defined as currently smoking every day, and intermittent smoking was defined as currently smoking on some days.

Attempts to Quit Smoking

An attempt to quit smoking was defined in this chapter as having quit smoking for more than 1 day during the previous year. Depending on the year of the survey, the NHIS asked about attempts to quit during the past year or in a lifetime. An example of a question is "During the past 12 months, have you stopped smoking for more than one day because you were trying to quit smoking?" For NHIS, attempts in the past year included people who (a) currently smoked cigarettes and reported having stopped smoking for more than 1 day during the past 12 months because they were trying to quit smoking and (b) quit smoking during the past year. The question and methods used to assess quit attempts in the BRFSS are similar to that of the NHIS: "During the past 12 months, have you stopped smoking for 1 day or longer because you were trying to quit smoking?" The TUS-CPS assessment of a past-year attempt to quit smoking cigarettes included (a) people who currently smoked cigarettes and who tried to quit smoking completely during the past 12 months, or who attempted to quit for at least 1 day during the past 12 months, or who made serious efforts to quit smoking even if it lasted less than 1 day during the past 12 months and (b) people who quit smoking during the past 12 months.

Polytobacco Use

Use of multiple tobacco products was defined as having used any combination of two or more tobacco products, depending on the products assessed in the survey. In surveys where e-cigarettes were assessed, they were defined as a tobacco product in reporting multiple tobacco product use.

Successful Cessation

The BRFSS asks, "How long has it been since you last smoked a cigarette, even one or two puffs?" Among people who currently smoked cigarettes and who quit smoking during the past year, those who responded that they had quit smoking cigarettes for more than 6 months during the past year were defined as having quit success. In the TUS-CPS, assessment of a sustained quit from cigarette smoking for 6 or more months included people who quit smoking for 6–12 months before the interview among people who currently smoked cigarettes for at least 2 years and among people who quit smoking during the past 12 months.

Current Use of Smokeless Tobacco

The NSDUH defines current use of smokeless tobacco as having used it during the 30 days before the survey. To determine current usage, the NSDUH asks whether the respondent has "used snuff, even once" and/or "used chewing tobacco, even once" during the past 30 days. An affirmative answer to either question categorizes that respondent as currently using such a product.

The YRBS defines current use of smokeless tobacco as having used chewing tobacco, snuff, dip, snus, or dissolvable tobacco products (e.g., Redman, Levi Garrett, Beech-Nut, Skoal, Skoal Bandits, Copenhagen, Camel Snus, Marlboro Snus, General Snus, Ariva, Stonewall, or Camel Orbs), not counting any electronic vapor products, on at least 1 day during the 30 days before the survey.

In the NHIS, respondents are first asked, "Smokeless tobacco products are placed in the mouth or nose and can include chewing tobacco, snuff, dip, snus (SNOOSE), or dissolvable tobacco. Have you ever used smokeless tobacco products even one time?" Those answering "yes" are then asked, "Do you now use smokeless tobacco products every day, some days, or not at all?" The NHIS defines current use of smokeless tobacco as having used chewing tobacco/snuff every day or some days.

Current Cigar Use

The NSDUH defines current cigar use as having smoked cigars during the 30 days before the survey. Cigars are defined as "big cigars, cigarillos, and even little cigars that look like cigarettes." To determine current usage, the

NSDUH asks whether the respondent has smoked “part or all of a cigar” during the past 30 days. An affirmative answer to either question categorizes that respondent as currently using such a product. The NHIS first asks, “Have you ever smoked a regular cigar, cigarillo, or little filtered cigar, even one time?” Those providing an affirmative response are asked “Do you now smoke regular cigars, cigarillos, or little filtered cigars every day, some days or not at all?” People who smoked cigars “every day” or “some days” are defined as currently smoking cigars. The YRBS defines current cigar use as having smoked cigars, cigarillos, or little cigars on at least 1 day during the 30 days before the survey.

Current Pipe Use

The NSDUH defines current pipe use as having used a pipe to smoke tobacco. People who report ever smoking tobacco in a pipe are asked, “During the past 30 days, that is, since [DATEFILL], have you smoked tobacco in a pipe, even once?” People who provide an affirmative response are defined as currently smoking pipes. The NHIS, however, defines pipe use as smoking tobacco in a regular pipe, water pipe, or hookah. People who report ever smoking a pipe filled with tobacco (either a regular pipe, water pipe, or hookah), even one time, are asked, “Do you now smoke pipe filled with tobacco—either regular pipes, water pipes, or hookahs—every day, some days, or not at all?” People who smoke pipes “every day” or “some days” are defined as currently smoking pipes.

The YRBS does not assess pipe use. The NYTS, however, assesses the use of pipes and hookahs, separately. For both products, current use is defined as having used either product on 1 or more days during the past 30 days.

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Chapter 3
Physiological, Chemosensory, and Genetic Influences of Menthol and Other Flavors in Tobacco Products

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Introduction

All currently marketed tobacco products contain natural or synthetic flavor chemicals and other additives, compounds, constituents, and ingredients that elicit multisensory experiences. These multisensory experiences include taste (gustation), smell (olfaction), trigeminal senses (cooling, burning, throat or mouth irritation), touch, sight, and sound. These may include, for example, the audial and visual cues offered by the colors and sounds of cigar wrappers, or the smell of a cigarillo, such as Swisher Sweets "Purple Swish" brand, which can emit a sweet grape odor even when sealed in its purple wrapper.

Tobacco processing includes a set of steps that contributes to the overall multisensory experience. Tobacco processing carefully considers the type of tobacco (e.g., Turkish blend); the blending of tobacco plants into a tobacco product; growing conditions; the fermentation and aging processes that make tobacco and tobacco smoke sweet, bitter, spicy, or smooth; and flavor additives (Box 3.1). Premium cigars can vary in taste and smell, even if flavors are not added to the cigars. Each tobacco product elicits a multisensory experience that has the potential to increase the appeal of, experimentation with, continued use of, and dependence on tobacco products.

Box 3.1 Cigarette Processing Steps

- Remove stems and store tobacco;
- Condition tobacco and prepare flue-cured blend, burley blend, and Turkish blend;
- Add casing materials (sugar, licorice, cocoa, etc.) to the burley blend;
- Prepare final blend by combining flue-cured, burley, and Turkish blends;
- Cut tobacco into cigarette-type filler;
- Apply top dressing (e.g., spices, sweeteners, etc.); and
- Make and pack cigarettes (R.J. Reynolds 1976).

Multisensory experiences, including the experience of flavors, can contribute to tobacco-related disparities. For example, menthol cigarettes and flavored little cigars and cigarillos are disproportionately used by particular groups characterized by race and ethnicity, sexual orientation and gender identity, and age (see Chapter 2, Table 2.6). Although African American people comprised about 12% of the U.S. population during 1980 (11.7%) and 2020 (12.4%) (Gibson and Jung 2002; Jones et al. 2021), an estimated 40% of excess deaths due to menthol cigarette smoking in the United States between 1980 and 2018 occurred among African Americans (Mendez and Le 2021). Intentionally designed and flavored tobacco products that deliver multisensory experiences, combined with decades of targeted marketing to certain minoritized racial and ethnic groups, sexual orientation and gender identity groups, age groups, and lower socioeconomic status (SES) groups, contribute to disparities across the tobacco use continuum.

What is flavor? *Flavor* includes the entirety of sensations perceived when one eats food, drinks a beverage, or consumes a tobacco product. Flavor is a combination of taste, smell, and the physical sensations one feels in the mouth, such as hot, cold, tingling, crispness, fluidity, or oiliness. Flavor perception is a synthesis of orthonasal and retronasal olfactory sensations and taste, with the latter including the ability to experience sweet, salty, sour, bitter, and umami (savory) tastes (Wolfe et al. 2014). Physical sensations in the mouth also contribute to flavor perceptions and are mediated by the sense of touch, including the ability to sense cold, hot, and tingling. In essence, flavorants are chemicals that can be added or created through chemical processes and differentially activate taste, smell, and physical sensations, contributing to flavor experiences. The term *tastant* refers to a substance that elicits taste, which is one aspect of multisensory flavor experiences. However, flavorants can also elicit sensory experiences, such as cooling, without the experiences of taste and smell.

Flavor researchers have recognized that defining flavor as odor and taste only is too narrow (Berenstein 2017). As one organizer of the first scientific symposium on flavors, hosted by the American Chemical Society in 1937, explained, "other factors than taste and smell contribute directly to flavor. Menthol, for instance, produces a strong feeling of coolness in mouth and nose, and this coolness is a particularly important part of the flavor of peppermint" (Crocker 1937, p. 273). Accordingly, oral somatosensation is also a key modality of flavor (Small 2012), and additives that provide oral somatosensation are flavoring chemicals.

The genetics, physiology, and chemosensory aspects of taste, smell, and somatosensory stimuli are the basis for the detection of flavor chemicals and for multisensory experiences. Both the olfaction and gustatory systems interact with somatosensation, such as temperature and touch, so that people who smoke experience the cooling and burning sensations of flavor chemicals, such as menthol.

Not all people who smoke like the experience of menthol in cigarettes (Oncken et al. 2015; Risso et al. 2016a, 2017). Whether a particular flavor experience or sensation appeals to someone is influenced by multilevel factors, including genetic and physiological variables (Drewnowski 1997), as well as targeted marketing to specific groups discussed in Chapter 5.

Flavor chemicals and additives that elicit multisensory experiences in tobacco products are a multibillion-dollar industry. International Flavors & Fragrances, Inc. (IFF), a major supplier to the tobacco industry, reported revenues totaling more than $12 billion in the fiscal year ending in December 2022, with a 5-year annual revenue growth rate of nearly 30% (IFF n.d.). As described later in this chapter, the tobacco industry and its flavor manufacturers have spent considerable time over the years conducting experiments to determine the combinations of flavors and other chemical additives that elicit multisensory effects and provide appealing sensory experiences.

Evidence in tobacco industry documents indicates that flavored products have been specifically marketed to young people, women, and members of certain racial and ethnic groups (Gardiner 2004; Carpenter et al. 2005). For example, the 1984 Brown & Williamson Taste Segmentation Study showed that people 35 years of age and younger who smoked preferred fruity flavors more so than older populations (Brown & Williamson 1984; Gardiner 2004; Carpenter et al. 2005). Additionally in 1991, Lorillard tobacco company stated that, "Given young adults (sic) proclivity toward flavors in other categories (i.e., soft drinks, wine coolers), a flavor enhanced menthol product may appeal to these smokers" (Lorillard 1991). R.J. Reynolds examined the aspects of taste that appealed to young adults, including not having a dry or lasting aftertaste, having a pleasant aroma, and leaving a pleasant and fresh taste (Philip Morris Records Collection 2010). The same document listed "key smoker wants" among "younger adult Black smokers," including "Lot of Menthol," "Leaves Fresh Taste," and "Not Bitter" (Philip Morris Records Collection 2010, p. 22). Based on its market research of menthol products from competitors (e.g., Newport), R.J. Reynolds recommended concepts for exploration including the development of a menthol aftertaste and aroma that would appeal to Black male and female 18- to 24-year-olds who smoked Newport cigarettes. Proposed strategies to improve R.J. Reynolds' products included adding polymer pellets and aroma precursors (Philip Morris Records Collection 2010). These same tobacco industry documents indicated the tobacco industry's desire to reach young adult Black people, referred to throughout this reference as "Black Menthol" through urban markets and the military.

The tobacco industry has conducted its own genetic, chemosensory, and taste preferences research. For example:

- In 2002, R.J. Reynolds proposed a study to ascertain if it was possible to differentiate between people who smoke, do not smoke, or use heated tobacco products based on their gene expression profiles (Hellman and Guy 2002).

- R.J. Reynolds conducted chemosensory research to understand how additives like cocoa and sugar could improve the quality of the smoking experience for consumers (R.J. Reynolds 1987).

- British American Tobacco Company studied how to reduce irritation from smoking by adding sweeteners at different points in tobacco paper processing (British American Tobacco Company 1968).

Additionally, the industry has long acknowledged that the sensory properties of menthol are central to its role in increasing the appeal of smoking. In discussion groups conducted for British American Tobacco conducted among people who smoked menthol and "potential users," the Creative Research Group concluded that mentholated cigarettes "undeniably impart a cooling influence, and … a by-product of this is to reduce harshness and to modify or mask the tobacco taste" (Creative Research Group 1982, p. 20; Yerger 2011). Philip Morris explored the appeal of menthol cigarettes in interviews with 1,367 people who smoked. Findings from its 1979 report of taste preferences indicated that:

> "What menthol smokers report they like and other smokers report they don't like about menthols is largely in terms of effect rather than taste. The key effects that seem to appeal to menthol smokers are menthol's perceived
>
> – Cooling effects
>
> – Clean, antiseptic effects
>
> – Slightly numbing, anesthetic effects
>
> – Heady, lifting effects" (The Roper Organization Inc. 1979, p. 5–6).

These are just a few examples of how the tobacco industry has used flavor chemicals and additives in the design and engineering of its products to appeal to specific groups of consumers. Compared with the tobacco industry's decades of research on the physiological and chemosensory effects of flavors in tobacco products on consumers, these topics have been explored less in public health research. The industry's knowledge of chemosensory and physiological effects of flavors on specific populations, as revealed in tobacco industry documents (Philip Morris Records Collection 2010), helped inform targeted product development and marketing.

This chapter specifically discusses individual-level factors (chemical senses, physiology, and human genetics) that influence the use of tobacco products containing natural and synthetic flavor chemicals, menthol, and other chemical additives that contribute to multisensory flavor experiences. It also discusses the flavor chemicals used in tobacco products, including the sensory effects, physiological effects, and somatosensory perceptions experienced by people who use them. Additionally, this chapter discusses how tobacco product flavors might help to explain some tobacco-related health disparities.

A Note on Race and Genetic Variation

As discussed in Chapter 1, race is a social construct that has been used to "identify, distinguish and marginalize some groups" and is best understood as a form of stratification rather than a distinct group of genetic dispositions (National Human Genome Research Institute 2023). It is important to recognize that there is greater genetic variance within than between racial and ethnic population groups (Jorde and Wooding 2004; Mersha and Beck 2020). This chapter explores why people in some socially stratified population groups (e.g., by race, gender, age) and those who carry specific genes may be more likely to use menthol or nonmenthol cigarettes. The emerging science on the role of genes in flavor experiences should be understood from a multidisciplinary perspective and in context with the multilevel factors influencing tobacco-related health disparities across the lifespan and across the tobacco use continuum (National Cancer Institute [NCI] 2017, Figure 1.1, p. 8). These multilevel factors include tobacco industry targeted marketing, tobacco product engineering tactics, differential pricing and marketing of flavored tobacco products in specific neighborhoods, structural and systemic racism and discrimination, policies, interpersonal relationships, stress, and societal and cultural influences. Other chapters in this report discuss how these additional factors interact across the lifespan to influence tobacco-related health disparities.

Literature Review Methods

A literature search of PubMed, Google, U.S. Food and Drug Administration (FDA) Tobacco Products web portal, and Truth Tobacco Industry Documents (formerly known as Legacy Tobacco Documents Library) was conducted for studies in English that were published through May 11, 2022. Search terms are listed in Table 3.1.

Table 3.1 Search strategies used for this chapter

Topic	Search strategy
Genetic, physiological, and chemosensory influences of flavors and menthol in the use of tobacco products	Time period: Through May 2022 Indexes: PubMed, Google Scholar, FDA Tobacco Products web portal, and Truth Tobacco Industry Documents Language: English Search terms: Flavors, menthol, transient receptor potential ion channels, synthetic cooling agents, synthetic sweeteners, Generally Recognized as Safe, GRAS, Flavor and Extract manufacturers Association, FEMA, flavor additives, sweet/candy/fruit flavors, flavored tobacco product categories, cigarettes, cigars, cigarillos, little cigars, smokeless tobacco, electronic cigarettes, e-cigarettes, various flavor chemicals and classes of flavors used in tobacco products, disparities in flavored tobacco products use, physiology of flavor perception, somatosensory perception of flavors, nicotinic receptors, sensory irritant receptors, sensory receptors, TRPM8/TRPA1/TRPV1 and flavor perception, mechanisms of flavor sensing, genetic basis of disparities in flavor preferences, and combinations thereof

Notes: Because this chapter focuses on various basic physiological, molecular, and genetic mechanisms of flavor sensing, several of the cited studies pertain to global populations and studies, not just to studies of U.S. populations and those based in the United States. Content focusing on tobacco-related health disparities and the genetic basis of flavor sensing is derived primarily from studies of nationally representative datasets of U.S. populations.

Information was summarized from the sources retrieved through the search, including research manuscripts; review articles; internal documents from tobacco manufacturers; and rules, regulations, and guidance documents for tobacco products from FDA. As this chapter focuses on various and basic physiological, molecular, and genetic mechanisms of flavor sensing, several of the cited studies pertain to U.S. populations and U.S.-based studies, as well as global populations and studies. Content focusing on tobacco use disparities and the genetic basis of flavor sensing is primarily derived from studies using national data comprised of representative samples of U.S. populations.

History of Flavor Chemicals in Tobacco Products

Flavor chemicals are used in tobacco products to elicit flavor sensations that can mask unpleasant tastes or odors and enhance taste (Carpenter et al. 2005). The history of flavors provides context to facilitate understanding of their use in tobacco products. For example, spices, a particular class of flavors, have been used for thousands of years to give flavor to foods and to cover up the pungent taste of meat prior to refrigeration (Rowe 2005). One of the oldest written formulas for flavors involved the use of myrrh, cinnamon, calamus, and cassia in olive oil, which was described in the book of Exodus of the Bible (Sell 2014). Until the discovery of distillation with ethanol, olive oil was an important solvent that was used to extract various flavorants (Sell 2014).

During medieval times, techniques were developed to extract flavorants from spices and essential oils through distillation. People who were wealthy used these flavor extracts as fragrances to improve the smell of the human body. Many of these spices and oils were transported from East Asia and the Middle East into Europe, even during the Dark Ages. The migration of flavors and fragrances, despite disapproval of their use by some churches, could not be halted as trade across the world expanded along with advancements in chemistry. While distillation revolutionized the fragrance and flavor industries, advances in synthetic and analytic organic chemistry in the nineteenth and twentieth centuries turned flavor chemistry into a more precise science (Sell 2014).

In the Industrial Age, chemists advanced the capacity to isolate and create chemicals in the laboratory that can be produced on a large scale for commercialization. For example, in 1834, cinnamaldehyde became one of the first chemicals to be isolated and then later synthesized (in 1852) by the Roure Bertrand Company (Rowe 2005). In the late 1800s, other chemicals, many of which are used today in tobacco products—such as benzaldehyde, methyl salicylate, vanillin, coumarin, cinnamic acid, saccharin, and lactic acid—became some of the first to be isolated or synthesized. The advancement of various analytic techniques (e.g., gas chromatography or mass spectrometry) allowed for the synthesis of flavor chemicals in the laboratory and resulted in mass commercialization of flavor chemicals (Rowe 2005).

After the Roure Bertrand Company isolated cinnamaldehyde, several other companies began to introduce more flavors and fragrances for use in a variety of consumer products. Table 3.2 lists some of the leading companies that manufacture flavors and fragrances. These companies produce chemicals that function to provide a product with a specified taste or smell (Rowe 2005). Many of these companies are large and multinational, and several of them produce flavor chemicals, such as menthol, that are commonly used by tobacco companies. The mass production of a wide variety of flavors and fragrances for a variety of consumer products has allowed the tobacco industry to produce products that contain multiple flavors and fragrances, which provide diverse sensory experiences. Chemosensory experiences produced by flavor chemicals are discussed later in this chapter.

Table 3.2 Leading companies that manufacture flavors and fragrance

Company	Primary products
International Flavors and Fragrances (IFF)	Produces essential oils for smoking tobacco and coolants
Symrise (entity formed by the merger of Haarmann & Reimer with Dragoco)	Vanillin, menthol, and filter capsules
Givaudan	Produces flavors for tobacco companies (Givaudan n.d.)
Firmenich	Produces flavors for the tobacco industry
Quest International	Cooling agents
Takasago	Menthol, vanillin, and cooling agents
Kerry	Food groups
Danisco	Food groups
Nestle	Food groups
Procter & Gamble	Household and consumer goods
Unilever	Household and consumer goods
L'Oréal	Household and consumer goods
Frutarom (acquired by IFF)	Aroma chemicals, domestic fragrances, and savory flavors
Duckworth's	Aroma chemicals, domestic fragrances, and savory flavors
Flavor & Fragrance Specialties	Aroma chemicals, domestic fragrances, and savory flavors
Sensient Technologies	Food and beverage colors, aroma chemicals, flavors in foods, other ingredients, cosmetics, pharmaceuticals, and household products
Robertet Groupe	Fragrances, flavors, and essential oils, including tobacco, for use in perfumes, cosmetics, aromatherapy, and food
T. Hasegawa	Flavors, including tobacco flavors and e-cigarette liquids
Huaboa International and Guangdong Golden Leaf Technology Development Co., Ltd., a subsidiary of Huaboa	Fragrances and flavors, including tobacco flavors, lining paper and filter, filter stick materials, and filter stick equipment
Mane	Flavors and fragrances in foods and perfumes

Source: Rowe (2005), with updates.

Past Regulation of Flavor Chemicals in Food and Tobacco Products

In 2009, through the *Family Smoking Prevention and Tobacco Control Act* (Tobacco Control Act) (Public Law 111-31), Congress gave FDA regulatory authority over tobacco products, including their manufacturing, sale, and distribution with an amendment to the *Federal Food, Drug, and Cosmetic Act* (FD&C Act) of 1938 (FDA 2020b). This authority also included the authority to adopt tobacco product standards that, among other things, may regulate the construction, components, ingredients, additives, constituents, and properties of the tobacco product (FDA 2020b). The *Tobacco Control Act* followed more than a century of federal regulation over flavor additives in food, drugs, and cosmetic products.

Flavors Used in Foods

Growing concerns about hidden dangers in the nation's food supply contributed to the enactment of the *Pure Food and Drugs Act of 1906*. One principal concern was that advances in chemistry made it possible for unscrupulous manufacturers to use synthetic preservatives, flavorings, and other additives to disguise and pass off low-quality and inferior foods as "authentic" (Berenstein 2017). Subsequently, the *FD&C Act* of 1938 authorized FDA to regulate food and drug safety (FDA 2018b). The *FD&C Act* was amended by the *Food Additives Amendment* of 1958, introducing a process for companies to submit food additive petitions to FDA for substances added to food (FDA 2018b). This amendment specified that if FDA deemed no harm would be caused by the additive in the limits of its intended use, then FDA would define these limits in its regulatory decision.

The 1958 *Food Additives Amendment* of the *FD&C Act* also specified that substances added to food do not have to undergo such FDA review if they are "generally recognized as safe" (GRAS), among qualified experts, under the conditions of their intended use (FDA 2018b). Under this provision, the *FD&C Act* implicitly authorized industry (i.e., commercial actors involved in food preparation) to conclude that substances added to or articles used as components in food, drinks, or chewing gum meet the criteria for GRAS. However, FDA may determine that such a conclusion has no basis and that the use of a substance in food requires approval as a food additive. FDA has also published a partial list of substances that are GRAS for use in food (FDA 2023; Code of Federal Regulations 2023 [Title 21, Parts 182 and 184]). Flavoring substances that are regulated as food additives are listed in FDA's regulations in Title 21, Code of Federal Regulations Part 172, and GRAS flavors are listed in FDA's regulations in Title 21, Code of Federal Regulations Parts 182 and 184 (Code of Federal Regulations 2023). Importantly, neither authorization as a food additive nor a conclusion of GRAS status—both of which are limited to food—applies to the use of these substances in tobacco products of any type.

A global network of industry organizations evaluates or compiles evaluations of the safety of flavors in foods—as well as fragrances in other products, such as cosmetics, detergents, and other consumer products—in response to national and international regulations. These industry-based organizations vary depending on whether the chemical is used as a flavor or a fragrance (Table 3.3). The U.S.-based Flavor and Extract Manufacturers Association (FEMA) maintains a list of more than 2,800 flavors that it considers to be GRAS for use in food, and the list is updated biannually (FEMA n.d.a).

Table 3.3 Industry organizations for fragrances and for flavors used in food

Organization	Focus
Geneva	Fragrances
	Fragrances
Geneva	Flavors in foods and beverages
(FEMA)	Flavors in foods for human consumption

Source: Rowe (2005), with updates.

Food Additive Approvals or GRAS Conclusions Apply to Foods, Not to Inhaled or Combusted Tobacco Products

Many electronic cigarette (e-cigarette) vendors have advertised that the chemicals used to manufacture e-cigarette liquids (e-liquids) are GRAS, per FEMA specifications, to wrongly imply their safety for inhalation (U.S. Department of Health and Human Services [USDHHS] 2016). However, no regulatory body has approved the safe level of any chemicals, including flavors, in tobacco products. As mentioned previously, GRAS conclusions are applicable only to ingestion of foods and are not applicable to the inhalation of tobacco products, combustible tobacco products, or combusted or aerosolized chemicals. In its 2018 Advanced Notice of Proposed Rulemaking (ANPRM) titled "Regulation of Flavors in Tobacco Products," FDA noted that,

> Certain substances may be authorized as a food additive or may be considered "generally recognized as safe" (GRAS) for certain uses in food. However, being authorized as a food additive or being considered GRAS, in and of itself, does not mean that the substances are safe when used in a tobacco product. The food additive approval or GRAS status of a substance applies only to specific intended uses in food, and are not supported by studies that account for inhalation toxicity (*Federal Register* 2018, p. 12298).

The ANPRM (2018, p. 12298) went on to explicitly discuss metabolic differences between inhaled and oral routes of exposure:

> Importantly, exposure to chemicals via the inhalation route can have very different effects from oral exposure, and most tobacco products are inhaled (*Federal Register* 2018, citing Klaassen 2013). For example, direct "portal of entry" effects to the respiratory tract, which is relatively more sensitive than the gastrointestinal tract, can occur upon inhalation exposure. There are also important metabolic differences between the two routes of exposure: After oral ingestion, a substance can be detoxified through "first-pass

> metabolism" in the liver before reaching systemic circulation. By contrast, substances introduced into the body via inhalation go directly into systemic circulation without the same potential for detoxification (*Federal Register* 2018, citing Klaassen 2013).

In sum, compared to ingestion, inhalation results in higher absorption of toxicants (Jabba et al. 2022; Leventhal et al. 2022). FDA has, however, acknowledged that GRAS status is not dispositive but may be informative when evaluating the toxicity of ingesting chemicals added to oral tobacco products, such as smokeless tobacco (FDA 2020c; *Federal Register* 2021).

In various announcements, FEMA (2015, 2016, 2020) has stated emphatically that the GRAS designation applies only to food and cannot be applied to flavorants in e-cigarettes. FEMA also declared that occupational exposure limits (OELs) (established for some flavorants by the Occupational Safety and Health Administration), recommended exposure limits (RELs) (established by the National Institute for Occupational Safety and Health), and threshold limit values (TLVs) (established by the American Conference of Government Industrial Hygienists) are (a) intended to serve as regulatory limits (for OELs) or benchmarks for limiting exposure to substances in the workplace (RELs and TLVs) and (b) should not be used as safety thresholds for e-cigarette use. For example, FEMA noted that OELs have been established for some flavor chemicals, but these limits "have no relevance to exposure to flavors from the use of e-cigarettes" (FEMA 2015, p. 2).

Disparities in Flavored Tobacco Product Use

As noted earlier in this chapter, the tobacco and flavor industries are multibillion-dollar industries that distribute their products worldwide (IFF n.d.). Flavors play a critical role in the appeal of tobacco products for youth, women, and certain minoritized racial and ethnic and sexual orientation and gender identity groups. Further, specific flavors and flavored products are target marketed to some groups who disproportionately use them (see Chapter 5). For example, approximately 80% of youth who begin using any tobacco product start with one that is flavored (USDHHS 2016). In one study, an estimated 40% of adolescents across five states who began smoking cigarettes used menthol cigarettes (Nonnemaker et al. 2013). Additionally, using data from the Population Assessment of Tobacco and Health (PATH) Study, more than 50% of young people 24 years of age and younger who ever used a filtered cigar or cigarillo reported that the first cigar product they smoked was flavored (Rostron et al. 2020). A systematic review by Smith and colleagues (2017) found that women who smoke are more likely than men to use mentholated cigarettes. Using data from the 2009 to 2010 National Adult Tobacco Survey, menthol cigarette use was higher among lesbian, gay, bisexual, and transgender (LGBT) groups than it was among people who identify as heterosexual or straight (Fallin et al. 2015). Hinds 3rd and colleagues (2018), using data from the Marketing and Promotions Across Colleges in Texas project, found that African American, Hispanic, and Asian young adults (18–29 years of age) are more likely than White young adults to use flavored cigars. Studies have shown that 70–90% of African American people who smoke use menthol cigarettes (Gardiner 2004; Pletcher et al. 2006; Lawrence et al. 2010; Caraballo and Asman 2011; Jones et al. 2013). Further, data from the 2017–2019 National Survey on Drug Use and Health showed that the overall prevalence of menthol cigarette use was 88.1% among Black people who smoked (Chapter 2; Table 2.6). The menthol compound is discussed in greater detail later in this chapter.

Flavors in e-cigarettes have been a key driver of the rise in the use of tobacco products by youth (King 2020, 2022). The 2016 Surgeon General's report on *E-Cigarette Use Among Youth and Young Adults* concluded that the rising use of e-cigarettes among youth constitutes a serious health problem that is driven by the availability of youth-appealing flavors, with both youth and young adults citing flavors as a primary reason for using these products (USDHHS 2016). Thousands of differently flavored e-cigarettes have been marketed to consumers (Zhu et al. 2014; Krüsemann et al. 2019; Havermans et al. 2021) with flavors created to produce multisensory experiences in those who are susceptible to tobacco use, nicotine dependence, and tobacco-related illnesses. Using data from the 2016–2017 PATH Study, Rostron and colleagues (2020) found that more than 80% of young people 24 years of age and younger who ever used e-cigarettes reported that their first e-cigarette was flavored. According to data from the 2021 National Youth Tobacco Survey (NYTS), about 85% of middle and high school students who used e-cigarettes used a flavored e-cigarette (Park-Lee et al. 2021).

Regulation of Flavors in Tobacco Products

Attention in the public health community to flavor chemicals in tobacco products has grown during the past decade, in part because the *Tobacco Control Act* (2009) gives FDA the authority to regulate additives, constituents, and ingredients in tobacco products. This authority includes the ability to regulate parts and components of tobacco products (e.g., wrapping paper, filters, liquids, tips, devices, and software). The *Tobacco Control Act* prohibits the sale of cigarettes with "characterizing flavors," with the exception of menthol and tobacco flavors (Figure 3.1). The *Tobacco Control Act* authorizes FDA to regulate cigarettes, cigarette tobacco, smokeless tobacco, and "roll your own" tobacco. FDA issued a final rule (the "deeming rule") in May 2016 extending the Act's applicability to all products meeting the definition, at that time,[1] of a "tobacco product"—under the *Food, Drug, and Cosmetic Act*—including cigars, hookahs, e-cigarette products, and components and parts but excluding accessories of tobacco products. Therefore, all newly deemed tobacco products must use one of three pathways to be approved for marketing: (1) submit a Premarket Tobacco Product Application, (2) undergo review for substantial equivalence, or (3) obtain an exemption for substantial equivalence (*Federal Register* 2016). FDA reviews Premarket Tobacco Product Applications to determine whether marketing of the product(s) is appropriate for the protection of the public health. FDA has the authority to issue a marketing authorization order under any of these pathways, which allows the product to be legally sold in the United States. E-cigarette products that have been granted marketing authorization as of 2023 include classic and rich tobacco-flavored NJOY, original flavored Vuse, and tobacco-flavored Logic (FDA n.d.).

Because of the dramatic increase in the use of e-cigarettes, especially flavored e-cigarettes, among youth, in January 2020, FDA issued a statement of enforcement priorities against certain unauthorized flavored e-cigarette products that appeal to youth. Specifically, companies that did not stop manufacturing, distributing, and selling cartridge- or pod-based e-cigarettes (except for menthol and tobacco flavors) risked enforcement actions by FDA (2020a). Importantly, the guidance preserved FDA's ability to shift its enforcement priorities, including in response to changes in patterns of product use among youth.

Figure 3.1 Excerpt from the *Family Smoking Prevention and Tobacco Control Act*

Section 907 Tobacco Product Standards
"(A) Special Rule for Cigarettes. Beginning 3 months after the date of enactment of the *Family Smoking Prevention and Tobacco Control Act*, a cigarette or any of its component parts (including the tobacco, filter, or paper) shall not contain, as a constituent (including a smoke constituent) or additive, an artificial or natural flavor (other than tobacco or menthol) or an herb or spice, including strawberry, grape, orange, clove, cinnamon, pineapple, vanilla, coconut, licorice, cocoa, chocolate, cherry, or coffee, that is a characterizing flavor of the tobacco product or tobacco smoke. Nothing in this subparagraph shall be construed to limit the Secretary's authority to take action under this section or other sections of this Act applicable to menthol or any artificial or natural flavor, herb, or spice not specified in this subparagraph."

Source: Family Smoking Prevention and Tobacco Control Act (2009, 123 Stat. 1776, 1799, codified at 21 U.S.C. § 387G(A)(1)(a)).

In 2021, FDA indicated that it intended to propose two product standards that prohibit (1) menthol as a characterizing flavor in cigarettes and (2) all characterizing flavors other than tobacco, including menthol, in cigars (FDA 2021). On April 22, 2022 (published in the *Federal Register* on May 4, 2022), FDA issued its proposed product standards. The proposed tobacco product standard for menthol cigarettes would prohibit menthol as a characterizing flavor in cigarettes and cigarette components or parts, including those sold separately to consumers (*Federal Register* 2022a). The proposed tobacco product standard prohibiting characterizing flavors other than tobacco in cigars "would provide that a cigar or any of its components or parts (including the tobacco, filter, or wrapper, as applicable) must not contain, as a constituent (including a smoke constituent) or additive, an artificial or natural flavor (other than tobacco) or an herb or spice,

[1]The definition of tobacco product was later amended in the *Consolidated Appropriations Act* of 2022, to include products that contain nicotine from any source (*Consolidated Appropriations Act* 2022). As of August 2023, FDA's deeming authority as it applies to premium cigars is the subject of litigation after the District Court of the District of Columbia vacated a portion of the deeming rule related to this product (*Cigar Association of America v. FDA* 2023).

including, but not limited to, strawberry, grape, orange, clove, cinnamon, pineapple, vanilla, coconut, licorice, cocoa, chocolate, cherry, coffee, mint, or menthol, that is a characterizing flavor of the tobacco product or tobacco smoke" (*Federal Register* 2022b, p. 26397).

Both proposed rules outline factors that, if finalized, would be relevant when determining whether a product has a characterizing flavor:

- The presence and amount of artificial or natural flavor additives, compounds, constituents, or ingredients, or any other flavoring ingredient in a tobacco product, including its components or parts;
- The multisensory experience (i.e., taste, aroma, and cooling or burning sensations in the mouth and throat) of a flavor during use of a tobacco product, including its components or parts;
- Flavor representations (including descriptors), either explicit or implicit, in or on the labeling (including packaging) or advertising of tobacco products; and
- Any other means that impart flavor or represent that the tobacco product has a characterizing flavor.

FDA has proposed that both tobacco product standards would be effective 1 year after the date of the publication of the final rule. If finalized as proposed, the rules would prohibit the manufacture, distribution, sale, or offering for distribution or sale, in the United States, of a cigarette or cigar or any of its components or parts that do not comply with Title 21 Code of Federal Regulations Parts 1162 (cigarettes) and 1166 (cigars) after such effective date. Importantly, as stated in the proposed rules, these proposed product standards do not include a prohibition on individual consumer possession or use, and FDA cannot and will not enforce against individual consumers for possession or use of menthol cigarettes or flavored cigars.

Some states and many localities have used the term *flavored tobacco product* to refer to products that impart a taste or smell other than the taste or smell of tobacco (Public Health Law Center 2023b). Explicitly incorporating the multisensory aspects of flavor such as cooling into flavor definitions could enhance the comprehensiveness of flavored tobacco product restrictions. The Public Health Law Center (2023a), a nongovernment organization, has revised its recommended definition of flavored tobacco products to more explicitly include sensory aspects (Box 3.2).

Thus, understanding flavor chemicals and their multisensory effects—whether synthetic or natural—has important implications for the regulation of tobacco products.

Box 3.2 Public Health Law Center (2023a) definition of flavored tobacco products

"FLAVORED TOBACCO PRODUCT" means any tobacco product that imparts:

1. a taste or odor distinguishable by an ordinary consumer, other than the taste or odor of tobacco, either prior to or during the consumption of such tobacco product, including but not limited to tastes or odors relating to any fruit, chocolate, vanilla, honey, candy, cocoa, dessert, alcoholic beverage, mint, wintergreen, menthol, herb, or spice; or
2. **a cooling or numbing sensation distinguishable by an ordinary consumer during the consumption of such tobacco produc**t.

PRESUMPTIVE FLAVORED TOBACCO PRODUCT. Any communication by or on behalf of the manufacturer or retailer of a tobacco product that such tobacco product imparts a taste or odor other than the taste or odor of tobacco, **or that imparts a cooling or numbing sensation,** constitutes presumptive evidence that the tobacco product is a flavored tobacco product.

This includes but is not limited to public statements that a product has a minty or cooling effect, such as describing the product as "chill," "ice," "fresh," "arctic," or "frost."

Flavor Chemicals and Other Chemicals in Tobacco Products

Flavor chemicals in tobacco products can mask the bitter taste, irritation, pain, and harsh sensations of tobacco and nicotine and, thus, make tobacco easier to use (Cummings et al. 2002; Galeotti et al. 2002; Carpenter et al. 2005; Harris 2006). Flavor chemicals, such as menthol, elicit sensory perceptions, a reinforcing factor that can influence the uptake of tobacco products among youth and young adults, increase the risk of nicotine dependence, impede quitting tobacco use, and increase the abuse liability of tobacco products (i.e., the potential of a drug product or substance to result in intentional, nontherapeutic use, even once, to achieve a desired psychological or physiological effect) (Center for Drug Evaluation and Research 2017; Wong et al. 2020; Bono et al. 2022; Center for Tobacco Products 2022). Additionally, flavor chemicals other than menthol can also increase the abuse liability of tobacco products, including e-cigarettes and cigars (Wong et al. 2020; Bono et al. 2022).

The following section discusses functional chemicals, which are designed to influence flavor perception, meaning that they stimulate the receptors in the oropharyngeal cavity, a topic discussed later in this chapter. Such chemicals stimulate the senses, including through aroma; physical sensations (such as tingling, cooling, warming, or astringency); and sweet, bitter, sour, salty, or umami (savory) tastes, which constitute the five primary taste categories.

Cooling Agents

A variety of chemicals produce cooling and refreshing sensations. Tobacco industry documents obtained from Brown & Williamson (1990, p. 1) state that, "Cooling agents are materials that give a cool feeling when in contact with the skin or mucous membrane, especially those of the mouth, nose, and throat of the human body. The cooling effect is not only caused by a latent heat of its evaporation, but also by its direct chemical action on the thermal sensitive receptors of the human body."

Menthol is one of the most widely known and frequently used cooling chemicals because it has cooling, refreshing, flavorant, and pain-blocking sensory effects. Menthol also has analgesic properties and acts as an antitussive (cough suppressant) and counterirritant (Laude et al. 1994; Proudfoot et al. 2006; Willis et al. 2011; Ha et al. 2015). Table 3.4 lists cooling agents, many of which are discussed in this chapter and are used in tobacco products. For example, "cooling agent 10" or 3-1-(p-methane-3-yloxy)-1,2-propanodiol, has a slight minty odor. Evidence from tobacco industry documents show that this chemical has been sprayed on tobacco, rolled into the cigarette paper, and used to cause a cooling sensation in the mouth when smoked. Cooling chemicals, even those without a taste or odor, have the potential to increase the appeal of tobacco products, facilitate their use, and contribute to tobacco-related health disparities (Rising and Alexander 2011; Jabba et al. 2022; Leventhal et al. 2022).

Table 3.4 Compounds that provide cooling, minty, and other sensations[a] used in tobacco products, food, cosmetics, personal care products, and other consumer products

Compound	Description	FEMA GRAS number	CAS registry number
Menthol stereoisomers			
(-)-Menthol = L-menthol = (1R,2S,5R)-5-methyl-2-propan-2-ylcyclohexan-1-ol	• Most commonly used in cigarettes, often naturally derived from cornmint (*Mentha arvensis*) oil (also present in peppermint or other mints)[b] • Clean, minty odor and intense cooling • L-menthol, the form found in nature, can also be synthetically produced by hydrogenating thymol and then isolating L-menthol but this results in a musty odor • FEMA flavor profile: mint, cool	2665	2216-51-5
(+)-Neomenthol = D-Neomenthol	• This stereoisomer is produced through hydrogenation of thymol	—[c]	63975-60-0
(+)-Isomenthol = D-Isomenthol	• This stereoisomer is produced through hydrogenation of thymol • No FEMA flavor profile found	4729	3623-52-7

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
(+)-Neoisomenthol = D-Neoisomenthol	• This stereoisomer is produced through hydrogenation of thymol • FEMA flavor profile: mint, cool	2666	20752-34-5
(+)-Menthol = D-menthol	• This form is not found in nature • A less desirable, musty mint odor compared to L-menthol; less cooling	—[c]	15356-60-2
(±)-Menthol = D,L-Menthol = Racemic Menthol	• Peppermint odor and taste • Equal amounts of L-menthol and D-menthol stereoisomers; typically synthetic • FEMA flavor profile: mint, cool	2665	1490-04-6
D,L-Menthol(±)-propylene glycol carbonate	• FEMA flavor profile: mint, cool	3992	156324-82-2
Menthol derivatives			
Menthyl acetate = (5-methyl-2-propan-2-ylcyclohexyl)acetate	• FEMA flavor profile: mint, cool	2668	16409-45-3
Frescolat MGC = L-menthol ethylene glycol carbonate	• Cooling on the skin and neutral taste and flavor • First patented as a tobacco flavorant, then patented as a general cooling agent • Used in tobacco products • No FEMA flavor profile listed	3805	156324-78-6
Frescolat MPC = L-menthol 1- and 2-propylene glycol carbonate	• Cooling on the skin and neutral taste and flavor • First patented as a tobacco flavorant, then patented as a general cooling agent • FEMA flavor profile: mint, cool	3806	30304-82-6; 868046-84-8
Carvone-5,6-oxide	• FEMA flavor profile: mint, cooling	4084	18383-49-8
Carvone	• FEMA flavor profile: basil, bitter, caraway, fennel, mint • Strong minty and cooling or irritant flavor in spearmint that is added to many tobacco products	2249	648-40-1; 2244-16-8; 99-49-0
Carvacrol = 2-methyl-5-(1-methylethyl) phenol	• FEMA flavor profile: caraway, spice, thyme • Liquid, colorless to pale yellow color; pungent, spicy odor	2245	499-75-2
Menthone = (2S,5R)-5-methyl-2-propan-2-ylcyclohexan-1-one	• FEMA flavor profile: green, fresh, mint • Minor cooling activity	2667	10458-14-7
2,3-dihydroxy-p-menthane	• Cooling	—[c]	—[c]
3,3,5-trimethylcyclohexanone glycerol ketal	• Cooling	—[c]	—[c]
(1R,3R,4S)-3-menthyl-3,6-dioxaheptanoate	• Cooling	—[c]	—[c]
(1R,2S,5R)-3-menthyl methoxyacetate	• Cooling	—[c]	—[c]
(1R,2S,5R)-3-menthyl 3.6,9-trioxadecanoate	• Cooling	—[c]	—[c]
(1R,2S,5R)-3-menthyl (2-hydroxyethoxy)acetate	• Cooling	—[c]	—[c]

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
(1R,2S,5R)-menthyl 11-hydroxy-3,6,9-trioxaundecanoate	• Cooling	—[c]	—[c]
3-(L-Menthoxy)-2-methylpropane-1,2-diol	• FEMA flavor profile: mint, cool	3849	195863-84-4
Cooling agent 10 = (-)-Menthoxypropane-1,2-diol = 3-[[5-Methyl-2-(1-methylethyl)cyclohexyl]oxy] propane-1,2-diol	• Cooling; increases saltiness • Produced by Takasago International Corp (Tokyo, Japan)	—[c]	87061-04-9
Other cooling agents			
AG-3-5 = Icilin = 1-[2-hydroxyphenyl]-4-[3-nitrophenyl]-1,2,3,6-tetrahydropyrimidine-2-one	• Cooling when in contact with mucous membranes and when ingested; nearly 200-fold more potent coolant than menthol	—[c]	36945-98-9
3-methyl-2-(1-pyrrolidinyl)-2-cyclopenten-1-one	• Cooling on oral cavity and skin	—[c]	41357-00-0
5-methyl-2-(1-pyrrolidinyl)-2-cyclopenten-1-one	• Cooling on oral cavity and skin	—[c]	4933-43-1
2,5-dimethyl-4-(1-pyrrolidinyl)-3[2H]-furanone	• Cooling on oral cavity and skin	—[c]	80873-59-2
4-methyl-3-(1-pyrrolidinyl)-2[5H]-furanone	• Cooling on oral cavity and skin	—[c]	770-99-0
Commercialized WS coolants			
WS-23 = Symcool WS-23 = 2-Isopropyl-N,2,3-trimethylbutyramide = N,2,3-trimethyl-2-(1-methylethyl)-butanamide	• About 75% of the cooling intensity compared with menthol • With WS-3, one of the two most commonly used carboxamide coolants • Clean cooling; no taste, bitterness, burn, sting, or tingle • Used in chewing gum, breath fresheners, confections, oral care, cosmetics, and e-liquids used in e-cigarettes • FEMA flavor profile: cooling	3804	51115-67-4
WS-3 = Symcool WS-3 = N-Ethyl-p-menthane-3-carboxamide = N-Ethyl-2-isopropyl-5-methylcyclohexane carboxamide = N-Ethyl-5-Methyl-2-(1-Methylethyl)-Cyclohexane Carboxamide	• About 50% greater cooling intensity than menthol • With WS-23, one of the two most commonly used carboxamide coolants • Nearly odorless; characterized by a high cooling activity with no side effects, such as burning, stinging, or tingling sensations • Nearly tasteless with a faint mint taste; good duration of physical cooling; can be used as an insecticide • Used in chewing gum, breath fresheners, confections, oral care, cosmetics, and e-liquids used in e-cigarettes • FEMA flavor profile: cooling	3455	39711-79-0
ICE 1500 = mixture of WS-3 and WS-23	• Combines the instant cooling sensations of WS-23 with the gradual and smooth cooling sensation of WS-3 (Leffingwell 2018) • "Provides saltiness and/or flavor enhancement of about 20–30% in a wide variety of foodstuffs such as salsas, salad dressings and marinades, margarine, soups and bouillons, as well as alcoholic beverages, when used at levels where the cooling sensation is imperceptible or barely perceptible" (Leffingwell 2018)	3455 and 3804	39711-79-0 and 51115-67-4

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
WS-5 = Symcool WS-5 = (1R,2S,5R)-N-((Ethoxycarbonyl)methyl)-p-methane-3-carboxamide = N-[(Ethoxycarbonyl)methyl)-p-menthane-3-carboxamide = N-(Ethoxycarbonylmethyl)-3-p-menthanecarboxamide	• Four times the cooling intensity of menthol • Only highly purified version is used for flavoring, otherwise it is very bitter • FEMA flavor profile: cooling	4309	68489-14-5
WS-12 = Symcool WS-12 = (1R,2S,5R)-N-(4-Methoxyphenyl)-p-menthanecarboxamide = (1R,2S,5R)-N-(4-Methoxyphenyl)-5-methyl-2-(1-methylethyl) cyclohexanecarboxamide	• Virtually nonvolatile, odorless, and tasteless • Strongest initial cooling and a longer lasting effect compared with other coolants, such as WS-3, WS-23, and WS-5 • "[WS-12] can be used at low levels to impart freshness into berry, citrus, and other fruit flavors in a variety of applications" (Leffingwell 2018) • FEMA flavor profile: cooling	4681	68489-09-8
WS-27 = N-Ethyl-2,2-diisopropylbutanamide	• FEMA flavor profile: cooling	4557	51115-70-9
WS-NA = N-Cyclopropyl-5-methyl-2-isopropylcyclohexanecarboxamide	• About 50% of the cooling intensity of menthol • FEMA flavor profile: imparts a cooling sensation	4693	73435-61-7
WS-116 = N-(1,1-Dimethyl-2-hydroxyethyl)-2,2-diethylbutanamide	• In conjunction with warming agents, enhances the warming sensation • FEMA flavor profile: cooling	4603	51115-77-6
WS-NA = Coolact 5 = 2-(L-Menthoxy)ethanol	• Cooling • No FEMA flavor profile listed	4154	38618-23-4
WS-14 = N-tert-butyl-p-menthane-3-carboxamide = N-[(Ethoxycarbonyl)methyl)-p-methane-3-carboxamide	• Cooling • About 75% of the cooling strength of menthol • Used as a cooling agent in Northwind cigarettes, which were introduced into a test market in 1981; Northwind cigarette test was unsuccessful, and the product was withdrawn from the market[d] • Commercially available as ICE 4000	4309	68489-14-5
Other commercially marketed coolants			
3-L-Menthoxypropane-1,2-diol	• Cooling • Creates warming sensation when mixed with vanillyl, butyl ether, ginger extract, capsicum • FEMA flavor profile: floral	3784	87061-04-9
3-(L-menthoxy)-2-methylpropane-1,2-diol	• Cooling • Creates warming sensation when mixed with vanillyl, butyl ether, ginger extract, capsicum	—[c]	195863-84-4
2,6-Diethyl-5-isopropyl-2-methyltetrahydropyran = 5-isopropyl-2,6-diethyl-2-methyltetrahydro-2H-pyran	• Refreshing effects • FEMA flavor profile: green	4680	1120363-98-5

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
trans-4-tert-Butylcyclohexanol	• TRPV1 antagonist that inhibits heat sensation and thus enhances cooling agents • FEMA flavor profile: earthy, fatty	4724	21862-63-5
2-(p-tolyloxy)-N-(1H-pyrazol-5-yl)-N-((thiophen-2-yl) methyl)acetamide = 2-(4-methylphenoxy)-N-(1H-pyrazol-3-yl)-N-(thiophen-2-ylmethyl)acetamide	• Compound made by biotech company Senomyx (San Diego, California) • FEMA flavor profile: cooling	4809	1374760-95-8
Freshone = 6-isopropyl-3,9-dimethyl-1,4-dioxaspiro[4.5]decan-2-one = 3,9-dimethyl-6-(1-methylethyl)-1,4-dioxaspiro[4.5]decan-2-one	• Refreshing cooling effect with some minty, fruity notes • FEMA flavor profile: imparts a cooling sensation	4285	831213-72-0
Coolact P = (-)-Isopulegol = Isopulegol = (1R,2S,5R)-5-methyl-2-prop-1-en-2-ylcyclohexan-1-ol	• Highly purified Isopulegol is odorless but imparts a feeling of freshness, crispness, and coolness to citrus-type fragrances • FEMA flavor profile: mint, cool	2962	89-79-2
Frescolat ML = (-)-Menthyl lactate = L-Menthyl lactate = [(1R,2S,5R)-5-methyl-2-propan-2-ylcyclohexyl] (2S)-2-hydroxypropanoate	• Faintly minty in odor and virtually tasteless; long-lasting cooling effect • FEMA flavor profile: mint, cool	3748	61597-98-6
Coolact 10 = 3-((-)-Menthoxy)propane-1,2-diol = 3-L-Menthoxypropane-1,2-diol	• Cooling without odor • FEMA flavor profile: floral • Made by Takasago International Corp. (Tokyo, Japan)	3784	87061-04-9
Frescolat MGA (*levo*) = (-)-Menthone 1,2-glycerol ketal = L-Menthone 1,2-glycerol ketal	• Cooling and refreshing, longer lasting sweetness in gum; more common than racemic form • FEMA flavor profile: mint, cool	3807	63187-91-7
Frescolat MGA (racemic) = D,L-Menthone 1,2-glycerol ketal = (±)-Menthone 1,2-glycerol ketal	• Cooling and refreshing, longer lasting sweetness in gum • FEMA flavor profile: mint, cool	3808	63187-91-7
(-)-Menthyl succinate = Mono-menthyl Succinate = 4-(5-methyl-2-propan-2-ylcyclohexyl)oxy-4-oxobutanoic acid	• Cooling agent for general use • Used in tobacco products • FEMA flavor profile: mint, cool	3810	77341-67-4
Cooler 2 = (-)-Menthyl glutarate = L-Monomenthyl glutarate = 5-[(1R,2S,5R)-5-methyl-2-propan-2-ylcyclohexyl]oxy-5-oxopentanoic acid	• FEMA flavor profile: mint, cool	4006	220621-22-7

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
Coolact 38D = PMD 38 = p-Menthane-3,8-diol = 2-(2-hydroxypropan-2-yl)-5-methylcyclohexan-1-ol	• Insecticide • FEMA flavor profile: mint, cool	4053	42822-86-6
Questice = (-)-Menthyl pyrrolidone carboxylate = L-Menthyl pyrrolidone carboxylate = [(1R,2S,5R)-5-methyl-2-propan-2-ylcyclohexyl] (2S)-5-oxopyrrolidine-2-carboxylate	• Produced by reacting (-)-menthol with L-pyrrolidin-2-one carboxylic acid • First patented as a long-lasting cooling and fresh ingredient used in toothpaste • Patented as an insect repellent • FEMA flavor profile: mint, cool	4155	68127-22-0
N,N-Dimethyl (-)-menthyl succinamide = (±)-N,N-Dimethyl Menthyl Succinamide = [(1R,2S,5R)-5-methyl-2-propan-2-ylcyclohexyl] 4-(dimethylamino)-4-oxobutanoate	• Cooling and refreshing on the tongue, palate, and front gums, imparting a fruity flavor with sour undertones • Long lasting cooling effect • FEMA flavor profile: imparts a cooling sensation	4230	544714-08-1
L-Menthyl (R,S)-3-Hydroxybutyrate = [(1R,2S,5R)-5-methyl-2-propan-2-ylcyclohexyl] 3-hydroxybutanoate	• FEMA flavor profile: mint, cool	4308	108766-16-1
Ultracool 7 = (-)-Menthyl acetoacetate = L-Menthyl acetoacetate = [(1S,2R,5S)-5-methyl-2-propan-2-ylcyclohexyl] 3-oxobutanoate	• FEMA flavor profile: mint, cool	4327	59557-05-0
(-)-Cubebol = Cubebol = (1R,4S,5R,6R,7S,10R)-4,10-dimethyl-7-propan-2-yltricyclo[4.4.0.01,5]decan-4-ol	• Refreshing • Weak smell and taste • FEMA flavor profile: spice • Warm, spicy, naturally cooling mint-like aroma	4497	23445-02-5
Evercool 180 = G-180 = N-P-benzeneacetonitrile menthanecarboxamide	• Cooling; increases saltiness at different levels • FEMA flavor profile: imparts a cooling sensation	4496	852379-28-3
Evercool 190 = G-190 = (1R,2S,5R)-N-(2-(pyridin-2-yl) ethyl)menthylcarboxamide = N-(2-(Pyridin-2-yl)ethyl)-3-p-menthanecarboxamide	• Cooling; increases saltiness at different levels • FEMA flavor profile: imparts a cooling sensation	4549	847565-09-7

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
N-(2-Hydroxyethyl)-2,3-dimethyl-2-isopropylbutanamide	• When used in conjunction with other cooling agents (e.g., WS-3), this compound provides superior cooling and flavor properties in confections and chewing gum • In conjunction with warming agents, it enhances the warming sensation • FEMA flavor profile: cooling	4602	883215-02-9
N-benzo[1,3] dioxol-5-yl-3-p-menthanecarboxamide	• 100 times more cooling intensity than menthol	—[c]	—[c]
N-benzooxazol-4-yl-3-p-menthanecarboxamide	• 100 times more cooling intensity than menthol	—[c]	—[c]
N-(1-isopropyl-1,2-dimethylpropyl)-1,3-benzodioxole-5-carboxamide	• WS-23 analog • Has about 2.2 times more cooling intensity than 2 ppm of menthol	—[c]	—[c]
N-(2-ethoxyethyl)-2-isopropyl-2,3-dimethylbutanamide	• WS-23 analog • Cooling intensities greater than or equal to WS-23	—[c]	—[c]
N-4-([1,2,4]triazol-l-yl)-phenyl-3-p-menthanecarboxamide	• 100 times more cooling intensity than menthol	—[c]	—[c]
N-4-(pyrazol-l-yl)-phenyl-3-p-menthanecarboxamide	• 100 times more cooling intensity than menthol	—[c]	—[c]
Di-(-)-menthyl glutarate = Dimenthyl Glutarate = bis(5-methyl-2-propan-2-ylcyclohexyl) pentanedioate	• Coolant • No FEMA flavor profile listed	4604	406179-71-3
(1R,2S,5R)-N-(4-(carbamoylmethyl)phenyl)-menthylcarboxamide = (2S,5R)-N-[4-(2-amino-2-oxoethyl)phenyl]-5-methyl-2-(propan-2-yl) cyclohexanecarboxamide	• Produces long lasting cooling in throat and mouth, with some bitterness • FEMA flavor profile: cooling	4684	1119711-29-3
2-[2-(p-menthan-3-yloxy) ethoxy]ethanol = 2[2-(p-menthyloxy)ethoxy] ethanol	• Coolant • No FEMA flavor profile listed	4718	28804-53-7
(1R,2R,4R)-1-(2-Hydroxy-4-methylcyclohexyl)ethanone = 1-(2-hydroxy-4-methylcyclohexyl)ethenone	• Coolant • No FEMA flavor profile listed	4742	917750-72-2
5-methyl-4-(1-pyrrolidinyl)-3-[2H]-furanone	• Cooling, odorless	—[c]	—[c]
4,5-dimethyl-3-(1-pyrrolidinyl)-2[5H]-furanone	• Cooling, faintly mint-like	—[c]	—[c]
4-methyl-3-(1-pyrrolidinyl)-2[5H]-furanone	• Cooling, odorless	—[c]	770-99-0
Eucalyptol = 1,3,3-trimethyl-2-oxabicyclo[2.2.2]octane 1, 8 Cinole	• Compound found in abundance in *Eucalyptus globulus* (southern blue gum) • Cooling, tingling, spicy • FEMA flavor profile: camphor, cool, eucalyptol, mint	2465	470-82-6

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
D-Sorbitol = (2R,3R,4R,5S)-hexane-1,2,3,4,5,6-hexol	• Sweetener that exhibits cooling when mixed with warm saliva • No FEMA flavor profile listed • Structural isomer of mannitol	3029	50-70-4
Mannitol = (2R,3R,4R,5R)-hexane-1,2,3,4,5,6-hexol	• Sweetener that exhibits cooling when completely dissolved[e] • Can mask unpleasant or bitter tastes • Structural isomer of sorbitol	—[c]	69-65-8
Urea	• Short cooling effects in fragrances	—[c]	57-13-6
Methyl salicylate = Methyl 2-hydroxybenzoate	• Flavor compound is naturally found in wintergreen oil from *Gaultheria* species that is commonly used in smokeless tobacco products • Has irritant effects, can desensitize irritant pathways and act as a permeation enhancer • Usually used in lower concentration; however, in high enough concentration, this compound is harmful if inhaled, ingested, or absorbed dermally • FEMA flavor profile: almond, caramel, peppermint, sharp	2745	119-36-8
Ethyl salicylate = Ethyl 2-hydroxybenzoate	• Artificial flavor compound often used in smokeless tobacco products • Formed by condensation reaction of salicylic acid and ethanol • Has a pleasant odor that resembles wintergreen and is also used in perfume and as an artificial flavor	2458	118-61-6
D-Camphor = (1*R*,4*R*)-1,7,7-trimethylbicyclo[2.2.1]heptan-2-one	• Found naturally in camphor laurel tree (*Cinnamomum camphora*) • FEMA flavor profile: camphor, earth, pine, spice	2230	464-49-3
DL-Camphor = 1,7,7-trimethylbicyclo[2.2.1] heptan-2-one	• FEMA flavor profile: mint, cool	4513	76-22-2
Cinnamomum camphora whole = Camphor Japanese white oil = Camphor oil	• Anti-inflammatory and analgesic properties • Herbal minty odor • No FEMA flavor profile listed	2231	8008-51-3
Thymol = 2-Isopropyl-5-methylphenol = Thyme camphor = 5-Methyl-2-isopropylphenol	• Herbal odor, like thyme; sweet-medicinal, herbaceous, warm, aromatic odor • FEMA flavor profile: spice and wood	3066	89-83-8
Capsaicin	• Found naturally in chili peppers • Acts as an analgesic that blocks pain and is a TRPV1 agonist • Pungent odor and burning taste • No FEMA flavor profile listed	3404	404-86-4
Nonanoyl 4-hydroxy-3-methoxybenzylamide = Nonivamide = N-Vanillylnonanamide	• Used as a topical analgesic and flavoring ingredient • Agonist of TRPV1 receptor • Parent compound is vanillylamide • FEMA flavor profile: savory	2787	2444-46-4
(*E*)-3-benzo[1,3]dioxol-5-yl-n,n-diphenyl-2-propenamide = N-[2-(methoxymethyl)-4-methylpentyl]-3,4-dimethylbenzamide	• Chemically synthesized • New chemical evaluated; intended to be used as a flavoring substance in specific categories of food[f] • Cooling properties; minty, burning, tingling, fresh, fruity notes[f] • No FEMA flavor profile listed	4788	1309389-73-8

Table 3.4 Continued

Compound	Description	FEMA GRAS number	CAS registry number
N-ethyl-5-methyl-2-(1-methylethenyl) cyclohexanecarboxamide	• Minty odor • Cooling sensation on skin[g] • No FEMA flavor profile listed	4808	1582789-90-9
Gamma-aminobutyric acid = 4-aminobutyric acid = GABA	• Savory, meat-like aroma • FEMA flavor profile: cooked and roasted, fruit	4821	56-12-2
2,4-dihydroxy-n-[(4-hydroxy-3-methoxyphenyl)methyl] benzamide = 2,4-dihydryxybenzoic acid vanillylamide	• No FEMA flavor profile listed	4835	877207-36-8
(E)-3-(3,4-dimethoxyphenyl)-n-[2-(4-methoxyphenyl)-ethyl]-acrylamide	• FEMA flavor profile: umami	4877	76733-95-4

Sources: Leffingwell (2009; 2018), Leffingwell and Rowsell (2014), FEMA (n.d.b), PubChem (n.d.), and Symrise (n.d.), Food and Agricultural Organization of the United Nations (n.d.) unless noted specifically otherwise.

Notes: Cooling agents can have sensory effects of cooling, activating various receptors in the body, with or without a minty taste. A substance's food additive approval or GRAS status is not applicable to inhalation. **CAS =** Chemical Abstracts Service; **FEMA =** Flavor and Extract Manufacturers Association; **GRAS =** generally recognized as safe; **ppm =** parts per million; **WS =** Wilkinson Sword.

[a]Select additional compounds, such as capsaicinoids, are included.

[b]The FEMA flavor library also lists various types of mint flavors separately, including peppermint oil (FEMA 2848), spearmint oil (FEMA 3032), scotch spearmint oil (FEMA 4221), curly mint oil (FEMA 4778), and ginger mint (FEMA 4811).

[c]Not available.

[d]Daylor (1982).

[e]Kearsley and Deis (2006) and Song and Vieille (2009).

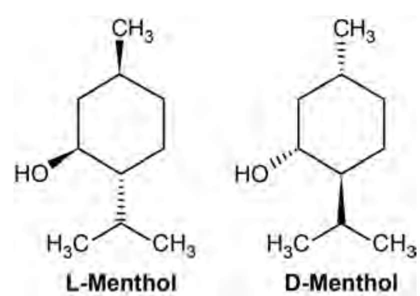
[f]Younes and colleagues (2022).

[g]Parchem (n.d.).

Production of Menthol and Other Cooling Agents

The majority of commonly used flavor chemicals and other additives in tobacco products are produced by chemical synthesis (Schwab et al. 2008; Dionísio et al. 2012). This includes menthol, which is used for its medicinal analgesic and anesthetic properties in cosmetics, household products, oral care products, chewing gum, and various confectionary products. Menthol (C10H20O) is one of the few chemicals that is used as a flavor, fragrance, and for its pharmacologic effects on the sensory nerves and muscle system (Figure 3.2). As the active ingredient in some over-the-counter and prescription drugs, menthol mildly numbs the throat and is used in cough drops and similar products to relieve sore throat and other analgesic purposes; for its antitussive properties; and as an antipruritic (also known as an abirritant or counterirritant) to relieve itching and localized irritation. Approximately one-fourth of the world's menthol production is used in tobacco products, surpassed only by its use in oral hygiene and pharmaceutical products (Clark 2007).

Figure 3.2 Structural formulas for L-menthol and D-menthol



Notes: **Left:** L-menthol (left) is a minty and cooling menthol isomer added to cigarettes and other tobacco products. L-menthol is also known as *levo* menthol, L(-)menthol, or (-)-menthol. **Right:** D-menthol is a minor isomer in mint oil, with no cooling effect and a phenolic odor.

Menthol can impart on the skin perceptions of cooling or warming sensations at a concentration of less than 1%; for oral cooling, the threshold for menthol is about 0.3 µg (Rowe 2005). This sensation results from stimulation of thermoreceptors and not temperature changes on the skin or in the body (Eccles 1994). Laboratory analyses have detected menthol in relatively small quantities (0.002–0.07 mg/cigarette, an average of 0.0183 mg/cigarette or 18 µg/cigarette) in cigarettes that are marketed in the United States as nonmenthol or regular cigarettes (Ai et al. 2016). Peppermint oil, one of two plant extracts from which menthol is derived, usually contains 40–50% L-menthol, 22% menthone, 5% eucalyptol (1,8-cineole), and small amounts of other menthol isomers and related compounds (Nair 2001; National Library of Medicine 2019). Menthol produces the rapid onset of a cooling sensation (Rowe 2005). The cooling effect of L-menthol, a menthol isomer, is 45 times stronger than the cooling effect of D-menthol, and L-menthol is the major menthol stereoisomer added to tobacco products (Eccles 1994; Rowe 2005; Chen et al. 2011). L-menthol is primarily responsible for interacting with the TRPM8 cold- and menthol-sensing receptor. Unlike L-menthol, which produces a cooling sensation when it binds to TRPM8 (Chuang et al. 2004; McKemy 2007), D-menthol does not induce a cooling sensation and instead irritates the skin (Gusain et al. 2017). L-menthol stimulates TRPM8 severalfold more than other menthol stereoisomers (Behrendt et al. 2004; Bandell et al. 2006).

Companies such as Symrise (formerly Haarmann and Reimer), Badische Anilin und Soda Fabrik (BASF), and the Takasago International Corporation mass produce menthol and synthetic menthol for multiple commercial products. Commercial menthol was first sourced by extracting natural plant materials from *Mentha piperita*, the peppermint plant. Of the eight possible stereoisomers of menthol, peppermint oil contains L-menthol almost exclusively. Only trace amounts of other stereoisomers are found in peppermint oil. L-menthol has a minty odor and cooling effect often associated with peppermint, whereas the other stereoisomers have less desirable odors and less cooling effects (Leffingwell 2009). Peppermint oil is largely used in gum, toothpaste, mouthwash, and other oral hygiene products (Eccles 1994; Leffingwell 2009). The second of the two plant extracts from which menthol is derived for mass-scale production, corn mint or *Mentha arvensis*, initially cultivated in Japan, produces higher yields of L-menthol than peppermint oil. Brazil used to be a major source of corn mint-derived L-menthol, but India and China currently produce the majority of *Mentha arvensis*-derived L-menthol (Leffingwell 2009; Singh and Kumar 2021; Semwal n.d.). Various other sources—such as citronella, eucalyptus oil, Indian turpentine oil, and thymol—can also be used to produce menthol (Eccles 1994; Leffingwell 2009).

Mass Production of Menthol as a Cooling Agent for Use in Tobacco Products

In the 1960s and 1970s, the production of naturally sourced menthol often could not satisfy the increasing demand from the tobacco industry and other industries using menthol, leading to large fluctuations in price and to supply problems (Leffingwell 2009). Tobacco manufacturers started partnering with flavor manufacturers that were seeking synthetic routes to produce menthol. Documents from R.J. Reynolds suggest that since 1975, the company's products have used synthetic menthol (R.J. Reynolds 1977). A 1992 memorandum from Lorillard stated that "60% synthetic menthol and 40% Brazilian menthol … is a standard mixture used in our mentholated cigarettes" (Viso 1992, p. 3). However, the current ratios of synthetic and natural menthol are unpublished.

In 1983, Takasago International Corporation, one of the world's largest fragrance and flavor producers, started using a stereoselective process to efficiently produce synthetic L-menthol on a large scale (Emura and Matsuda 2014). The stereoselective process started with myrcene and used rhodium and ruthenium catalysts to produce L-menthol. Later, the process was optimized using alternative catalysts to produce higher yields (Maeda et al. 2012). For example, German-based Symrise AG's process starts from meta-cresol, which is sourced from coal tar or toluene, resulting in a racemic mixture, a mixture that has equal amounts of L- and D-menthol, and is followed by a stereoselective separation step (Hopp 1989).

Prices for natural menthol continued to rise in the 1990s, a frequent complaint by the tobacco industry, making synthetic menthol more price competitive (Juentgen and Tutte-Olm 1996). Global production of natural and synthetic menthol increased from 12,000 tons in 1989 to more than 48,000 tons in 2016, with revenue of approximately $775 million in 2016 (QYResearch 2017). The production of menthol, the majority of which is for oral hygiene products (Leffingwell 2009), was expected to exceed 61,000 tons in 2022, with estimated revenue of $932 million (QYResearch 2017). A 2020 market research report estimated that global production of menthol cigarettes would grow by 3% from 2021 to 2026 (IMARC Group 2020).

Data from the National Survey on Drug Use and Health indicate that the leading brands of menthol cigarettes from 2014 to 2019 were Newport and Marlboro, comprising more than 50% of the menthol cigarette market (Miller Lo et al. 2022). The Newport brand was first owned by Lorillard Tobacco Company and was then acquired by R.J. Reynolds in 2014. Newport is the most commonly used menthol brand among African American people who smoke; more than half of people who used

Newport in 2019 were African American (Miller Lo et al. 2022). Additionally, more than 50% of people who used Newport in 2019 had incomes lower than $30,000 per year (Miller Lo et al. 2022). The Marlboro brand includes both menthol and nonmenthol varieties and is owned by Philip Morris/Altria. In addition to Newport and Marlboro, many cigarette brands offer menthol varieties, such as Pall Mall, Camel, American Spirit, L&M, Winston, Eagle, Basic, Kool, Pyramid, USA Gold, 305s, Virginia Slims, "roll your own" tobacco, and others (Miller Lo et al. 2022). FDA's proposed rule to prohibit menthol as a characterizing flavor in cigarettes would have a significant impact on tobacco use among all people who initiate smoking with or currently smoke menthol cigarettes, including in particular populations who disproportionately use menthol cigarettes, such as youth, women, African American people, members of the LGBTQI+ (LGBT, queer or questioning, intersex, and other sexual orientation and gender identities) community, and people with lower incomes (see Chapter 2).

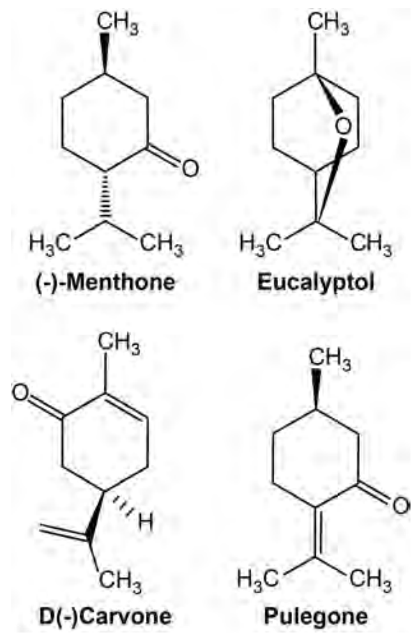
Mint Flavorants and Cooling Agents

In addition to menthol, other chemicals can produce crispness and cooling or refreshing sensations with or without a minty or menthol taste or odor. For example, menthone, a ketone analog of menthol, is often detected in tobacco products and produces a strong minty odor (Figure 3.3) (Schmitz et al. 2015; Krüsemann et al. 2017). Menthone has the potential for transdermal drug delivery (Zhao et al. 2001; Brain et al. 2006; Kamatou et al. 2013). It is also used in chewing gum and candy (Dionísio et al. 2012). Menthone and its derivatives have cooling effects and some are marketed under the trade name Frescolat (Leffingwell 2018).

Eucalyptol (1,8-cineole), known for its presence in the leaves of the eucalyptus tree, is present in mint oil and other essential oils (Figure 3.3) (National Center for Biotechnology Information n.d.). It emits a eucalyptus odor, a minty smell, and has a mild cooling effect.

Carvone, the minty flavorant in spearmint, can also be found in a wide variety of mint- or menthol-flavored tobacco products, including cigarettes, e-cigarettes, and moist snuff and snus (Figure 3.3). Two stereoisomers of carvone exist: (S)-(+)-carvone is the major flavorant in caraway seeds, and (R)-(-) carvone is the major flavorant in spearmint oil and the main component responsible for the minty aroma in that plant (Dionísio et al. 2012). Carvone emits an intense minty odor that is more pungent than menthol's odor. Similar to menthol, carvone has been identified in e-cigarette products that have a variety of flavor descriptors (Jabba et al. 2022).

Figure 3.3 Structural formulas for menthone, eucalyptol, carvone, and pulegone



Notes: **Top Left:** (-)-Menthone is a component of mint oil, with a strong minty odor and minor cooling activity. **Top Right:** Eucalyptol is the cooling and soothing agent in eucalyptus oil. **Bottom Left:** Carvone is the strong minty and cooling or irritant flavor in spearmint that is added to many tobacco products. **Bottom Right:** Pulegone is a potential carcinogenic constituent of mint oils and is present in several mint- and menthol-flavored tobacco products as an adulterant, when mint oil acts as the source of menthol.

Although these compounds may exhibit a minty smell and cooling effect, there is no association between the mint smell and the cooling effects (Eccles 1994). Compounds that lacked a menthol or minty odor but retained a cooling effect were first developed in the 1970s by Wilkinson Sword (WS), a company that produces shaving products (Watson et al. 1978). Some chemicals in the WS-series distinguished themselves by having cooling properties without a minty odor and with less irritancy than menthol (Watson et al. 1978). These agents are now widely used in chewing gums, confections, shaving products, and other skin and hair care products.

Following the development of the original WS series of synthetic cooling agents, many other cooling agents were developed for additional consumer products and foods. Some of these agents can produce cooling on different parts of the body (e.g., skin, mouth, throat, tongue) and can impart fruity or citrus flavors when used at certain levels (Table 3.4).

The effects of chemicals listed in Table 3.4 may differ in intensity and duration. For example:

- WS-12 [(1R,2S,5R)-N-(4-Methoxyphenyl)-p-menthane carboxamide] is tasteless and odorless and can be used at low levels to impart freshness in berry, citrus, and other fruit flavors. It is the strongest of the WS cooling agents and has a longer lasting effect than WS-3, WS-5, and WS-23 (Leffingwell and Rowsell 2014).

- (-)-Menthyl (S)-3-hydroxybutyrate has a cooling effect but is odorless and tasteless (Leffingwell and Rowsell 2014).

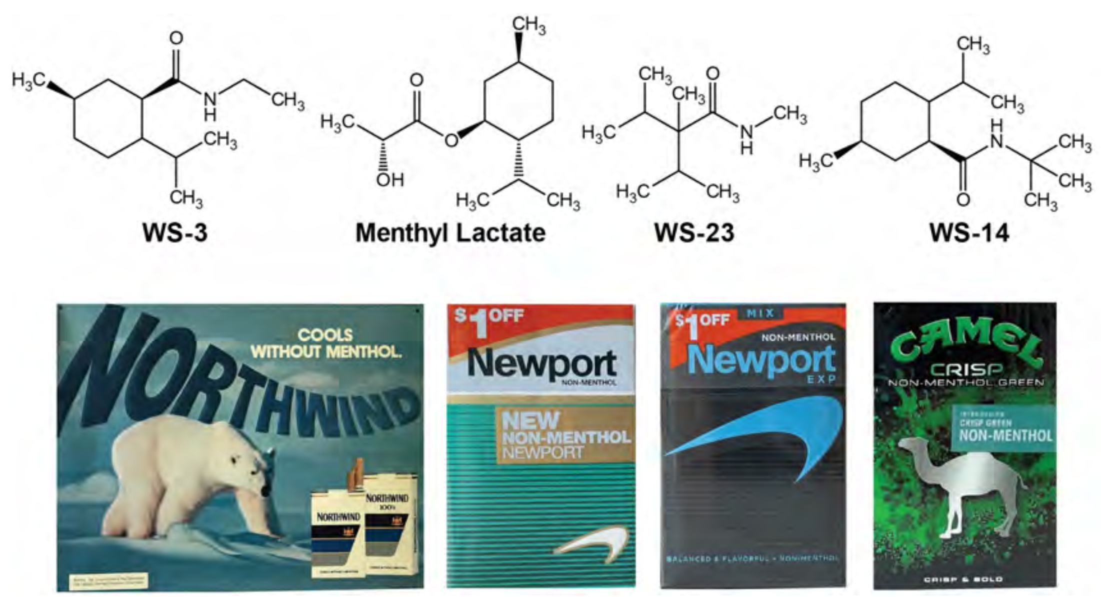
- Frescolat ML [(-)-Menthyl lactate] has a cooling effect and a faintly minty odor, and is virtually tasteless (Leffingwell 2009).

Synthetic Cooling Agents in Combustible Cigarettes

Documents from the tobacco industry reveal that a cool-without-menthol concept was discussed before the development of synthetic cooling agents (Hind 1972). In 1974 and 1975, R.J. Reynolds tested among consumers the compounds identified as WS-3, WS-10, WS-14, WS-23, WS-123, and WS-125 for their cooling effects in cigarettes and found that WS-14 [N-([ethoxycarbonyl]methyl)-p-menthane-3-carboximide] was as acceptable to consumers as menthol (Leffingwell and Rowsell 2014). R.J. Reynolds did not pursue commercialization of synthetic cooling agents in cigarettes any further at the time, citing in an inter-office memorandum that the risk that marketing a "cool" but not "menthol" product that used WS-14 or another synthetic cooling agent could draw unwanted attention to tobacco additives, public investigation, or federal regulation (Leffingwell 1975). In the early 1980s, Philip Morris test-marketed a new brand of cigarettes, Northwind, in the St. Louis, Missouri, area (Figure 3.4). Labeled with the slogan "Cools without Menthol," Northwind contained the odorless cooling compound WS-14 (commercially available as ICE 4000) (Leffingwell 2009). However, the campaign was not successful with consumers, and internal concerns were raised about the toxicity of unknown combustion products of WS-14 and lack of testing (Newman 1981; Daylor 1982).

Since then, several synthetic cooling agents, including WS-3 and WS-23, have been reviewed by FEMA and are included in the FEMA GRAS list (Leffingwell and Rowsell 2014). (As discussed elsewhere in this chapter, a substance's GRAS status is not a determination that

Figure 3.4 Synthetic cooling agents added to cigarettes and e-cigarettes



Notes: **Top:** Synthetic cooling agents WS-3, menthyl lactate and WS-23, found in e-liquids. WS-3 was detected in combustible cigarettes in Germany and is an additive to nonmenthol cigarettes marketed in California after the state's flavored tobacco product ban in 2022. WS-14 was added to Northwind cigarettes in the 1980s. **Bottom:** Advertisement for the Northwind cigarette brand, containing WS-14, test marketed by Philip Morris in 1981. Newport Non-Menthol, Newport EXP Non-Menthol, and Camel Crisp, which were marketed by R.J. Reynolds in California beginning in December 2022 with synthetic cooling agent WS-3 as an additive.

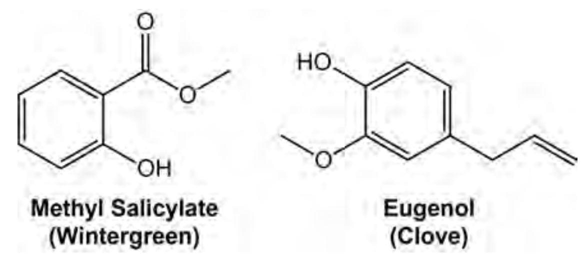
other exposure routes are safe.) A chemical analytic study by Reger and colleagues (2018) detected small amounts of the cooling agents WS-3 and isopulegol in combustible cigarettes marketed in Germany, suggesting that at least some manufacturers are adding these agents to contemporary combustible tobacco products. WS-3, isopulegol, and multiple other synthetic or natural cooling agents were banned as cigarette additives in Germany (German Federal Office of Justice 2017).

In December 2022, California's law restricting flavored tobacco sales, including menthol cigarettes, took effect (Public Health Law Center 2022). Prior to the restrictions, R.J. Reynolds immediately began marketing cigarettes containing synthetic coolants as "nonmenthol" (Craver 2023) (Figure 3.4). For example, for varieties of the Newport (Newport Non-Menthol Green, Newport EXP) and Camel (Camel Crisp) brands, the ingredient lists from R.J. Reynolds specifically include N-tert-butyl-p-menthane-3-carboxamide (i.e., WS-3) (R.J. Reynolds Tobacco Company 2023). The availability of these products has the potential to undermine the health impact of menthol cigarette restrictions. On April 25, 2023, the California Attorney General issued notices to the tobacco companies marketing these products, R.J. Reynolds and ITG Brands LLC, determining "that each of these Reviewed Products is presumptively FLAVORED under the California flavor ban law" (State of California Department of Justice 2023, p. 1). R.J. Reynolds filed a lawsuit against the California Attorney General on May 11, 2023, asking the notices to be rescinded (Reynolds American 2023).

Wintergreen Flavor and Methyl Salicylate

Wintergreen is a popular flavor in smokeless tobacco products, including snuff and snus. Methyl salicylate, which is the flavor compound in wintergreen natural oil (Figure 3.5), has counterirritant effects, can desensitize irritant pathways, and can act as a permeation enhancer (Hassan et al. 2010; Moghadam et al. 2013). It is widely used as a topical analgesic in creams. Methyl salicylate is toxic and can be lethal if, for example, it is ingested by children as part of wintergreen oil or is used excessively by athletes as a topical application (Anderson et al. 2017). Levels of methyl salicylate in smokeless tobacco products are substantially higher than such levels in the highest methyl salicylate-containing confectionary products (Chen et al. 2010). Although it has a FEMA GRAS designation for food products, ingestion of methyl salicylate via smokeless tobacco products can exceed recommended safety levels for food (Chen et al. 2010). Methyl salicylate is covered in more detail in the discussion of methyl salicylate as a smokeless tobacco additive later in this chapter.

Figure 3.5 Structural formulas for analgesic and anesthetic flavors



Notes: **Left:** Methyl salicylate, the wintergreen flavor, is widely popular in smokeless tobacco products, such as moist snuff and sinus, and is also added to some e-liquids. Methyl salicylate has analgesic and counterirritant properties. **Right:** Eugenol, the clove flavor, is also present in some e-liquids and has anesthetic and cooling properties.

Eugenol and Other Clove-Derived Flavors

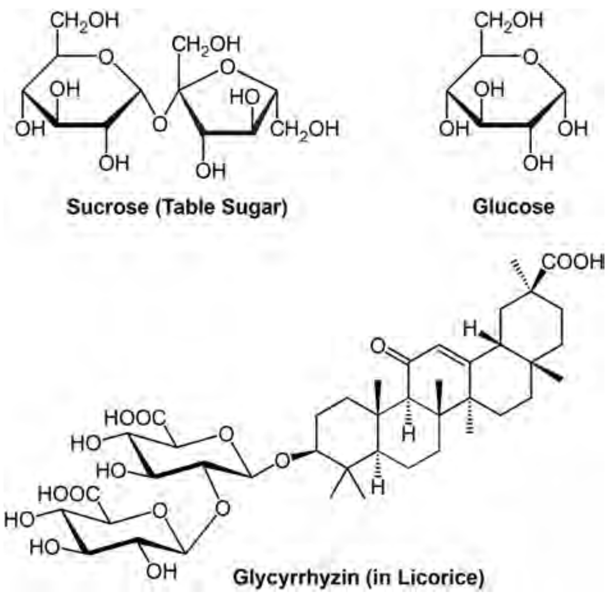
Eugenol and its derivatives, such as methyl eugenol, are derived from clove and have both cooling and local anesthetic effects (Figure 3.5). Eugenol is used as a dental anesthetic and may dampen the irritating effects of smoke in the respiratory system (Roemer et al. 2014). Clove cigarettes are highly popular in Indonesia and were sold in the United States until 2009, when the 2009 *Tobacco Control Act* prohibited the sale of cigarettes with a characterizing flavor other than menthol or tobacco.

Sweet, Candy, and Fruit Flavors

As is the case with chemicals with mint and cooling effects, sweeteners have been used in conventional commercial tobacco products for decades, and sweet flavors have become more common over time in such products as cigars, hookah tobacco, e-cigarettes, and smokeless tobacco (Scott-Sheldon and Stroud 2018; Ali et al. 2020; Delnevo et al. 2021a; Wang et al. 2022b). Sweet is one of five basic tastes and is derived from both natural sugars and synthetic sweeteners. Different sugars produce different levels of sweetness. For example, fructose is sweeter than sucrose (table sugar). Sugars are also naturally found in the tobacco leaf. The blending of various types of tobacco, combined with sweetener additives, can influence the sweet taste of a tobacco product that is not advertised as having a characterizing flavor other than tobacco.

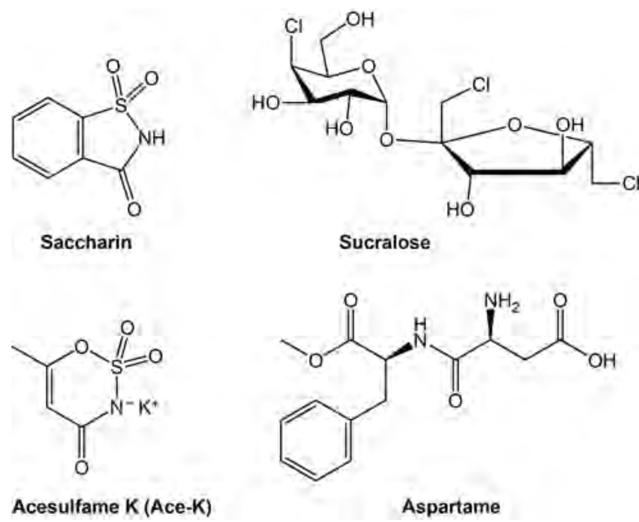
Tobacco products widely use natural sweeteners, including sucrose sourced from sugar cane or sugar beets (Figure 3.6). For example, R.J. Reynolds' ingredient lists

Figure 3.6 Structural formulas for natural sweeteners in tobacco products



Notes: Sugars, such as sucrose (table sugar) and glucose, are added to cigarettes, chewing tobacco, and snuff. Glycyrrhizin, a natural sweetener in licorice, is added to casing used in cigarettes and cigars. Glycyrrhizin is 30–50 times as sweet as table sugar.

Figure 3.7 Synthetic, high-intensity sweeteners added to tobacco products



Notes: Saccharin is added to traditional smokeless products, such as moist snuff, and in the mouthpieces and wrapping paper of flavored cigarillos and little cigars. Sucralose is added to snus at very high levels, producing intense sweetness. Acesulfame K is added to some cigarillos and the wood mouth pieces of little cigars. Aspartame is found in some snus and snuff products and in cigarillos.

commonly include “sugars” for combustible cigarettes and “sucralose” for smokeless tobacco products (R.J. Reynolds Tobacco Company n.d.). Tobacco casings also contain other natural sweeteners, such as licorice (Carmines et al. 2005). The sweetness of licorice comes from glycyrrhizin, which has been detected in a range of tobacco products (Figure 3.6). Glycyrrhizin is a saponin natural product, known for its detergent-like and gelling actions. Excessive consumption of glycyrrhizin can lead to hypertension (Nazari et al. 2017; Deutch et al. 2019) and hypokalemia-induced symptoms, such as muscle cramping or cardiac arrythmias (Nazari et al. 2017). Glycyrrhizin is 30 to 50 times as sweet as sucrose (Ajagannanavar et al. 2014).

The use of saccharin as a sweetener in cigarettes dates back to the 1890s when the tobacco industry began using it as an ingredient in chewing tobacco (Tilley 1985). Saccharin is a synthetic, high-intensity sweetener that is 200–700 times sweeter than sucrose (FDA 2018a). More recently, sucralose (e.g., Splenda) was added to tobacco products. Sucralose is a chlorinated derivative of sucrose and is approximately 600 times sweeter than sucrose (FDA 2018a). The presence of acesulfame potassium (acesulfame K or Ace-K) and aspartame has been reported in tobacco products but not as frequently as reported for other artificial sweeteners (Figure 3.7). When heated, these artificial sweeteners are less stable than sucrose, lessening the effects of the sweet taste. The safety of inhaling combusted or aerosolized artificial sweeteners has not been established. As explained previously, a substance’s food additive approval or GRAS status is not applicable to the inhalation of tobacco products or combustible tobacco products.

Other Flavor Chemicals

Many other flavorants are used in tobacco products, including the tobacco flavor itself. Because of the large number of flavorants, only a few of those most commonly used are mentioned here. Vanillin—the vanilla flavor (Brown et al. 2014)—was one of the first chemical compounds commercially produced in the mid-1800s. Using coniferin as a precursor, synthetically produced vanillin was first sold by the company Haarmann & Reimer, now Symrise, in 1874 (Tiemann and Haarmann 1874; Reimer 1876). Later, vanillin was synthesized from wood lignin, a byproduct of the wood pulp industry. Today, the large majority of synthetic vanillin is produced using a petrochemical process, with guaiacol as a precursor (Hocking 1997). Vanillin is one of the most widely used flavorants added to ice cream, chocolate, baked goods, confections, and beverages. It is considered a sweet-associated flavor. Ethyl vanillin, one of the first synthetic derivatives of a natural flavorant, is three times as potent as vanillin and is often used together with vanillin. Vanillin and ethyl vanillin are the most frequently detected flavorants in e-cigarettes. These compounds were found in 50% of e-liquids marketed in the United States and in more than 30% of those marketed outside the United States (Tierney et al. 2016; Krüsemann et al. 2020). Vanillin combined with other flavors like cherry has been added to little cigars by injecting it by hand into the cigar (Osmalov 1970).

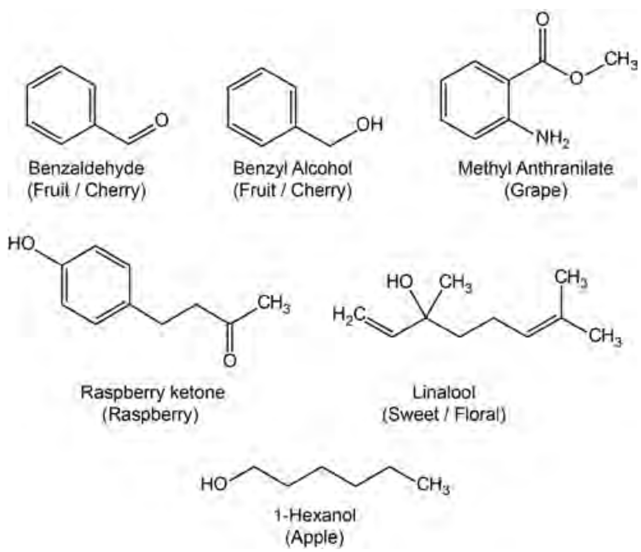
Little is known about the physiological and pharmacological effects of vanillin beyond its role as a flavorant. In rodent experiments, vanillin given orally at a high dose was found to have antidepressant behavioral effects, inhibiting monoamine oxidase (MAO) (Shoeb et al. 2013; Xu et al. 2015). Vanillin- and ethyl vanillin-containing e-liquids also inhibited MAO. However, animals inhaling vanillin did not display any changes in behavior (Ueno et al. 2019).

Cinnamaldehyde was the first chemical to be isolated for use as a flavor and a fragrance (Hajinejad et al. 2020). Fruit and berry flavors often come from such chemicals as benzaldehyde, raspberry ketone, linalool, geraniol, limonene, benzyl alcohol, and ethyl acetate and other esters (Figure 3.8).

Carotenoid-related flavors include damascenone (Figure 3.9), which is used to generate tobacco flavors in such products as e-cigarettes. How "tobacco flavor" and "tobacco" are treated as characterizing flavors will have implications for any regulations that reference such characterizing flavors. Such implications may include efforts to exploit what might be seen as potential regulatory loopholes because some tobacco products that are marketed as tobacco flavor include non-negligible concentrations of flavor additives. Gas chromatography and mass spectrometry analysis have identified the presence of numerous flavor chemicals in tobacco-flavored e-liquids, including beta-damascenone, maltol, ethyl maltol, benzyl alcohol, ethyl acetate, ethyl butyrate, vanillin, ethyl vanillin, and other minor constituent flavor chemicals (Tierney et al. 2016). These flavor chemicals were found in concentrations that could not be obtained simply by using tobacco extracts (Tierney et al. 2016), meaning that they were added to the e-liquids through other means. However, such findings do not apply to all e-liquids. Similar research conducted on two tobacco flavor styles of JUUL, a popular cartridge-based e-cigarette brand, found "negligible concentrations" of total flavor chemicals, with low levels of benzyl alcohol in Classic Tobacco JUUL and "negligible" flavor chemicals in Virginia Tobacco JUUL (Omaiye et al. 2019).

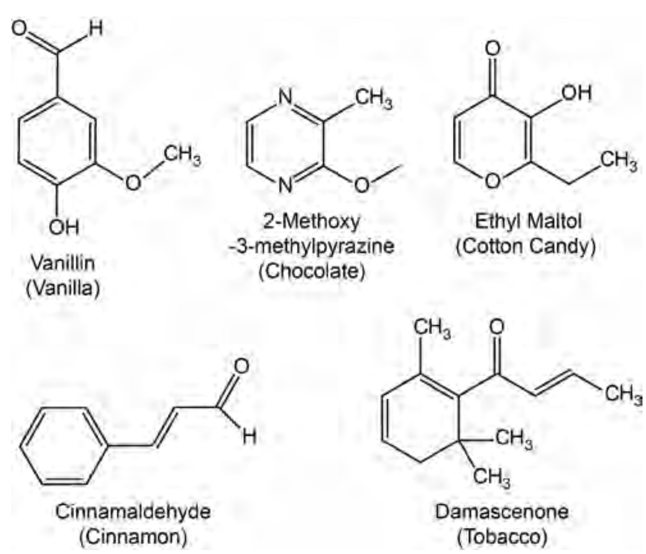
Concept flavor-named tobacco products, which are flavored products described with terms that do not

Figure 3.8 Chemicals in fruity, sweet, and floral flavors



Notes: A large variety of fruit flavors is used in tobacco products, including e-cigarettes, cigarillos, little cigars, and smokeless products. These flavors are often identical to the flavor chemicals in natural fruit and stimulate the olfactory system. Some flavorants, including benzaldehyde and raspberry ketone, are aldehydes and may cause irritation and other toxicologic effects when present at higher concentrations and inhaled. Other flavorants include esters or alcohols.

Figure 3.9 Candy, baked goods, sweet, and tobacco flavors



Notes: Vanillin, the vanilla flavor is contained in a wide range of e-liquids, as a characterizing flavor, or as a flavor note to cherry and other fruit flavored mixes. Pyrazines confer chocolate, cocoa, and coffee flavor notes, and ethyl maltol has an intense cotton candy or caramel flavor. Cinnamaldehyde is the major cinnamon flavor. Damascenone is found in many tobacco flavored e-liquids.

expressly refer to flavors, such as "purple" or "jazz," are discussed further in the section "Cigars, Cigarillos, and Little Cigars" of this chapter. Concept flavor-named cigarette products are also sold in the United States. Examples of cigarettes marketed as nonmenthol include Camel Crush Oasis Blue capsule cigarettes, which is described as "tropical oasis" (State of California Department of Justice 2023), and Newport EXP Mix cigarettes, which is described as "balanced and flavorful" (Figure 3.4). Capsule cigarettes are discussed later in this chapter.

In addition, pyrazines, chocolate, and coffee flavors are added to e-liquids, processed tobacco leaves, and cigarette and cigar casings. Pyrazines are one of the most frequently used additives for enhancing flavors in conventional cigarettes (Leffingwell et al. 1972). Pyrazines are a family of N-heterocyclic compounds that can also be derived from tobacco leaves (Leffingwell et al. 1972; Alpert et al. 2016) and make smoking more palatable by reducing sidestream odor, irritation, and the harshness of nicotine (Connolly et al. 2000; Alpert et al. 2016). Pyrazines, such as 2,5-dimethylpyrazine, are added to tobacco products to impart chocolate or coffee flavors. 2,5-dimethylpyrazine used in e-liquids was shown to elicit respiratory epithelial cell damage, raising concerns for people who use e-cigarettes long term (Sherwood and Boitano 2016). Data from tobacco industry documents show that pyrazines have been used to optimize nicotine delivery and dosing and to reinforce smoking behavior by stimulating olfactory receptors (Alpert et al. 2016). Thus, pyrazine additives may contribute to difficulty quitting among people who smoke.

Additional Chemical Additives

Additional chemicals, including levulinic acid and benzoic acid, may also be added to tobacco products to reduce the harshness of nicotine and facilitate the uptake of tobacco products. Tobacco industry documents reveal that levulinic acid has been used to raise nicotine yields in cigarettes and increase consumer perceptions of smoothness and mildness (Keithly et al. 2005). Specifically, levulinic acid lowers pH in tobacco smoke and reduces sensation in the upper respiratory tract, which allows for deeper smoke inhalation and may facilitate nicotine binding to neurons that would otherwise not respond to nicotine (Keithly et al. 2005). Further, pod-based e-cigarettes, such as JUUL, deliver nicotine protonated with benzoic acid, instead of freebase nicotine, which lowers pH to allow for greater nicotine delivery and less harshness (Ghosh et al. 2021). Laboratory studies suggest that nicotine salt-based e-liquids (e.g., JUUL) cause cytotoxicity, exerting biological effects that surpass the expected effects of freebase nicotine (Omaiye et al. 2019; Ghosh et al. 2021; Zhang et al. 2021). Nicotine salts are used in a variety of tobacco products, including oral nicotine pouches (Stanfill et al. 2021).

Flavor Chemicals and Other Additives in Various Categories of Tobacco Products

Following the implementation of the *Tobacco Control Act*, which prohibited characterizing flavors (other than tobacco and menthol) in cigarettes, sales of capsule cigarettes and flavored noncigarette tobacco products—such as flavored cigars (including little cigars and cigarillos) and e-cigarettes—increased (Delnevo et al. 2017; King et al. 2018; Rossel 2018; Moodie et al. 2019). The next section discusses various products and their relationships to tobacco-related health disparities.

Capsule Cigarettes

Capsule cigarettes contain a flavorant-filled capsule in the cigarette filter; people who use these products apply pressure to the filter to break the capsule and release a burst of flavor into the smoke. Capsule cigarettes were developed and introduced in Japan in 2007 but are now marketed worldwide (Kahnert et al. 2012; Thrasher et al. 2016). Moreover, capsule cigarettes are the fastest growing segment of the combustible tobacco market (Rossel 2018; Moodie et al. 2019). The flavor company Symrise is cited as a source for flavor-filled capsules in Philip Morris cigarettes (Pithawalla 2007). In the United States, R.J. Reynolds markets menthol-flavored capsule cigarettes under the Camel Crush brand. Outside the United States, capsule cigarettes are marketed in many different flavors, including mint, menthol, and fruit. Double-capsule designs marketed outside the United States allow consumers to choose two flavors in one cigarette, with one popular choice being a mint or menthol capsule plus a fruit-flavored capsule (Abad-Vivero et al. 2016; Thrasher et al. 2016). Flavor capsules are also available in filters for "roll your own" and make-your-own cigarettes, as well as in cigars, cigarillos, and heated tobacco products (Booth 2018; Moodie et al. 2018; Cho and Thrasher 2019).

Nonmenthol Camel Crush Oasis capsule cigarettes were introduced by R.J. Reynolds following California's prohibition on the sale of flavored tobacco products—including menthol-flavored products—which took effect in December 2022 (Craver 2023; R.J. Reynolds Tobacco Company 2023). The packaging for the Oasis Blue product includes the descriptors "Tropical Oasis" and "One Crush for a Smooth Tropical Oasis;" packaging for the Oasis Green product states "One Crush—Non-Menthol to a Tropical Oasis;" and packaging for the Oasis Silver product states "One Crush for a Mellow Tropical Oasis" (State of California Department of Justice 2023), suggesting that each product delivers different multisensory flavor experiences.

Cigarette consumption declined between 2008 and 2020, and reductions were greater for nonmenthol cigarettes, which has been attributed in part to the introduction of menthol capsule cigarettes (Delnevo et al. 2022). Sales of menthol capsule cigarettes increased rapidly from 2008 to 2010; sales growth continued at a slower pace from 2010 to 2014 and then plateaued from 2014 to 2020 (Delnevo et al. 2022). Flavor ingredients for menthol capsule cigarettes include menthol, menthone, eucalyptol, and isopulegol (Kahnert et al. 2012; Kim et al. 2018). Sales, distribution, and target marketing of capsule cigarettes marketed as nonmenthol will be important to monitor.

Disparities in the use of capsule cigarettes have been observed in the United States by age and by race and ethnicity. According to data from the 2013–2014 Population Assessment of Tobacco and Health (PATH) Study, capsule cigarettes were the usual cigarettes smoked by 9.4% of young adults (18–24 years of age) who smoked compared with less than 1% of adults 44 years of age and older who smoked (Emond et al. 2018). Among young adults 18–24 years of age who smoked, use of flavored capsules was highest among those who were Hispanic (17.3%), followed by non-Hispanic White (8.4%) and non-Hispanic Black (3.2%) people.

According to a 2012–2014 study in the United States, Mexico, and Australia, 5% of people who smoked used capsule cigarettes (Thrasher et al. 2016). In various market studies, participants have deemed capsule cigarettes as being technologically more advanced and providing a fresher feeling than conventional cigarettes (Moodie et al. 2015, 2018). Correspondingly, capsule cigarettes are misperceived to be healthier than and different from conventional cigarettes (Moodie et al. 2018; Talhout et al. 2018). Finally, data from New Zealand suggest that capsule cigarettes (a) appear to be more attractive to people who do not smoke but are susceptible to smoking than to those who do smoke and (b) might be chosen more frequently than other products to initiate smoking (Hoek et al. 2019).

Cigars, Cigarillos, and Little Cigars

According to data from the 2023 NYTS, cigars equaled cigarettes as the most commonly used combusted tobacco product among middle and high school students (Birdsey et al. 2023). Cigar smoking in the past 30 days was higher among non-Hispanic Black students (2.3%) than it was among non-Hispanic White students (1.0%) (Birdsey et al., 2023). The prevalence of cigar use was also higher among youth who identified as lesbian, gay, or bisexual than it was among youth who identified as heterosexual or reported being unsure of their sexual orientation (Gentzke et al. 2020). As of March 2024, flavored cigars (including flavored cigarillos and flavored little cigars) were still on the market. However, as noted previously, FDA has proposed a tobacco product standard that would prohibit all characterizing flavors, including menthol but not including tobacco flavor, in cigars (including cigarillos and little cigars). Cigars that meet the definition of "premium cigars" in a court order (*Cigar Association of America v. FDA* 2023) as having only tobacco flavor would not be included because they do not contain characterizing flavor ingredients other than tobacco flavor. This proposed tobacco product standard, if finalized, could have a significant impact on reducing tobacco-related health disparities (*Federal Register* 2022b).

As sold, little cigars are often indistinguishable from cigarettes (Delnevo and Hrywna 2007). They resemble cigarettes in size and shape and are typically offered in packs of 20 (the minimum pack size for cigarettes in the United States), but they are defined as cigars because they are wrapped in a tobacco-containing wrapping paper (Table 3.5). Cigarillos are small cigars of varying sizes and may be offered in small packs of two or three. Although such products were available before the enactment of the *Tobacco Control Act*, sales of cigarillos and little cigars have increased significantly since the passage of the *Tobacco Control Act* (Regan et al. 2012; Cantrell et al. 2013; Delnevo et al. 2017; Kuiper et al. 2018). Sales of flavored cigars increased by almost 50% from 2008 to 2017 (Delnevo et al. 2017). Black & Mild and Swisher Sweets—sold in what are described as two-packs and three-packs—dominate the market of machine-produced cigars, having garnered more than 60% market share as of 2017 (Delnevo et al. 2017). Flavored little cigars and cigarillos have higher odds of availability and of lower prices in neighborhoods with higher proportions of African American people (Cantrell et al. 2013). More exterior advertising for little cigars and cigarillos has also been found in stores in neighborhoods with higher proportions of 18- to 34-year-old African American residents and in neighborhoods with higher proportions of young adult residents of any race (Cantrell et al. 2013).

Flavors in cigarillos and little cigars contribute to their popularity among youth (USDHHS 2012; Cantrell et al. 2013; Kong et al. 2017), as 65% of U.S. middle and high school students who used cigars in 2021 reported flavored cigar use (Gentzke et al. 2022). Furthermore, cigars contribute significantly to racial and ethnic disparities in the use of combustible tobacco products. In 2021, non-Hispanic Black students reported higher prevalence of current combustible tobacco product use (5.2%) than

Table 3.5 Features of cigarettes, cigars, and cigar subtypes

Product	Wrapper	Stick characteristics	Pack size (excludes local and state restrictions)	Allowable characterizing flavors, as of March 2024 (excludes local and state restrictions)
Cigarettes	Typically paper	• Typically filtered	• Not less than 20 (required)	Menthol and tobacco only
Cigars	Substance containing tobacco	• Can be large or small	• No minimum	Any flavor (except premium cigars)
Little cigars	Substance containing tobacco	• Typically filtered • Similar to cigarettes in size and shape	• No minimum, often offered in packs of 20	Any flavor
Cigarillos	Substance containing tobacco	• Small cigars of varying sizes • May have a plastic tip	• No minimum, often sold in packs of two or three	Any flavor
Large cigars	Substance containing tobacco	• Large, often machine made	• No minimum • Often sold individually	Any flavor
Premium cigars	Whole leaf tobacco (not reconstituted tobacco)	• Typically handmade • Filler contains at least 50% natural, long-leaf tobacco • Weigh at least 6 lbs per 1,000 sticks • Do not have filters or tips	• No minimum • Often sold individually	No characterizing flavor other than tobacco

Notes: Most cigarettes are wrapped in paper, but they can also be wrapped in any substance not containing tobacco. The term "cigarette" also includes any roll of tobacco wrapped in any substance containing tobacco which, because of its appearance, the type of tobacco used in the filler, or its packaging and labeling, is likely to be offered to, or purchased by, consumers as a cigarette wrapped in paper or in any substance not containing tobacco. For federal tax purposes, "small cigars" are defined as cigars that weigh 3 lbs or less per 1,000 cigars, and "large cigars" are defined as cigars that weigh more than 3 lbs per 1,000 cigars (U.S. Government Publishing Office 2011). The U.S. District Court for the District of Columbia has defined premium cigars as those that (1) are wrapped in whole tobacco leaf; (2) contain a 100-percent leaf tobacco binder; (3) contain at least 50-percent (of the filler by weight) long filler tobacco; (4) are handmade or hand rolled; (5) have no filter, nontobacco tip, or nontobacco mouthpiece; (6) do not have a characterizing flavor other than tobacco; (7) contain only tobacco, water, and vegetable gum with no other ingredients or additives; and (8) weigh more than 6 pounds per 1,000 units (*Cigar Association of America v. FDA* 2023). **FDA =** U.S. Food and Drug Administration.

non-Hispanic White or Hispanic students, and specifically, cigar use (3.1%) (Gentzke et al. 2022). Available evidence suggests that (a) levels of carcinogens may be higher in mainstream smoke from little cigars than in mainstream smoke from cigarettes, which may be attributable to differences in tobacco blends, storage time for the tobacco leaf before manufacture, and manufacturing processes (Hamad et al. 2017), and (b) smoke from flavored little cigars has similar cytotoxic effects as the smoke from nonflavored or tobacco-flavored little cigars (Ghosh et al. 2017).

The top selling brands of cigarillos and little cigars, such as Black & Mild and Swisher Sweets, are marketed in colorful and flavorful varieties. Fruit, candy, and alcohol flavors include cherry, cherry vanilla, wine, cocktail, apple, and cream. Jazz, sweet wood, casino, and wine flavors are commonly sold flavors by Black & Mild. Concept flavor names, such as Island Bash and purple, may imply a flavor, such as tropical fruit or grape, without explicitly naming the characterizing flavor. However, more ambiguous concept flavor names, such as jazz and casino, may describe an attractive environment that appeals to people with particular lifestyles, while the flavor implication is less clear.

Concept flavor names are common in cigars (Gammon et al. 2019; Birdsey et al. 2019) but are also used in other tobacco products, such as e-cigarettes, cigarettes, and smokeless tobacco. FDA considered concept flavor names in proposing the tobacco product standard prohibiting characterizing flavors other than tobacco in cigars (*Federal Register* 2022b).

For example, Box 3.3 lists some of the cigar concept flavor names from two brands that have the highest market

Box 3.3 Example concept flavor names by two brands of cigars: Black & Mild and Swisher Sweets

- Aromatic (Swisher Sweets)
- Blazing fire (Swisher Sweets)
- Casino (Black & Mild)
- Coastal cocktail (Swisher Sweets)
- Diamonds (Swisher Sweets)
- Island bash (Swisher Sweets)
- Jazz (Black & Mild)
- Purple swish (Swisher Sweets)
- Smooth (Swisher Sweets)
- Wild rush (Swisher Sweets)

share in the United States, Black & Mild and Swisher Sweets (Gammon et al. 2019; Delnevo et al. 2021b).

Chemical analysis has revealed that the typical compositions of flavor chemicals in flavored cigarillos and little cigars are similar to the flavor chemical compositions in candy products. For example, in one comprehensive analytic study, a grape-flavored blunt cigar was found to contain methyl anthranilate, a typical component of grape-flavored candy (Brown et al. 2014). An apple-flavored cigarillo contained 1-hexanol, and cherry-flavored cigarillos and cigars contained benzaldehyde and benzyl alcohol, which are typical apple- and cherry-flavored chemicals found in candy, respectively (Brown et al. 2014). Raspberry-flavored products contained raspberry ketone, and many cherry-flavored cigarillos contained vanillin, the vanilla flavor (Brown et al. 2014). Benzyl alcohol, the cherry flavorant, was also found in peach-flavored and grape-flavored cigarillos, suggesting that the accuracy of the fruit flavors listed on packaging is limited and that it may be challenging for consumers to distinguish these flavors (Brown et al. 2014). Other frequently used flavorants include ethyl maltol (cotton candy flavorant) and linalool (a flowery and fruity flavorant). Many flavored cigarillos and little cigars contain varying amounts of menthol even though menthol may not be marketed as a characterizing flavor in the cigar (Brown et al. 2014).

Menthol flavored tobacco products are popular among youth and among Black or African American people who use tobacco products, and menthol is often marketed as a characterizing flavor in cigars (Sterling et al. 2016a; Cohn et al. 2017; Rose et al. 2020). Furthermore, among Black adults who smoked cigarettes, perceiving menthol additives in little cigars and cigarillos as less harmful compared to tobacco flavor was associated with statistically significantly higher odds of using flavored little cigars and cigarillos compared with those who perceived that menthol flavor additives were as harmful as tobacco flavor (Sterling et al. 2016a).

Clove Cigars

Following the prohibition of clove as a characterizing flavor in cigarettes mandated under the *Tobacco Control Act*, Kretek International began selling clove-flavored cigars under the Djarum brand (Delnevo and Hrywna 2015; Jo et al. 2015). The company increased the weight of the product to more than 3 pounds per thousand sticks, enabling classification as a cigar for tax purposes. Sales for this brand in the United States increased from $444,192 in 2009 to approximately $6.7 million in 2012 (Delnevo and Hrywna 2015).

Artificial Sweeteners in Cigarillos and Little Cigars

Many cigarillos and little cigars are designated as having a sweet flavor. After the 2009 enactment of the *Tobacco Control Act*, which prohibited all characterizing flavors except menthol and tobacco in cigarettes, the tobacco industry filed several applications for patents describing the design of novel cigarillo products. One application, filed by Altria (Philip Morris), the owner of the Black & Mild brand of cigarillos, described procedures to add artificial sweeteners to the tobacco wrapper and mouthpiece (Sweeney et al. 2013). Later, Erythropel and colleagues (2018) analyzed sweetener additives in cigarillos marketed as sweet in the United States and compared the products with cigarillos with other flavor designations; 31 cigarillos and little cigars were tested from six of the top-selling U.S. brands in 2016 (combined 89% market share) (Giovenco et al. 2018). All but two of the tested cigarillos contained high-intensity sweeteners on the side or tip of the mouthpiece (Erythropel et al. 2018). Saccharin and glycyrrhizin, derived from licorice, were detected most often. Levels of sweetness did not appear to differ in the cigarillo parts touching the mouth (the side or tip of the mouthpiece). In most cigarillos, the sweetener was restricted to the mouth section. The sweetener was found throughout the wrapping leaf in some cigarillos. Acesulfame K and neotame, two heat-sensitive sweeteners, were detected on wood-tipped cigarillos, resulting in very high levels of sweetness (Erythropel et al. 2018). Sweeteners were not found on cigarillos with plastic tips, but only a few cigarillo brands were sold with these tips (Erythropel et al. 2018). These findings suggest that high-intensity sweeteners are used in almost all cigarillos and little cigars marketed in the United States, regardless of the flavor designation.

The placement of sweeteners on the mouth end of tobacco products may trigger intense perceptions of sweet flavors. Sweet flavors may mask the otherwise harsh effects of tobacco and nicotine in cigarillos. Studies indicate that the preference for sweet flavors is higher among children and adolescents than it is among adults (Hoffman et al. 2016). Similar to the situation with U.S.-marketed snus (a form of smokeless tobacco), the sweetness of wrapping papers on cigarillos and little cigars is exceedingly intense compared with sucrose (Erythropel et al. 2018). The combination of intense sweetness and candy flavorings likely contributes to the appeal of cigarillos and little cigars among adolescents and young adults.

Disparities in the Use of Cigarillos and Little Cigars

The sales of little cigars have increased in the United States and have contributed to overall sales of cigars (Gammon et al. 2019; Wang et al. 2022a). As noted, cigarillos and little cigars marketed in the United States are popular among African American adolescents and young adults (Cantrell et al. 2013; Sterling et al. 2015, 2016c; Nasim et al. 2016). In addition, a small national study found that transgender adults had nearly four times higher odds of smoking cigars compared to cisgender populations (Buchting et al. 2017). Marketing tactics by the tobacco industry that likely contribute to these disparities in cigar use are discussed further in Chapter 5.

The *Tobacco Control Act* prohibits the sale of cigarettes in packages of fewer than 20 cigarettes. However, cigarillos and little cigars remain available in packages containing only two or three items, making such products more affordable and potentially more attractive to young people who are experimenting with these products (Ganz et al. 2021). Tobacco industry documents suggest that product design and flavoring was a deliberate and iterative process to optimize the appeal of cigarillos and little cigars to youth, women, and African American people who smoke, especially those who smoke mentholated tobacco products (Kostygina et al. 2016). Studies suggest that some African American people who smoke cigars hold inaccurate perceptions that (a) cigarillos and little cigars are less risky than cigarettes, citing their fruity or medicinal flavors, and (b) they consist of "natural" tobacco, suggesting that they are absent of additives and thereby less harmful. However, the scientific evidence does not support that these products are less harmful (NCI 1998; Chang et al. 2015). In contrast, some African American people who smoke perceive cigarettes to be industrial products with poor-quality tobacco and greater risk (Cornacchione et al. 2016; Sterling et al. 2016b,c).

People who use cigarillos and little cigars often use multiple tobacco products, also known as polytobacco use or polyuse (Lee et al. 2014; Sterling et al. 2016a; Cheng et al. 2017; Roberts et al. 2017). In an online survey of U.S. adults 18–44 years of age who smoked cigarettes, about 45% of the young adults sampled (18–24 years of age) reported also smoking little cigars and cigarillos, and 55% of the young adults smoked cigarettes only (Sterling et al. 2016c). Some African American males who smoked menthol cigarettes used cigarettes and cigarillos or little cigars interchangeably and preferred menthol notes (i.e., that menthol could be one of many added flavorants) in cigarillos (Sterling et al. 2016a).

Another use for cigarillos and little cigars is to produce blunts, whereby the tobacco filling is partly or completely replaced with cannabis (Giovenco et al. 2017). Approximately two-thirds of adolescents who currently use cigars report using cigars to make blunts (Trapl et al. 2018). Focus groups of adolescents and young adults revealed that flavors, low prices, availability and accessibility (including ability to bypass age restrictions), and easily opened perforated wrappers made cigars useful for blunt use (Kong et al. 2018).

Smokeless Tobacco Products

Smokeless tobacco products—including chewing tobacco, moist snuff, and snus—are available in a wide range of characterizing flavors in the United States, and the tobacco industry has frequently introduced novel flavor combinations. The flavor chemical compositions in smokeless tobacco products are often similar to the flavors in confectionary products, such as hard candy, mints, and chewing gum (Chen et al. 2010; Brown et al. 2014). For example, benzyl alcohol has been identified as an added flavor in cherry candies and cherry-flavored tobacco products (Brown et al. 2014). Several studies have shown that the chemical concentrations of flavors in smokeless products are significantly higher than such concentrations in confectionary products (Chen et al. 2010; Miao et al. 2016).

Menthol and Methyl Salicylate Flavors in Smokeless Tobacco Products

Mint and wintergreen flavors are the most popular flavors among people who use smokeless tobacco products in the United States (Chen et al. 2010; Brown et al. 2014; Bonhomme et al. 2016). Mentholated smokeless tobacco products marketed in the United States often contain high levels of menthol. In a 2010 study, the average level of menthol per gram (g) of smokeless tobacco was 4.3 milligrams (mg/g), and the highest level was 5.3 mg/g (Chen et al. 2010). These levels exceeded the menthol contents in confectionary products at that time, which ranged from 2.1 to 3.5 mg/g (Burdock and Fenaroli 2010; Chen et al. 2010).

Smokeless tobacco products often contain high levels of methyl salicylate, the wintergreen flavor, relative to the acceptable daily intake (ADI) of methyl salicylate of 0.5 mg/kg per day specified by the Food and Agriculture Organization of the United Nations and the World Health Organization (Chen et al. 2010; Lisko et al. 2014). In 2010, the average level of methyl salicylate in smokeless tobacco products marketed in the United States was 23.8 mg/g; the highest level measured was 29.7 mg/g. These levels were 5 to 15 times higher than the level of methyl salicylate found in confectionary products and hard candy, which ranged from 2.0 to 4.6 mg/g (Burdock and Fenaroli 2010; Chen et al. 2010). These findings raise concerns that people who regularly use smokeless tobacco products may exceed the ADI of methyl salicylate (Chen et al. 2010; Lisko et al. 2014). Additionally, methyl salicylate ingestion can be fatal at high levels (Chan 1996; Mount Sinai–New York n.d.).

Artificial Sweeteners in Smokeless Tobacco Products

Tobacco industry documents list various sweeteners that have been used in some smokeless tobacco products, but new sweeteners and product categories have since been introduced (Wang 1993; FDA 2018a). Miao and colleagues (2016), in their analysis of sweeteners used in smokeless tobacco products marketed in the United States, revealed that these products contain only trace amounts of added natural sugars (<0.08% weight/weight). Among U.S.-marketed moist snuff products tested by Miao and colleagues (2016), all contained saccharine, and just one contained sucralose. Among snus products, sucralose was detected at high levels in all of the products examined; each pouch of snus contained 6–11 mg of sucralose. Snus pouch wrapping materials also contained sucralose, and a subset of snus products contained aspartame. The study also examined a dissolvable tobacco product that has since been discontinued. This product contained sorbitol—a sugar alcohol with a sweetness comparable to that of sucrose. Sorbitol accounted for more than 50% of the bulk of the product—but also contained a high amount of sucralose (4.48 mg/unit) but no aspartame or saccharine. The amount of sucralose in the examined dissolvable product was higher than the amount of sucralose in confectionary products. The majority of the moist snuff products sold in the United States were introduced before sucralose was approved for use in foods in 1999 (FDA 2018a).

Saccharin is perceived as sweet but also has a bitter taste. Due to their favorable properties, including lack of bitterness, sucralose and aspartame replaced saccharin as a high-intensity sweetener in most food products (Bartoshuk 1979). Tobacco manufacturers may not have replaced saccharin in snuff products because people who have used them long term have been habituated to its taste profile and may disapprove of a change to other sweeteners. This view is supported by the observation that the saccharin content in snuff products marketed in 2016 (Miao et al. 2016) did not differ much from the levels in snuff products measured in the early 1990s (Wang 1993).

In contrast to moist snuff, all snus products marketed in the United States contain sucralose, mostly in combination with aspartame (Miao et al. 2016). Snus products were introduced in the U.S. market in 2006 when sucralose was already widely used in food products (Biener and Bogen 2009). According to Miao and colleagues (2016), the levels of sucralose in the tests of U.S.-marketed snus products, both by percentage of weight and weight per product unit, exceeded the levels of sucralose in any solid confectionary product (candy, mint lozenges, chewing gum). The levels of sucralose per snus pouch (6–11 mg/unit) were much higher than the levels of sucralose in confectionary products (<0.4 mg/unit). Thus, absolute levels of sucralose in snus were 14 to 25 times higher than the highest levels of sucralose in any candy product (Miao et al. 2016). Levels of saccharin were higher in moist tobacco products than they were in snus, gum, sugar-free candy, soda, e-cigarettes, and dissolvable tobacco products. Snus contained higher levels of aspartame than the aforementioned products, indicating that the types and amount of sweeteners vary by tobacco product and can exceed levels found in nontobacco products (Miao et al. 2016).

These data show that smokeless tobacco products are likely to be more highly sweetened than confectionary products. With sucralose perceived as 600 times sweeter than sugar and with added aspartame, the sweetness of snus and dissolvable tobacco products exceeds the sweetness of their unit (pouch or lozenge) weight in sugar (Miao et al. 2016; FDA 2018a). For example, a Camel Snus pouch with 6–7 mg of sucralose per pouch is as sweet as 3.6–4.2 g of sugar. The sweetness of a Camel Snus pouch that weighs only 0.55 g is seven to eight times as intense as the sweetness of a piece of sugar with the same weight (Miao et al. 2016).

Intense sweeteners may be used to mask the adverse taste and sensory effects of the processed tobacco in smokeless tobacco products, which contains irritating and bitter nicotine and other tobacco constituents (Kroeze and Bartoshuk 1985). The optimal levels of sweetener in smokeless tobacco products are likely determined in tests by internal company panelists and consumer groups, suggesting that higher levels of sweetness are required to establish the palatability of these tobacco-containing products (Cantrell and Morgan 2006; Cantrell and Brown 2009).

Research by the tobacco industry revealed that the average male who uses snus consumes 12 pouches per day (Krautter et al. 2015; Cheng et al. 2017). Thus, with one snus pouch delivering as much as 11 mg of sucralose, the average male who used snus would consume as much as 132 mg of sucralose per day. Although this amount is still below the ADI of 5 mg per kilogram of body weight per day (FDA 2018a), consumption of additional sucralose-containing products—such as beverages, candy, and baked goods—may lead people who use snus to exceed the ADI for sucralose. Notably, a study by Pepino (2015) revealed that non-nutritive sweeteners affect metabolic signaling in pancreatic beta cells and change the composition of the gut microbiome, potentially contributing to metabolic dysregulation.

Disparities in the Use of Smokeless Tobacco

Among U.S. adults overall, the prevalence of smokeless tobacco use was 2.3% in 2020. However, the prevalence of smokeless tobacco use is higher among American Indian and Alaska Native adults (6.8%) than among Asian (0.4%), Black (0.8%), Hispanic (0.4%), and White (3.2%) adults; higher among people living in rural locations (5.9%) than among those living in urban locations (1.7%); and higher among male adults (4.5%) than among female adults (0.3%) (Cornelius et al. 2022). The use of smokeless tobacco is especially high in rural areas in the southeastern and southern United States, driven in part by targeted tobacco industry marketing to these communities (see Chapter 5) (Bell et al. 2000; Arabi 2007; Talley et al. 2011; Miller Lo et al. 2017; Pesko and Robarts 2017; Roberts et al. 2017). It is unclear whether the flavor profiles of marketed smokeless products contribute to or simply maintain the disparities in use patterns.

Trends in Smokeless Tobacco Sales

Sales of smokeless tobacco products in the United States have increased from $2.94 billion in 2011 (122.7 million pounds) to $4.82 billion in 2020 (126.9 million pounds)[2] (Federal Trade Commission 2021). Smokeless tobacco products that are offered in pouches, such as moist snuff and snus, are increasingly popular and may appeal to new users who do not like the aversively strong taste of loose smokeless tobacco products and who have the perception that loose smokeless tobacco products are "unclean" (Delnevo et al. 2014). The smokeless tobacco market is also partially driven by value or discounted brands such as Grizzly, which accounted for 33% of the market in 2019 (Delnevo et al. 2021a).

Together, loose and pouched moist snuff products dominate the U.S. smokeless tobacco market. However, when the tobacco industry introduced snus products in the United States, it marketed these products as "reduced risk alternative" products (basing its argument on the reduced content of tobacco nitrosamines in snus compared with that in cigarettes) (Stepanov et al. 2008). In 2019, FDA authorized Swedish Match USA to market eight snus products with the modified risk claim, "Using General Snus instead of cigarettes puts you at a lower risk of mouth cancer, heart disease, lung cancer, stroke, emphysema, and chronic bronchitis" (FDA 2019). Since 2006, snus products have been marketed with larger pouch sizes and, in more recent years, with more flavor choices (Stepanov et al. 2012). For example, the marketing for Camel Snus Mellow may suggest a mild flavor to consumers and may appeal to new users who find other taste choices to be too strong (Minaker et al. 2014). In general, however, the uptake of snus continues to be low in the United States, despite some recent sales growth (Biener et al. 2016; Federal Trade Commission 2021). From 2019 to 2020, sales of snus increased from more than $169 million to $179 million, and sales of the much larger moist snuff category increased from $4.07 billion to $4.35 billion[3] (Federal Trade Commission 2021).

Nicotine Pouches

Nicotine pouches were introduced in the United States in 2016 (Marynak et al. 2021). These products contain either tobacco-derived or nontobacco (e.g., synthetic) nicotine without tobacco leaf material, as well as flavorants and sweeteners in a microfiber pouch. The pouches are inserted behind the upper lip, similar to snus. Sales of nicotine pouch products grew rapidly in the United States with nearly 46 million units sold from January to June 2020 (Marynak et al. 2021). Growth has continued since, with Swedish Match's ZYN brand leading sales with more than 200 million units sold and 66.5% of market share in 2022 (Swedish Match 2022). Nicotine pouch products, including ZYN brand, are sold in several nicotine levels; contain sweeteners, including sucralose and acesulfame potassium (an artificial sweetener also known as Ace-K); and are offered in a wide variety of flavors, including menthol, mint, wintergreen, citrus, cherry, cinnamon, and coffee (Marynak et al. 2021). Varieties of the ZYN brand, such as smooth and chill, have been advertised as "flavor ban approved" (Tackett et al. 2022; Jabba et al. 2023), and a chemical analysis study revealed that ZYN Chill contains the synthetic cooling agent, WS-3, which produces cooling sensations that are a key component of flavor experiences (Jabba et al. 2023). Moreover, ZYN Chill is described on the U.S. version of the ZYN website as "a refreshing unflavored nicotine experience" (ZYN n.d.) (Figure 3.10), with one online reviewer saying the product

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[2]Sales reflect nominal dollars not adjusted for inflation.

[3]Ibid.

Figure 3.10 Cooling varieties, including the concept flavor name, Chill, for the nicotine pouch brand, ZYN

Source: Trinkets & Trash (2021).
Notes: Image depicts an email sent in May 2021 that announced the nationwide release of chill and menthol varieties of ZYN brand nicotine pouches. The chill variety is described as unflavored.

"has a slight sweetness" and observing that ZYN Chill variety has "an actual chilling sensation which is honestly refreshing" (Tackett et al. 2022). Marketing products as "unflavored," despite apparently discernable somatosensory properties (e.g., refreshing, chilling), illustrates the importance for any tobacco product standards to explicitly include somatosensory aspects of flavor without discernable taste or smell.

Population-level studies, such as NYTS and PATH, are only beginning to survey the use of nicotine pouch products. For example, in 2021, an estimated half a million U.S. middle and high school students reported ever using nicotine pouches; among U.S. middle and high school students who reported use of nicotine pouches during the past 30 days, 61.6% reported using flavored nicotine pouches (Gentzke et al. 2022). In 2022, among high school students, reliable estimates of nicotine pouch use in the past 30 days were available only for non-Hispanic White (2.0%; 95% CI, 1.4–2.9) and Hispanic (1.1%; 95% CI, 0.7–1.8) youth. Although estimates of current nicotine pouch use were similar among these population groups, the prevalence of ever use of nicotine pouches was higher among non-Hispanic White youth (4.8%; 95% CI, 3.5–6.5) than it was among Hispanic youth (1.4%; 95% CI, 1.0–2.1) (Park-Lee et al. 2022). Additional nationally representative data are needed to determine whether flavored nicotine pouch products—or other emerging oral nicotine products such as nicotine lozenges, nicotine tablets, or nicotine toothpicks—contribute to youth initiation of tobacco products and/or tobacco-related health disparities.

E-Cigarettes

This section describes chemicals and flavorants added to e-cigarettes to impart cooling and sweetness.

Cooling Flavors and Synthetic Cooling Agents in E-Cigarettes

Cooling flavors, including but not limited to menthol, represent a large segment of the e-cigarette market. Descriptors for cooling flavors may include menthol, ice, cool, chill, freeze, and frost and may be combined with fruity flavors (e.g., banana ice) or concept flavor names (e.g., lush ice) (Ali et al. 2022). From January 2017 to November 2021, unit sales of cooling flavored e-cigarettes increased by 693.0%, and the share of cooling flavors among total e-cigarette unit sales increased from 26.4% to 54.9% (Ali et al. 2022). During the same period, the percentage of e-cigarette menthol sales as a proportion of cooling flavors decreased from 94.5% to 73.0% (Ali et al. 2022).

Synthetic cooling agents for use in e-liquids are widely available to the public for purchase from online suppliers in the United States and elsewhere (Jabba et al. 2022). In addition, many flavored e-liquids are advertised to contain cooling agents, often using the general name Koolada. Available agents are WS-3, WS-5, WS-23, and L menthyl lactate (Table 3.4). As described in Table 3.4, WS-3 and WS-5 are synthetic chemicals and are nearly odorless and tasteless. According to one manufacturer (Symrise n.d.), WS-3 has cooling properties that impact the back of the mouth and tongue and the roof of the mouth, whereas WS-5 has cooling effects on the roof of the mouth and back of the tongue. WS-5 has a bitter aftertaste and is one of the strongest coolants, with more than twice the intensity of WS-3 (Symrise n.d.). These odorless synthetic coolants may be used by the industry as a potential strategy to circumvent characterizing flavor restrictions (Jabba et al. 2022), including for combustible menthol cigarettes.

Analytic studies by the tobacco industry revealed the presence of WS-3, L-methyl lactate, and menthone-glycerol-ketal in e-cigarette aerosol (Moldoveanu and Kilby 2014). An independent study also found synthetic coolants in e-liquid refills and in the disposable e-cigarette brand Puff Bar, including in fruit-, dessert-, and sweet-flavored products (Jabba et al. 2022). Notably, the study found that e-cigarette products marketed in the United States can contain WS-3 and WS-23, and "carryover of [these] synthetic cooling agents from e-liquids into the vapor was highly efficient, approximating 100%" (Jabba et al. 2022, p. 1042). For most of these (18 of 25 refill liquids analyzed and 10 of 14 Puff Bars analyzed), modeling the long-term daily consumption of the vaped e-liquids suggests that consumer exposures could exceed safety thresholds for organ toxicity established by the Joint Expert Committee on Food Additives, which is jointly administered by the Food and Agriculture Organization of the United Nations and the World Health Organization (Jabba et al. 2022).[4] Additional research into the presence and health effects of synthetic cooling agents in all tobacco products is warranted.

The Sweet Taste of E-Cigarettes: Learned Conditioning and Sweeteners in E-Liquids

Many sweet and fruit flavored e-cigarettes are advertised and marketed. Content analyses of advertising on e-liquid bottles and websites indicate that pictorial images that depict different flavors (e.g., apple pie, chocolate) are used to promote sweet and fruit-flavored e-liquids (Soule et al. 2019; Hardie et al. 2022). People who use these e-cigarettes often report that they perceive them as sweet flavored. Chemical analytic studies (n = 66) detected the presence of sugars (sucrose, glucose, or fructose) in a variety of flavored and unheated e-liquids, ranging from 6.4–88.9 µg/mL for glucose, to 8.8–331.2 µg/mL for fructose, and to 9.3–620.1 µg/mL for sucrose. Glucose was identified in 22% of samples, and fructose and sucrose were found in 53% of all samples (Fagan et al. 2018). This same study found a significant negative correlation between acrolein and fructose (r = –0.26, p = .0006), acrolein and sucrose (r = –0.21, p = .0006), formaldehyde and fructose (r = –0.22, p = .004), and formaldehyde and sucrose (r = –0.25, p = .002) (Fagan et al. 2018). Both acrolein and formaldehyde are listed on FDA's list of harmful and potentially harmful constituents (HPHCs) in tobacco products (FDA 2012). Although all samples in this study were flavored, Fagan and colleagues (2018) did not test whether these concentrations elicited the perception of sweetness from people who use e-cigarettes.

The perception of sweetness of e-cigarette aerosol is likely derived, in part, from the solvents glycerol and propylene glycol. Glycerol, a sugar alcohol, is perceived as sweet but with an intensity lower than that of sucrose (i.e., table sugar) (Moskowitz 1971). Tests in young adults demonstrated that mixtures of glycerol and propylene glycol in water are perceived as sweet and that perceived sweetness increases with the concentration of glycerol and propylene glycol (Rao et al. 2018).

Sucralose is often found in e-liquids (Moser et al. 2021) and is widely available in vape stores and from online vaping supply stores for people to add to custom e-liquids (see, for example, EC Blend n.d.; Flavor Jungle n.d.; TBD Liquids n.d.). As a chlorinated derivative of sucrose, sucralose is much more heat-stable than other synthetic sweeteners and is considered safe for baking (FDA 2018a). However, as discussed previously, the safety of synthetic sweeteners when inhaled from tobacco products is unknown. For example, when sucralose is heated on metal surfaces, chlorinated organic chemicals have been reported to decompose and/or form, which may catalyze the decomposition of the sweetener (Rahn and Yaylayan 2010; de Oliveira et al. 2015; Lu et al. 2015). Although sucralose is more heat stable than other synthetic sweeteners, an

[4]Jabba and colleagues (2022) further note that "[T]he absorption efficiency for chemicals by the respiratory system is higher than the efficiency of the digestive tract and usually, an oral-to-inhalation ratio of 2 is applied for route-to-route [R2R] extrapolation [citing The Interdepartmental Group on Health Risks from Chemicals 2006; European Chemicals Agency 2012], reflecting the higher absorption of toxicants following inhalation [citing The Interdepartmental Group on Health Risks from Chemicals 2006; European Chemicals Agency 2012; Schröder et al. 2016]. In this study, R2R extrapolation was not used, however, if applied, the MOE values would be even lower, reflecting an even higher risk associated with inhalation of these two synthetic cooling agents at various daily consumption volumes."

analytic chemical study revealed that sucralose is unstable when aerosolized by e-cigarettes, producing toxic chlorinated organic compounds (Duell et al. 2019). In online message boards about vaping, people who use e-cigarettes often report sucralose deposits on the coil, suggesting that significant amounts of the sweeteners are not aerosolized and may be concentrated on and near the coil, raising concerns about thermal decomposition and the generation of toxic products (Dong et al. 2013; Lu et al. 2015). In a study by Rosbrook and colleagues (2017), participants comparing flavored e-cigarettes with and without sucralose could only discern the presence of sucralose when using cartridge systems, which is likely due to a higher concentration of sucralose in the aerosol from cartridge systems compared with the concentration in the aerosol from tank systems. This study suggests that e-cigarette delivery systems may result in highly variable aerosol yield and deposits of sucralose in the mouths of people who use e-cigarettes (Rosbrook et al. 2017).

Ethyl maltol, used as a sweet flavorant, is widely used by the e-cigarette industry and is known as the cotton candy flavorant (Tierney et al. 2016). Erythritol, a sugar alcohol, is another compound offered as a sweetener by online vape stores (Nude Nicotine n.d.). Erythritol has cooling effects, is structurally related to glycerol, and is 60–70% less sweet than sucrose (BeMiller 2018). It is unclear if erythritol imparts a significant sweetness (BeMiller 2018).

Some online suppliers of e-liquids also offer stevia sweeteners, which contain stevioside. Studies have not explored how frequently people who use e-cigarettes have customized their e-liquids with stevia sweeteners. Similar to sucralose, there is no information on the safety of stevioside when inhaled through the use of tobacco products.

The Physiology of Flavor Perception

Menthol cigarettes are an important focus of scientific and public health efforts because (1) since September 2009, federal law prohibits the sale of cigarettes in the United States with characterizing flavors other than menthol (and tobacco) and (2) menthol cigarettes are disproportionately used by certain population groups, such as African American and Native Hawaiian people, youth, young adults, women, members of minoritized sexual orientation and gender identity groups, and people with lower incomes (Chapter 2, Table 2.6) (Cubbin et al. 2010; Rock et al. 2010; Jones et al. 2013; Giovino et al. 2015; Villanti et al. 2016).

As indicated in the introduction, *flavor* is a combination of retronasal olfactory sensations, somatosensory perceptions, and taste, with the latter including the ability to experience sweet, salty, sour, bitter, and umami tastes (Wolfe et al. 2014). In essence, flavor chemicals are chemicals that can be added or created through chemical processes and impart the senses of taste (gustation) and smell (olfaction), contributing to flavor experiences. Not everyone experiences taste and smell the same way. In addition to such factors as marketing, physiological factors and genetics can influence how different racial and ethnic groups, women, and youth experience flavors.

In context with targeted marketing tactics by the tobacco industry (discussed in Chapter 5), knowing how flavor perceptions, including perceptions of menthol, could be manipulated to influence the use of tobacco products by members of these groups, is critical to understand tobacco-related health disparities. Appendix 3.1 provides a foundation for understanding the underlying mechanisms and physiology of flavor perceptions, including how olfaction (sense of smell), gustation (sense of taste), and activation of the somatosensory system can influence tobacco use behaviors.

Disparities in the Physiology of Flavor Perceptions

As discussed previously, taste is one component of flavor. Tobacco use changes the size, shape, and vascularization of the tongue's papillae (Pavlos et al. 2009), thus elevating taste thresholds and leading to a loss of taste overall (Tomassini et al. 2007; Khan et al. 2016). Humans distinguish five basic taste qualities: sweet, bitter, sour, salty, and umami. Umami is the savory taste of amino acids and nucleotides, such as glutamate, that are used as taste enhancers. These five basic taste qualities invoke multisensory experiences for people who use tobacco products. Sweet, salty, bitter, sour, and umami tastes appear to decrease with age, and on average, women perceive tastes more intensely than men (Hoffman et al. 2016; Barragán et al. 2018). A review study found that youth have a greater preference for sweet flavors than adults, and that both sweet preference and aversion to bitterness decline as people age (Hoffman et al. 2016). Additionally, not everyone experiences the five basic tastes in the same way because of genetic variability in taste-specific genes.

For example, studies have found differences in bitter taste experiences by age, gender, and race and ethnicity (Mennella et al. 2005; Mangold et al. 2008), which in turn, may influence tobacco product use behaviors. Individuals who are better able to taste bitter compounds, such as the taste compounds present in tobacco smoke, may be less likely to smoke combustible tobacco products (Mangold et al. 2008; Risso et al. 2016a).

Additionally, a study found that people who use chewing tobacco had significantly lower taste perceptions for salty tastes—measured as average time to identify tastes—than those who did not use chewing tobacco (Kale et al. 2019). People who used chewing tobacco tended to have lower taste perceptions for sweet tastes and higher taste perceptions for sour and bitter tastes compared with people who did not use chewing tobacco; however, these differences were not statistically significant (Kale et al. 2019).

These factors can also influence whether and how people perceive the taste of nicotine, coolants, and chemical flavors. Some of these differences in taste perceptions are discussed in this chapter. These differences in taste perceptions, in combination with targeted marketing by tobacco companies, may help to explain the greater prevalence of flavored tobacco use in youth and young adults versus older adults (Dai and Hao 2019; Gentzke et al. 2022) and in people who are female versus people who are male (Rath et al. 2016; Pang et al. 2020; Gentzke et al. 2022).

Bitter perception is thought to have developed as a mechanism to avoid toxic chemicals in food, especially from certain toxic plants (Wooding 2006). Plant toxins—such as strychnine and ricin—are extremely bitter, and evolutionary mechanisms may have selected for traits that detect such toxins and signal intense bitter perception to produce avoidance behavior.

Menthol has irritating effects and can be perceived as bitter, resulting in some people who smoke choosing to use nonmenthol cigarettes. For example, although large percentages of different population groups who smoke use menthol (e.g., women, certain racial and ethnic and sexual orientation and gender identity groups), about 60% of the total population of adults who smoke do not use menthol cigarettes (see Table 2.6 in Chapter 2). Menthol can reduce irritation caused by tobacco irritants, such as acetic acid and cyclohexanone (Willis et al. 2011); however, menthol use at high levels can cause irritation. Data from the National Health and Nutrition Examination Survey showed that people who smoked menthol cigarettes reported greater bitterness due to 6-n-propylthiouracil (PROP) than those who smoked nonmenthol cigarettes (Duffy et al. 2019).

Individual differences in bitter perception of certain chemicals were first reported in a study by Fox (1932), in which phenylthiocarbamide (PTC) was perceived as extremely bitter by some test participants but not by others. This difference was subsequently identified as a heritable Mendelian trait, suggesting that genetic variations determine differences in taste perception (Snyder 1931; Wooding 2006). Studies in the 1960s revealed that detection thresholds for two bitter agents, quinine and 6N-PROP, a bitter agent detected by the same pathway as PTC, were higher in people who smoked than in people who did not smoke and were elevated in men who smoked heavily (Fischer et al. 1963; Kaplan et al. 1964). Several later studies corroborated this finding in people who smoked and were from various racial and ethnic groups. For example, a study in an American Indian population revealed that PTC non-taster status was strongly associated with cigarette smoking, including light smoking, compared with no smoking or social smoking (Enoch et al. 2001). Another study found that non-taster status was strongly associated with measures of nicotine dependence among a sample of African American adults who smoked, particularly among African American women who smoked (Mangold et al. 2008). These studies hypothesized that non-tasters are less averse to the bitter taste of cigarette smoke and are, therefore, at increased risk for nicotine addiction and heavy smoking (Enoch et al. 2001; Mangold et al. 2008; Risso et al. 2016a). A systematic review of studies on the preferences of consumers of e-cigarettes found that adults tend to dislike e-cigarette flavors that elicit bitterness and harshness (Zare et al. 2018). The tobacco industry has conducted prior research on taste preferences (Philip Morris Records Collection 2010), which might inform marketing tactics.

Some study participants perceive menthol to be mildly bitter when applied to their tongues (Green and Schullery 2003). A patent application by the company Givaudan described the discovery of *TAS2R7*, a menthol-activated bitter receptor, and proposed to use this receptor as a target to suppress the bitter taste of menthol that some consumers may perceive to be aversive (Slack and Pennimpede 2013).

Contributions of Individual Systems and Targets to Flavor Perception

The Flavor of Tobacco Smoke

Tobacco smoke consists of many chemicals. The gas phase of tobacco smoke contains aldehydes—such as acrolein, croton aldehyde, and formaldehyde—that are irritants that trigger burning and itching sensations and activate the cough reflex (Lee et al. 2010; USDHHS 2010).

Tobacco smoke also contains particulates, often covered with charged and reactive chemical moieties. Tobacco alkaloids may contribute to the bitter taste perception that is triggered by smoke inhalation and when using smokeless tobacco products (Lee et al. 2010). Tobacco smoke is hot, and the hot temperature can cause pain and coughing. Temperatures measured in the combustion coal at the burning end of the tobacco rod can reach 900°C during a puff and fall to 400°C between puffs (Baker 1981).

Multiple olfactory, gustatory, and somatosensory receptor systems contribute to generally aversive perceptions of tobacco smoke, especially in people who do not smoke or are just beginning to smoke. Transient receptor potential ankyrin 1 (TRPA1), the receptor of reactive irritants from smoke, is the primary receptor for smoke aldehydes in airway-innervating somatosensory neurons, and TRP vanilloid 1 (TRPV1), as a heat sensor, may respond to heated smoke (Bautista et al. 2006; Andrè et al. 2008; Escalera et al. 2008).

The Role of Nicotinic Receptors

The Bitterness of Nicotine

Nicotine is included in FDA's list of HPHCs in tobacco products (FDA 2012). Nicotinic acetylcholine receptors (nAChRs) are the major pharmacological targets of nicotine in the brain, mediating its psychoactive and addictive properties (Govind et al. 2009; Wittenberg et al. 2020). nAChRs are also expressed in ganglia of the autonomic nervous system, contributing to the effects of nicotine on the cardiovascular system (Vieira-Alves et al. 2020). Nicotine also contributes to the taste and flavor perception of tobacco products. Nicotine has a bitter taste that initiates aversive behavior in animals (Dahl et al. 1997; Scott et al. 1998; Oliveira-Maia et al. 2009). Experiments in mice revealed that nicotine elicits both dependent and independent taste responses of TRPM5, an ion channel responsible for the peripheral transduction of bitter tastes (Oliveira-Maia et al. 2009). This same study found that mecamylamine, an nAChR inhibitor, significantly reduces the aversive taste experiences of nicotine (Oliveira-Maia et al. 2009). Two additional studies showed that that nAChR subunit genes are expressed in taste cells in the tongues of rodents and humans, giving rise to functional receptors (Qian et al. 2018a, b). These cells also expressed TRPM5 and bitter taste receptors, suggesting that activation of nAChRs in these cells elicits a bitter taste.

Peripheral Nicotinic Receptors

Peripheral somatosensory neurons also express nAChRs. The highest expression is found in vagal sensory neurons innervating the lungs and lower airways (Kaelberer et al. 2020). These neurons sense irritants and trigger the cough reflex and other respiratory defensive reflexes. Hexamethonium, an inhibitor of nAChRs, when administered as an inhaled aerosol, stopped cigarette smoke-induced respiratory reflexes in dogs, suggesting that nicotine is a major mediator of the irritant effects of smoke (Lee and Morton 1986). Human study participants reported perceiving cigarette smoke with higher levels of nicotine content as being more irritating than smoke with lower levels of nicotine content (Lee et al. 1993). Nicotine elicited calcium influx through nicotinic receptor ion channels into cultured vagal sensory nerves, suggesting that nicotine can excite vagal neurons that transmit irritant and pain signals (Xu et al. 2007). Experiments in mice revealed that nicotine at higher concentrations in cigarette smoke or in smokeless tobacco products activates the release of CGRP, a pro-inflammatory neuropeptide, from tracheal sensory nerve endings. At lower concentrations, this activity could be inhibited by mecamylamine, the inhibitor of nAChRs. Only at higher concentrations of nicotine were TRPA1 and TRPV1-related mechanisms of CGRP release detected (Kichko et al. 2013). When tobacco smoke was separated into the nicotine-free gas phase and the nicotine-containing particulate phase, TRPA1 was identified as the major mediator of CGRP release in response to gas-phase exposure, and nAChRs were solely responsible for CGRP release in the particulate phase (Kichko et al. 2015). These studies demonstrated that, while TRPA1 and TRPV1 can be activated by nicotine, nAChRs are at least 200-fold more sensitive to nicotine and respond robustly to high concentrations of nicotine in tobacco products. The vagal sensory neurons innervating the airways were found to express a diverse group of nAChR subunits (Mao et al. 2006; Gu et al. 2008; Kaelberer et al. 2020). Taken together, nicotine has substantial effects on taste and irritant sensing and contributes to the flavor perception associated with tobacco products, with peripheral nAChRs as major transducers.

Sensing of Menthol in Tobacco: Peripheral and Central Mechanisms

Menthol facilitates the inhalation of tobacco smoke or the oral use of smokeless tobacco by suppressing the aversive sensations elicited by irritants and bitter flavorants in tobacco, thereby aiding in tobacco use initiation (FDA 2013). Menthol also affects, either directly or indirectly, the dopaminergic reward circuity engaged by nicotine, modulating smoking behavior and making it harder for people who smoke menthol cigarettes to quit successfully (FDA 2013). Finally, menthol, through its unique chemosensory properties, can serve as a cue associated with a nicotine reward (Rose and Behm 2004; Wang et al. 2014; Wickham 2020). Studies in rodent models have revealed the fundamental mechanisms involved in these three effects, emphasizing menthol's pharmacological actions during tobacco use.

TRPM8 and TRPA1-Mediated Effects of Menthol in Rodent Models of Tobacco Use Initiation

TRP melastatin 8 (TRPM8) was identified as the somatosensory receptor for menthol in cold-sensing neurons. In models of pain, activation of these neurons, either by physical cooling or by menthol and related cooling compounds, has analgesic effects. The analgesic effects of menthol were not present in mice that were deficient in the *TRPM8* gene (Dhaka et al. 2007; Liu et al. 2013).

Studies in rodents investigated whether menthol has similar analgesic or counterirritant effects in the respiratory system. The respiratory irritation response, a sensory nerve-dependent reflex, permits mice and rats to respond to irritant exposures by lowering their respiratory rates (Alarie 1966; Ulrich et al. 1972; Alarie et al. 1998; Morris et al. 1999; Morris et al. 2005). This response is elicited by activation of trigeminal nerves in the nasal passages of rodents. The capability of a given irritant to elicit this response is used to classify the severity of irritants according to their RD50 (i.e., exposure concentration producing a 50% respiratory rate decrease), as measured by barometric plethysmography. Tobacco smoke irritants—such as acrolein (an aldehyde)—potently suppress respiration in mice. However, this response can be prevented by pretreatment with capsaicin, a TRPV1 agonist known to desensitize trigeminal sensory nerves to irritants (Morris et al. 1999).

A study using barometric plethysmography in mice revealed that menthol, at concentrations present in the mainstream smoke of cigarettes, stopped the respiratory irritation effects of tobacco smoke irritants (Willis et al. 2011). Irritants examined in the study included acrolein, acetic acid (an acidic irritant), and cyclohexanone. Menthol did not counter the irritant effects of cigarette smoke in mice that were pretreated with an inhibitor of TRPM8, demonstrating that TRPM8 is essential for menthol to suppress irritation. This study also examined the effects of eucalyptol, a menthol-related cooling product naturally found in eucalyptus leaves that is often added to tobacco products. Eucalyptol also suppressed respiratory irritation by acrolein, suggesting that menthol and menthol-related cooling compounds have counterirritant effects. This study also revealed that menthol's own irritant effects rely on TRPA1, since TRPA1-deficient mice failed to display respiratory irritation when exposed to menthol vapor (Willis et al. 2011).

A later study examined the effects of menthol on irritation caused by exposure to tobacco smoke in mice (Ha et al. 2015). This study demonstrated that menthol, at concentrations observed in mainstream cigarette smoke, efficiently suppresses irritation, resulting in a higher respiratory rate in the presence of tobacco smoke. Mice exposed to mentholated tobacco smoke had higher levels of cotinine in their blood than mice exposed to nonmentholated tobacco smoke, suggesting that menthol's counterirritant effects may facilitate the uptake of nicotine (Ha et al. 2015). Both studies used mice naïve to tobacco smoke, modeling initiation of tobacco use in people who have never smoked (Willis et al. 2011; Ha et al. 2015).

Similar effects of menthol were observed in oral nicotine intake studies modeling oral tobacco product initiation, such as the use of smokeless tobacco products that are often strongly mentholated. Mice, given the choice between a nicotine solution with an aversive nicotine concentration or the same nicotine solution with menthol, strongly preferred using the mentholated solution (Fan et al. 2016). Menthol was added at a concentration similar to levels estimated to be present in the saliva of people who use smokeless tobacco products. In contrast, TRPM8-deficient mice showed aversion to the mentholated nicotine solution and preferred the nonmentholated solution. This observation suggests that the TRPM8-engaged analgesic circuitry also suppresses underlying irritant effects of menthol that are unmasked when TRPM8 is absent. The effects of menthol on the nicotine intake of mice were shown to be sex- and age-dependent and involve an alpha-7 nicotinic receptor mechanism (Bagdas et al. 2020). TRPA1 mediates oral aversive effects of menthol when used at high concentrations (Lemon et al. 2019).

Taken together, these rodent models of tobacco product initiation, either through inhalation or ingestion, strongly support a role for menthol as a counterirritant, allowing people who use tobacco products to overcome the aversive sensory effects of these products. The relevance of animal models to humans is discussed later.

Menthol as a Cue for Nicotine Uptake and Relapse

Studies in rodents provide strong evidence that menthol can act as a cue for conditioning and reinforcing nicotine uptake and relapse. In conditioning experiments in adolescent rats, an oral menthol cue elicited more frequent intravenous self-administration of nicotine in rats in the treatment group than in rats in the control group (Wang et al. 2014). Conditioning with menthol also caused increased drug-seeking behavior when nicotine was withheld. Similar behaviors were observed when mice were given cold water or WS-23, an odorless synthetic cooling agent and TRPM8 agonist. This study demonstrates that the oral cooling properties of menthol can serve as a cue for nicotine taking (Wang et al. 2014). Another study in which rats were trained to press a lever to self-administer nicotine intake, signaled by a sensory cue using injection of menthol, had similar outcomes, demonstrating that menthol injection is a strong cue to reinitiate nicotine use after stopping (i.e., relapse) (Harrison et al. 2017).

Flavors, such as menthol, are often paired with sweeteners used in candy, chocolate, and baked goods, leading to conditioning to expect a nutritive reward. A study by Palmatier and colleagues (2020) modeled the initial association of menthol with sweetness and then investigated the effects of prior pairing on the self-administration of nicotine in mice. The study revealed that prior conditioning to menthol or licorice with sucrose increased self-administration of nicotine, especially low levels of nicotine, in mice.

Together, these studies demonstrate that menthol can act as a strong cue for nicotine uptake, through TRPM8-mediated mechanisms upon oral exposure and TRPM8-independent mechanisms after injection. Olfactory exposure paradigms, using menthol vapor and smoke from menthol cigarettes, may reveal whether menthol can also serve as a robust olfactory cue for people who use mentholated tobacco products.

Further, Rose and Behm (2004) conducted a study examining the effects of several pharmacological (nicotine skin patches and an nAChR antagonist) and behavioral (switching to denicotinized cigarettes or to cigarettes having different menthol flavor or to ventilated-filter cigarettes) treatments on the response to rewarding cigarette smoking cues in a study of 233 adults who smoked and were recruited for a quit smoking study. Respondents rated the rewarding effects of their usual brand of cigarettes to cigarettes with differing menthol content (menthol or nonmenthol) during a 2-week treatment phase. This study found that all pharmacological treatments reduced reward ratings for the respondents' usual brand of cigarettes compared to the placebo. However, there was a significant interaction between usual brand (menthol vs. nonmenthol) and the effect of pharmacological treatment on reward cues. People using any active pharmacological treatment who usually smoked menthol cigarettes and were switched to nonmenthol cigarettes did not show a reduction in the reward rating of their usual (mentholated) cigarette over the treatment period, but people who usually smoked nonmenthol cigarettes and who were switched to menthol cigarettes did show a significant decline in their reward ratings of their usual (nonmentholated) cigarette. According to the authors, these findings highlight the importance of sensory cues in influencing the reward of smoking (Rose and Behm 2004).

Olfactory Receptors for Menthol-Like Compounds

Menthol and menthol-like compounds often have a minty odor that is associated with the fresh, cooling, and sometimes stinging sensations elicited by these compounds. Although the somatosensory receptors for menthol, TRPM8 and TRPA1, have been identified, it has been much more difficult to identify specific odorant receptors. Humans and rodents express hundreds, if not thousands, of odorant receptors that express poorly in the heterologous systems used for screening G-protein-coupled receptors (GPCRs; see Appendix 3.1) (Matsunami 2005; Krautwurst 2008). Krautwurst and colleagues (1998) identified an odorant receptor that responds to carvone, the minty flavorant in spearmint. However, odorant receptors for menthol, menthone, eucalyptol, and other menthol-related compounds remain elusive. Odorant detection is highly complex, as several odorant receptors respond to an odorant at different concentrations. Modern high throughput mRNA trapping and sequencing approaches have enabled the in vivo identification of odorant receptors in rodents for selected odorants, such as acetophenone (Jiang et al. 2015; Hu and Matsunami 2018).

Menthol's Effects on Nicotinic Receptors and Central Reward Mechanisms

As described previously, nicotinic receptors in peripheral sensory neurons mediate the majority of sensory irritant effects of nicotine at concentrations measured during the use of tobacco products. A study examining nicotine-activated currents in trigeminal neurons revealed that menthol had inhibitory effects on these currents, suggesting that menthol may act on nicotinic receptors (Hans et al. 2012). When expressing human alpha-4 beta-2 nAChRs in a heterologous expression system, the study concluded that menthol can act as an allosteric modulator of nicotinic receptors. This mechanism may contribute to menthol's counterirritant effects of nicotine-induced irritation in peripheral sensory neurons. Menthol was also shown to interact with alpha-7 nicotinic receptors to increase intake. For example, mice with operative alpha-7 nicotinic receptors consumed more mentholated nicotine than nonmentholated nicotine compared with mice with inoperative alpha-7 nicotinic receptors (Ashoor et al. 2013).

Recent studies revealed that menthol modulates behavioral responses to nicotine associated with nicotine's effects in the central nervous system. For example, menthol was shown to blunt nicotine's psychostimulant activities leading to decreased motor behavior in mice (Fait et al. 2017). Menthol facilitated the dopamine-releasing effect of nicotine in the nucleus accumbens of rats, showing that menthol interacts with nicotine to activate the brain reward system (Zhang et al. 2018).

More evidence for the actions of menthol came from studies investigating menthol's effects on nAChRs involved in the dopaminergic reward circuitry in the central nervous system (Henderson et al. 2016, 2018; Avelar et al. 2019; Bavan et al. 2019; Mulcahy et al. 2020). Menthol was shown to modulate nicotine-induced neuronal currents in mice, either by directly reducing current amplitude or by preventing receptor desensitization while activated by nicotine (Henderson et al. 2016). Menthol had direct effects on the firing frequency of dopaminergic neurons after stimulating the nicotinic receptors and reduced behavioral responses associated with nicotine reward. Menthol may affect the stoichiometry of acetylcholine receptors, changing nicotine's long-term effects. Long-term treatment with menthol combined with nicotine in mice led to increased neural activity of dopamine neurons that was significantly higher than in mice that were treated with nicotine alone, implying that the combination of menthol and nicotine triggers a stronger rewarding effect than nicotine alone (Henderson et al. 2017). In studies of self-administration of e-cigarette aerosol in mice, menthol enhanced the rate of acquisition of self-administration behavior (Cooper et al. 2021). Proteomic studies of mice revealed that administration of menthol plus nicotine altered the expression levels of nicotinic receptor subunits and more than 200 other proteins in the hypothalamus (Mulcahy et al. 2020). These alterations occur at concentrations of nicotine that approximate concentrations likely present in the central nervous system of people who smoke.

Menthol was also shown to inhibit the metabolism of nicotine, thereby slowing degradation of nicotine in the body and extending its pharmacological effects (Benowitz et al. 2004). Effects of menthol were also described in epithelial tissues, where menthol was shown to facilitate nicotine permeation, an effect that may lead to a more rapid increase of blood nicotine levels in people who smoke or use oral smokeless tobacco products (Squier et al. 2010).

A Green Apple Flavorant Eliciting Reward Mechanisms and Modulating Nicotinic Receptors

Although research on tobacco flavorants has focused predominantly on menthol and menthol-related natural or synthetic additives, evidence is emerging that other additives may also exert pharmacological, behavioral, and toxicologic effects beyond their function as pleasant odorants. For example, farnesol and farnesene are flavorants used in green apple, an e-cigarette flavor that is especially popular among adolescents and young adults (Avelar et al. 2019; Cooper et al. 2020; Jackson et al. 2021). Farnesol was shown to produce reward behavior in male mice that were tested in the conditioned place preference assay, a commonly used assay to measure motivational effects of substances by assessing the amount of time an animal spends in an area that has been associated with a stimulus (Avelar et al. 2019). This effect may have resulted from an increased firing frequency of dopamine neurons in the ventral tegmental area that were recorded after farnesol was administered. Farnesol increased expression of alpha-6* nAChRs in male mice but not in female mice; alpha-6* nAChRs may play a specific role in the initiation of nicotine reward. Farnesene, another green apple and food flavor, also triggered reward behavior in both male and female mice. Farnesene was found to directly affect nicotinic receptor currents, activating currents with approximately 30% of nicotine's efficacy. The presence of farnesene significantly increased nicotine's potency to activate currents in neurons in the ventral tegmental area. This was likely due to a shift in certain nAChR subunit types, with alpha-4 beta-2 receptors expressed more highly (Cooper et al. 2020). In addition, mice upon exposure to certain green apple flavorants—including farnesene, hexyl acetate, methylbutyl acetate, and ethyl acetate—displayed enhanced rates of self-administration and reinforcement behaviors (Cooper et al. 2021). These results strengthen the evidence that some flavorants by themselves and flavored e-liquids without nicotine can promote reward-related behaviors. With combinations of more than 200 flavorants used in e-liquids (Krüsemann et al. 2021), a comprehensive and systematic research program is required to better understand their pharmacological and behavioral effects. In addition to menthol and green apple flavorants, other flavorants likely affect reward behavior, modulate aversion and irritation responses, target cardiovascular physiology, and interact otherwise with pharmacological targets that are critical for addiction behavior and health.

Relevance of Animal Models to Human Health

Overall, animal studies have strengthened concerns about the pharmacological effects of menthol as an additive in tobacco products and have provided detailed mechanistic insights into counterirritant and behavioral effects of menthol. TRP ion channels—including TRPM8, TRPA1, and nicotinic receptors—show a high degree of conservation between rodent models and humans. As such, menthol targets are localized to the same neuronal tissues and cell types in both rodents and humans. Human psychophysical studies have produced comparable outcomes, reporting cooling, analgesic, antitussive, and counterirritant effects of menthol. For example, in studies with human participants, repeated application of a mixture of L- and D-menthol to the oral mucosa desensitized the burning and stinging sensations elicited by menthol, while the cooling effect persisted (Cliff and Green 1994). Additionally, Perkins and colleagues (2017) asked people who smoked menthol cigarettes to discriminate between menthol cigarettes with extremely low levels of nicotine and test cigarettes with higher levels of nicotine. The study found that to distinguish menthol from a nonmenthol taste, the nicotine content needed to be higher for people who smoked menthol cigarettes (>80%, 16 mg/g) than for people who smoked nonmenthol cigarettes (11 mg/g, $p < 0.005$) (Perkins et al. 2018). The finding could be explained by a direct inhibitory or desensitizing effect of menthol toward nicotinic receptors (Henderson et al. 2016, 2017, 2019; Perkins et al. 2018; Cooper and Henderson 2020; Mulcahy et al. 2020).

Uncertainties remain about (a) the concentrations of flavorants and other chemical additives in tobacco products reaching the brain of humans and in animal models, (b) the differential disposition and metabolism of flavorants and other chemical additives, and (c) the differential habituation and conditioning to certain flavorants and other chemical additives due to their presence in the human diet and consumer products. Advances in the design of animal models, such as self-administration models of aerosol from e-cigarettes, are beginning to model human behavior more closely.

The Roles of Genes in Flavor Preferences Among Disparate Populations

This section examines the relevance of genetics to the use of flavored tobacco products. It discusses how the tobacco industry has played a role in genetic research and tobacco use, describes key issues related to the role of race and ancestry in genetics research, and presents research related to gene variations that are linked to flavored tobacco use. Of note, some of the genetic studies on the role of flavor preferences described in this section may be limited in that they have investigated candidate loci only in relatively small cohorts.

The Role of the Tobacco Industry in Genetic Research of Nicotine Addiction and Flavor Preferences

Multilevel factors help to explain disparities in the use of flavored tobacco products, including menthol-flavored products. The tobacco industry's decades-long targeted marketing of menthol cigarettes to specific groups is one such factor. Accumulating evidence suggests that genetics are an additional factor determining flavor preferences and the increased vulnerability of specific groups to targeted marketing of certain flavors.

The tobacco industry has long been aware of genetic factors influencing flavor preferences. Since the mid-twentieth century, the tobacco industry encouraged and funded the formation of academic research groups to investigate the genetic determinants of nicotine dependence and flavor preferences (Kaplan et al. 1964; Gundle et al. 2010). These efforts were coordinated by The Tobacco Industry Research Committee—later renamed The Council for Tobacco Research—which was founded by the major tobacco companies in the United States in 1953.

The Council for Tobacco Research embarked on a funding program to support research at academic institutions and private research entities, with the goal of creating scientific controversy about the causal relationships between smoking and smoking-induced diseases, such as lung cancer (Tobacco Industry Research Committee 1954; Brandt 2012). Genetic studies were funded to prove the "constitutional hypothesis" that "one or more genes affect a person's risk for lung cancer, and that at least some of the same genes influence whether people become smokers" (Gundle et al. 2010, p. 105). The goal was to deflect blame from the industry, claiming that the genetic constitution of certain groups of people who smoke is responsible for their heightened risk of cancer, and that most people who smoke are "safe" smokers who do not develop cancer (Gundle et al. 2010).

The Tobacco Industry Research Committee also funded some of the earliest genetic studies that examined genetic links to flavor aversion and preferences. Links between genetic variations determining flavor preferences and smoking behavior were first reported in the 1960s, suggesting that specific manipulation of tobacco product flavor profiles may increase product uptake in populations in which genetic traits favoring the resulting flavor profiles are represented. A widely cited study published in 1964 that reported a genetic link between the capability to detect certain bitter chemicals and smoking status was funded by The Tobacco Industry Research Committee (Kaplan et al. 1964). A search in the Truth Tobacco Industry Document Library revealed that the lead investigator of this study, conducted in Cleveland, Ohio, applied for a research grant to The Tobacco Industry Research

Committee in 1962 (Ferris and Kaplan 1962) and submitted research progress reports to the Committee in 1963 (Kaplan 1963).

The tobacco industry has conducted research for decades on taster types (R.J. Reynolds 1987) and taste experiences to inform the design and engineering of cigarettes and the marketing of flavors, cooling and refreshing effects, and sweet tastes to specific population groups. The industry has used flavor panels to evaluate the influence of flavors on people who use tobacco products and combined their knowledge of flavor preferences with research on the appeal of images and colors (such as blue and green to connotate cooling of menthol) (R.J. Reynolds 1987), which continue to be used in targeted marketing of flavored tobacco products.

Issues of Race and Ancestry in Genetics Research

This section describes studies that identified genetic variations linked to preference for menthol or nonmenthol cigarettes in some population groups. Information discussed in this chapter suggests that genetic variation and physiological factors, such as taster status, may help to explain why menthol is marketed aggressively to certain population groups. As such, the higher use of menthol among groups with specific genetic variations would not likely occur in the absence of such marketing. This section explores the potential effects of gene variations on smoking behaviors and flavor preferences, but as noted previously in this chapter, there is greater genetic variance within versus between racial and ethnic population groups (Jorde and Wooding 2004; Mersha and Beck 2020).

The discipline of genetics research is currently reassessing the use of race categories to designate and separate study populations (Yudell et al. 2016; National Academies of Sciences, Engineering, and Medicine 2023). In the past, genetic studies often relied on self-identification of study participants as belonging to a racial group, an approach now known to lack scientific rigor (Duello et al. 2021). Earlier, the eugenics movement used pseudoscience to rank races according to their purported genetic fitness and intelligence, justifying racial discrimination and egregious human rights violations (National Human Genome Research Institute n.d.). However, only recently, modern genetic techniques based on the advances of the Human Genome Project and its successors, such as the 1000 Genomes Project, have enabled more accurate determinations of ancestry and admixture from other populations for each study participant at a level of detail that was previously unattainable (The International Genome Sample Resource n.d.). These advances have been accompanied by discussions in the field that call for the use of ancestral categories and the abandonment of unfounded racial categorization of study populations, due to a lack of rigor and the fluidity of the social construct of “race” over time (Yudell et al. 2016). The genetic studies discussed in this section, published over a range of decades, need to be assessed from the perspective of these rapidly changing concepts, advancing technologies, and increased understanding.

Potential Effects of Variations in TRP Genes on Perceptions of Tobacco and Menthol

The disparities in menthol preference among people from different racial and ethnic backgrounds may be partly explained by variations in TRP ion channel genes—specifically the genes encoding for TRPM8 and TRPA1, the menthol receptors in peripheral sensory neurons. These are candidate loci that, depending on haplotypes, may affect sensitivity to menthol. For example, mutations leading to reduced expression of TRPM8 in peripheral nerves may result in diminished cooling sensation and weaker analgesic and counterirritant effects of menthol, as shown in mice that lack expression of TRPM8 (Dhaka et al. 2007; Liu et al. 2013; Fan et al. 2016). Carriers of such a hypomorphic haplotype may prefer more strongly mentholated tobacco products to achieve the same cooling and counterirritant effects and sustain nicotine levels.

Genetic variations in the *TRPA1* gene, encoding for the major smoke irritant receptor, may affect the irritant sensitivity of carriers. For example, a clinical study in test subjects exposed to diesel engine exhaust found that variations in the *TRPA1* gene were associated with an increase in cough frequencies (Yoon et al. 2022). Diesel exhaust and tobacco smoke share major irritants, such as the TRPA1 activators, acrolein, and particulate matter. Thus, carriers of sensitizing *TRPA1* gene variations may also display increased sensitivity to irritants in tobacco smoke—such as acrolein, particulates, or nicotine—lowering cough threshold and causing oral, nasal, or throat irritation. Carriers of such gene variations may use menthol cigarettes to suppress irritation more efficiently via the TRPM8-mediated cold or analgesic pathway.

TRP ion channels were initially identified as sensors for chemical and physical stimuli in pain-sensing nerves and nerves transmitting temperature signals (hot, cool). Genetic analysis of a Colombian family affected by a familial episodic pain syndrome identified a mutation in the *TRPA1* gene (i.e., the menthol or irritant receptor) as the underlying cause (Kremeyer et al. 2010; Boukalova et al. 2014). Chemical stimuli activated the resulting missense mutant (N855S) much more strongly, and homozygous carriers showed increased chemical pain responses. In animal studies, Andrè and colleagues (2008) demonstrated that the increased chemical sensitivity of the TRPA1 mutant clearly translates to human physiology, resulting in heightened sensitivity of mutation carriers to painful chemical stimuli. Similar mutations may increase the sensitivity to smoke irritants or menthol among people who smoke.

Migraine is another condition known to be activated by chemical stimuli in some people. Both menthol receptors, TRPA1 and TRPM8, are expressed in nasal and dural trigeminal nerve fibers implicated in migraine pain (Huang et al. 2012; Benemei et al. 2014; Dussor et al. 2014; Ren et al. 2018). Several genomewide association studies have linked variations in the *TRPM8* gene to migraine (Chasman et al. 2011, 2014; Freilinger et al. 2012; Ghosh et al. 2013; Fan et al. 2014; Dussor and Cao 2016).

Thus, certain variations in menthol receptor genes can impact profoundly the chemical sensitivity and irritant responsiveness of carriers. Genetic variations in TRP genes may also affect smoking behavior and menthol preference in diverse populations of people who smoke.

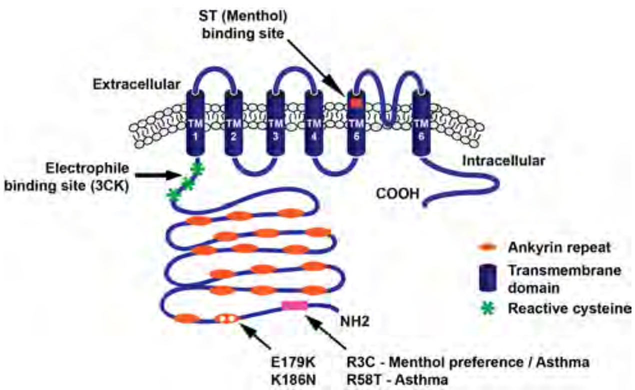
Uhl and colleagues (2011) identified a human genetic variation that may be linked to a preference for menthol cigarettes in people who smoke heavily (≥15 cigarettes smoked per day). Focusing on allelic variants in the *TRPA1* gene and encoding for the menthol-sensitive smoke or irritant receptor, the study analyzed the DNA of 820 American people of European ancestry from North Carolina and Baltimore, Maryland, who had a desire to quit smoking and who were recruited for previous addiction genetics studies (Drgon et al. 2010; Rose et al. 2010). The sample included 122 female and 100 male adults who smoked heavily and preferred menthol cigarettes, 243 females and 276 male adults of similar age who smoked heavily and preferred nonmenthol cigarettes, and smaller groups of people who smoked lightly who preferred menthol or nonmenthol cigarettes. Sixty-eight known single nucleotide polymorphisms (SNPs) in the *TRPA1* gene were genotyped, and of these, data from the 51 SNPs that displayed minor allele frequencies >0.05 in this study population were analyzed. Of the 51 SNPs analyzed in the cohort of people in the heavy smoking group, 11 SNPs fulfilled the statistical linkage criteria ($p < 0.05$) for association with smoking menthol cigarettes. These 11 SNPs are inherited together, representing a haplotype. Although 10 of 11 SNPs in this haplotype are intronic, SNP rs13268757 in the first exon of the *TRPA1* gene changes the amino acid sequence (missense SNP). Irrespective of smoking intensity (heavy or light), this SNP in the *TRPA1* gene (SNP rs13268757) was associated with preference for menthol cigarettes. However, this association was not statistically significant among people in the light smoking group (<15 cigarettes per day), possibly due to lower statistical power to detect differences in this group. Uhl and colleagues (2011) also investigated the DNA of people in a different heavy smoking group (≥15 cigarettes smoked per day) surveyed in 2006, identifying six SNPs in the *TRPA1* gene that were linked to preference for menthol cigarettes. By analyzing the database of short genetic variations (National Library of Medicine 2018), Uhl and colleagues (2011) found a higher frequency of SNP rs13268757 in populations of Asian or African descent and proposed to investigate the linkage to preference for menthol cigarettes in these populations in the future.

In the study conducted by Uhl and colleagues (2011), SNP rs13268757 in the *TRPA1* gene was the only polymorphism that changed the sequence of the TRPA1 receptor, causing an arginine amino acid residue (R; genetically encoded by nucleotide triplet CGC) at Position 3 of the TRPA1 protein to change into a cysteine amino acid residue (C; genetically encoded by nucleotide triplet TGC), named as the R3C mutation. To examine the functional effects of this R3C mutation on activation by chemicals related to irritants in tobacco smoke, Deering-Rice and colleagues (2015) used fluorescent imaging of $Ca2^{+}$-flux in HEK293 cells. All irritants tested elicited stronger (twice as high) functional responses in the R3C-variant when administered at the same concentrations. This observation suggests that the R3C mutation increases the sensitivity of TRPA1 to irritants, resulting in higher Ca^{2+}-flux at the same agonist concentration.

This sequence variation, located in the extreme N-terminal of the protein, may also modify the surface expression of TRPA1 channels in the cells, potentially resulting in a larger number of channels that allow greater amounts of Ca^{2+}-ions to permeate the cell membrane. At this time, it is not known whether the R3C variation also results in increased TRPA1 currents in human sensory neurons. It may be possible that the respiratory sensory nerves of people who smoke and are carrying the mutation would be excited at lower densities of smoke, and carriers would perceive cigarette smoke as very irritating and painful. For example, smoke from nonmentholated cigarettes could feel more noxious than smoke from mentholated cigarettes to carriers, who might then choose to smoke menthol cigarettes because menthol, through the activation of TRPM8, would suppress the increased irritation (Figure 3.11). Further investigation is warranted to elucidate these relationships.

Studies of rodents have shown that TRPA1 is essential for pulmonary inflammation and airway hyperreactivity in both allergic and chemically induced asthma (Caceres et al. 2009; Hox et al. 2013; Devos et al. 2016). Several studies have linked *TRPA1* gene polymorphisms to childhood asthma (Kremeyer et al. 2010; Gallo et al. 2017). Intriguingly, homozygous carriers of the mutation for familial episodic pain syndrome in the *TRPA1* gene experience difficulties in

Figure 3.11 Human TRPA1 SNPs linked to disparities in menthol preference, asthma, and pain syndromes



Notes: The R3C polymorphism was linked to menthol preference in a genetic study (Uhl et al. 2011). The same polymorphism was found to increase irritant-induced TRPA1 responses and is linked to poorly controlled asthma in children, together with the R58T polymorphism. Variations resulting in chronic pain are localized to residues E179 and K188 (Deering-Rice et al. 2015). **SNP =** single nucleotide polymorphism; **TRPA1 =** transient receptor potential ankyrin 1.

breathing during the painful episodes, suggesting that the effects of the gain-of-function mutation extend to the respiratory system (Kremeyer et al. 2010).

In a study genotyping a cohort of 989 children with asthma, Deering-Rice and colleagues (2015) found a close correlation between poorly controlled asthma and homozygosity for the rs13268757 SNP in the *TRPA1* gene, the same SNP resulting in the R3C mutation that is associated with preference for menthol cigarettes. The allele frequency of the mutation was 12.1% in the asthmatic cohort, and more than 50% of the homozygous cohort had poorly controlled asthma, defined by their failure to respond to corticosteroid treatment (Deering-Rice et al. 2015). Earlier, Mendiondo and colleagues (2010) used data from the nationally representative 2005 National Health Interview Survey to compare health status and menthol or nonmenthol cigarette status among adults who currently smoked ($n = 3{,}949$) and formerly smoked ($n = 4{,}414$). Compared with people who smoked nonmenthol cigarettes, a greater proportion of those who smoked menthol cigarettes had asthma (9.4% vs. 7.2%; $p = 0.025$). By race and ethnicity, Hispanic adults who smoked menthol cigarettes had a significantly higher prevalence of asthma than Hispanic adults who smoked nonmenthol cigarettes (13.0% vs. 4.5%; $p < 0.001$). Although a higher prevalence of asthma was observed among Black (9.9% vs. 7.2%; $p = 0.236$) and non-Hispanic White (8.8% vs. 7.7%; $p = 0.42$) adults who smoked menthol cigarettes than among those who smoked nonmenthol cigarettes, these associations were not statistically significant. Additionally, people who formerly smoked menthol cigarettes were treated in emergency rooms for asthma 2.3 times more often than people who formerly smoked nonmenthol cigarettes in analyses adjusted for age, education, region, race and ethnicity, income, and sex. Although these data were cross-sectional, the findings suggest an increased risk of asthma exacerbations for menthol cigarette smoking compared with nonmenthol cigarette smoking.

The link between preference for menthol cigarettes and asthma and the involvement of TRPA1, the menthol or irritant receptor, in genetically determined disparities of flavor perception deserves further attention and research. Only one study (Uhl et al. 2011) has documented a possible link between a TRPA1 polymorphism and preference for menthol cigarettes, and data on *TRPM8* gene variations have not been reported.

Additional validation studies of larger cohorts, preferably among people of different racial and ethnic backgrounds, are necessary to understand the significance of this finding. Compared with recent studies of pain genetics that used genomewide association studies with cohort sizes in the tens to hundreds of thousands, genetic studies on people who smoke menthol cigarettes remain limited in scope and have investigated candidate loci in only relatively small cohorts.

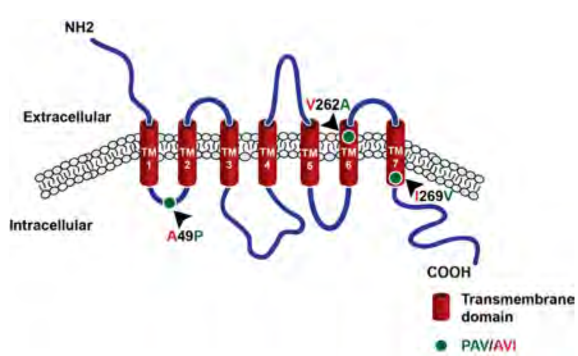
Bitter Receptor Gene Variations in the *TAS2R38* Gene Linked to Menthol Smoking in Female, Black or African American, Hispanic or Latino, and White People who Smoke

Variations in the genes encoding for the bitter receptors TAS2R38 and TAS2R16 have been linked to smoking status and nicotine addiction in people who use tobacco products (Mangold et al. 2008; Risso et al. 2016a). Menthol is thought to affect bitter taste perception, possibly reducing bitter sensation of nicotine (Lawrence et al. 2011). At the same time, menthol at certain levels can be perceived as bitter, and the flavor industry has pursued efforts to reduce such bitterness (Green and Schullery 2003; Slack and Pennimpede 2013) and balance the levels of both menthol and nicotine to appeal to consumers with different taster status.

Candidate gene studies of menthol smoking in people who smoke have investigated the effects of both TAS2R38 taster (PAV) and non-taster (AVI) haplotypes on menthol preference (Figure 3.12). The TAS2R38 bitter receptor PAV (taster) allele has been associated with menthol smoking in White women who smoke; Table 3.6 summarizes the studies that examined this finding. A 2015 study examined self-reported menthol smoking in 323 Hispanic and Caucasian women who were pregnant and participating in a smoking cessation trial (Oncken et al. 2015). PTC taster- or non-taster status was determined by genotyping of SNPs rs713598, rs1726866, and rs10246939 in the *TAS2R38* gene, giving rise to either the PAV (taster) or AVI (non-taster) variant and other minor variants (Figure 3.12). The frequency of the PAV (taster) allele was higher in pregnant women who smoked menthol cigarettes than in those who smoked nonmenthol cigarettes: 54% versus 30% in non-Hispanic women and 53% versus 25% in Hispanic women (Oncken et al. 2015). Among test participants who were homozygous for the PAV (taster) haplotype, 85% of the non-Hispanic women and 100% of the Hispanic women had a high likelihood of smoking menthol cigarettes. An additive model, compared with recessive or dominant, fit best with the data for the non-Hispanic population group. This was the first study linking the *TAS2R38* locus to the use of mentholated cigarettes, but the study was limited to Hispanic and Caucasian women.

Risso and colleagues (2017) examined the association between the use of menthol cigarettes and the taster and non-taster polymorphisms in TAS2R38 among 718 African American people who smoked (236 females and 482 males). Sequencing of the *TAS2R38* reading frame

Figure 3.12 Polymorphic sites in the TAS2R38 bitter receptor, a determinant of menthol preference



Notes: TAS2R38 is the target of the bitter agents PTC and PROP. Three polymorphic sites in the *Tas2r38* gene underlie the taster (PAV) and non-taster (AVI) haplotypes. The AVI variant is linked to nicotine dependence and heavy-smoking status, and the PAV taster variant is linked to menthol preference, likely due to suppression of bitterness perception.

noted a higher prevalence of intermediate haplotypes (AAI, AAV, PVI, and PAI) in addition to the PAV (taster) and AVI (non-taster) haplotypes. The study revealed a correlation between PAV (taster) alleles and the use of menthol cigarettes: the PAV allele was found in 48.2% of people who smoked menthol cigarettes and 42.1% of people who smoked nonmenthol cigarettes ($p = 0.04$). However, there was no complementary relationship between the increase in PAV haplotype and concomitant decrease of the AVI haplotype, likely because of the increased frequency of the intermediate haplotypes. Nevertheless, the frequency of the AVI (non-taster) haplotype was lower in people who smoked menthol cigarettes (29.8%) than in people who smoked nonmenthol cigarettes (37.7%). This association was observed in both men and women who smoked, and there was evidence of a statistically significant gene–dosage effect, as an increasing number of non-taster alleles correlated with nonmenthol smoking (Risso et al. 2017).

In another study, people with the highest sensitivity to PROP, the so-called “supertasters” who are likely homozygous for the PAV haplotype, liked e-cigarettes containing menthol more than they liked other flavors of e-cigarettes. It is possible that genetic factors influencing menthol preference may be independent of the type of tobacco product (e.g., e-cigarettes or cigarettes) being used (Mead et al. 2019). Further investigation is warranted.

The tobacco industry has promoted the use of menthol cigarettes in African American communities for decades through targeted marketing (Stahre et al. 2010; Klausner 2011; Dauphinee et al. 2013; Sterling et al. 2016a). However, it remains unclear whether variations in the candidate genes, *TRPA1* and *TAS2R38* also contribute to the substantially higher prevalence of menthol cigarette smoking among African American people who smoke compared to White people who smoke. As noted previously in this chapter, the tobacco industry may rely on these underlying genetic factors and mechanisms in its targeted marketing of menthol cigarettes to specific groups.

A Sensory Nerve Receptor Gene Variation in the *MRGPRX4* Gene Linked to Menthol Smoking

A whole-exome sequence variation analysis led by a team from the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health revealed strong evidence for genetic contributions to disparities in the menthol preferences of people who smoked (Kozlitina et al. 2019). This study investigated the association between exome sequence variations and menthol smoking in people who smoked, analyzing

Table 3.6 Associations between SNPs and menthol cigarette smoking

Study	Gene name	Function	SNP	Coding mutation	Menthol preference	Population	Frequency of people who smoke menthol cigarettes and OR
Oncken et al. (2015)	TAS2R38	• Plays a role in the perception of bitterness • Is linked to gustducin • Mediates TRPM5 gating of bitter taste	• rs713598 • rs1726866 • rs10246939	A49P, A262V, and V296I: AVI (non-taster) vs. PAV (taster)	PAV>AVI; Caucasian women who were pregnant and smoked menthol cigarettes had a greater number of PAV haplotypes compared with their counterparts who smoked nonmenthol cigarettes	• Non-Hispanic Caucasian women • Hispanic Caucasian women	• Non-Hispanic Caucasian women: – PAV (54%)>AVI (30%) for menthol preference – OR = 3.02 (p = 0.001) • Hispanic Caucasian women: – PAV (53%)>AVI (25%) for menthol preference – OR = 3.60 (p = 0.020)
Risso et al. (2016b)	TAS2R38	—	—	—	• AVI haplotype was inversely associated with menthol cigarette smoking • PAV haplotype was associated with menthol cigarette smoking	African American	• AVI: – People who smoked menthol cigarettes = 29.8% – People who smoked nonmenthol cigarettes = 37.7% – OR (overall): 0.70 (p = 0.08) – OR (males): 0.72 (p = 0.01) – OR (females): 0.89 (p = 0.01) – Copies of haplotypes: ○ 0 = 62.3% ○ 1 = 53.8% ○ 2 = 44.0% • PAV: – People who smoked menthol cigarettes = 48.2% – People who smoked nonmenthol cigarettes = 42.1% – OR = 1.24 (p = 0.04)

Table 3.6 Continued

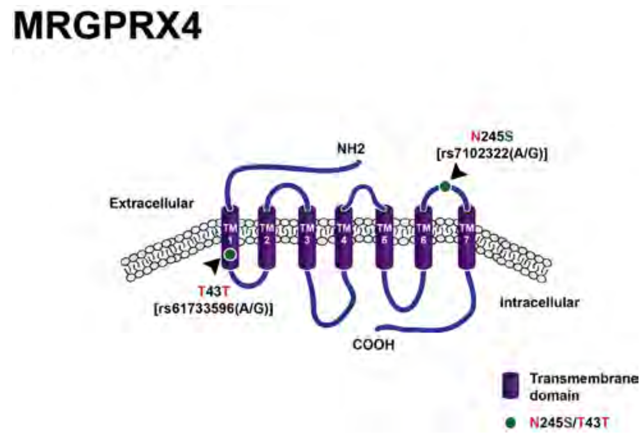
Study	Gene name	Function	SNP	Coding mutation	Menthol preference	Population	Frequency of people who smoke menthol cigarettes and OR
Uhl et al. (2011)	TRPA1	Nonselective cationic TRP ion channel involved in chemical sensing, inflammatory pain, mechanical stress, and possibly in cold perception	• rs13268757 (exon1) • rs10111216 • rs4738205 • rs1373297 • rs1443952 • rs12677736 • rs10101155 • rs12548486 • rs4737338 • rs1373302 • rs3824150 (intron SNPs)	Exon1 (R to C missense mutation)	• Minor allele encoding for the missense cysteine had inverse preference for mentholated cigarettes in people who smoked heavily • Ten other intronic SNPs had preference for mentholated cigarettes in people who smoked heavily • Overall, the haplotype displays significant association with menthol cigarette preference in people who smoked heavily	• American people of European origin who smoked: – Heavily (>15 cigarettes smoked per day) – Lightly (≤15 cigarettes per day)	• Menthol preference was associated with 4–7% higher minor allele frequencies for 10 intronic SNPs • Exon 1 missense SNP had an opposite association, with a 4.2% lower menthol preference • OR = 1.3 (p = 0.006)
Kozlitina et al. (2019)	MRGPRX4	G-protein-coupled receptor expressed in sensory neurons that are involved in nociception and somatosensation	• rs7102322[G] and rs61733596[G]: – Minor allele = G – Major allele = A • Exclusive to those of African ancestry	• N245S (for rs7102322[G]) • T43T (for rs61733596[G])	Associated with menthol smoking behavior	Multiethnic population and African American people	• N245S (for rs7102322[G]): – 7.0–10.4% (menthol) vs.1.3% (nonmenthol) – OR = 5–8 (p = 0.000056) • T43T (for rs61733596[G]): – 6.6% (menthol) vs.1.5% (nonmenthol) – OR = 3.3 (p = 0.007)

Notes: **AVI =** Ala49Val262Ile296; **OR =** odds ratio; **PAV =** Pro49Ala262Val296; **SNP =** single nucleotide polymorphism.

genetic samples from 561 study participants (394 African American people and 167 American people of European origin) from the Dallas Heart Study and the Dallas Biobank (Victor et al. 2004). Replication cohorts curated by the Schroeder Institute were derived from populations from the Washington, D.C., area. The analysis identified rs7102322, an African American-specific exome variation located in the *MRGPRX4* gene (Mas-Related GPR family member X4), with strong associations to menthol smoking: a frequency of 8% in the Dallas cohorts and 5% in the Schroeder cohort. This variation was not found among American people of European origin in the control samples who smoked nonmenthol cigarettes. The rs7102322 appeared with 5- to 8-fold higher frequency among African American people, appearing among 10.4% of people who smoked menthol cigarettes versus 1.3% of people who smoked nonmenthol cigarettes in the Dallas cohort (odds ratio = 8.5), and among 7.0% of people who smoked menthol cigarettes versus 1.3% of people who smoked nonmenthol cigarettes in the Schroeder cohort (odds ratio = 6.3). The African American cohort from the Schroeder Institute had a lower overall frequency of rs7102322 because of its European American admixture. The minor allele frequency of rs7102322 was higher in African-ancestry populations (11.5 %) than it was in African American people in the southwest United States (8.0%). Complete exome sequencing of the *MRGPRX4* gene in the Dallas cohort revealed that rs7102322 was in complete linkage disequilibrium with another exon sequence variation, rs61733596, that was also associated with menthol smoking (Kozlitina et al. 2019). In contrast to prior studies, this study examined ancestry and admixture from other ancestries in the study populations, relying on data from the 1000 Genomes Project.

MRGPRX4 encodes for a GPCR of the Mas-related GPCR (MRGPCR) family (Figure 3.13). MRGPRs were initially identified in peripheral sensory neurons, with some family members labeling neuronal subtypes involved in itch signaling (Dong et al. 2001; Meixiong and Dong 2017). The sensation of itch (pruritus)—in response to environmental irritants, mast cell degranulation (which releases histamine), and non-histaminergic pathways—is triggered by pruriceptors, which are specialized sensory nerves with circuitries distinct from the nociceptors that initiate the sensation of pain (Bautista et al. 2014). However, pruriceptors and nociceptors share similar signaling mechanisms, including such ion channels as TRPA1 and TRPV1 (Bautista et al. 2014). Some MRGPRs are directly activated by itch-inducing agents, including such drugs as chloroquine, leading to downstream activation of TRPA1 (Wilson et al. 2011; Bautista et al. 2014). Although MRGPRs are known for their functional roles in skin-innervating neurons, they are also expressed in sensory nerves innervating the respiratory system and thus may sense tobacco product flavors and other constituents of cigarette smoke.

Figure 3.13 Polymorphic sites in the MRGPRX4 G-protein coupled receptor linked to menthol preference in African American people who smoke



Notes: MRGPRX4 (Mas-related G-protein-coupled receptor X4) is a member of the MRG receptor family expressed in peripheral sensory neurons. The polymorphism, rs7102322, induces an amino acid change, N245S, in the third extracellular loop of the receptor, leading to diminished responses to the synthetic ligand, Nateglinide. (Nateglinide is also a clinically approved drug for type II diabetes.) This polymorphism is present exclusively in African American people, with a frequency of 5–8%, and African American people who smoke menthol cigarettes have a 5- to 8-fold higher likelihood of carrying this variation.

The *MRGPR* gene family shows rapid evolutionary divergence. Mice have 27 *MRGPR* genes, with seven subfamilies and almost the same number of pseudogenes, but the human genome contains only eight intact genes of the *MRGPR* gene family (Meixiong and Dong 2017). *MRGPRX4* is a member of the human *MRGPRX* gene subfamily with four members and is most closely related to the murine *MRGPRA* family. However, sequence divergence does not allow assignments of corresponding species orthologues between humans and mice (Meixiong and Dong 2017).

The *MRGPRX4* gene is expressed in dorsal root ganglia, suggesting that the receptor may be involved in sensory mechanisms (Kozlitina et al. 2019; Meixiong et al. 2019). A functional pharmacological screen identified *MRGPRX4* as a target of nateglinide, a drug used to treat type II diabetes, where it acts as an inhibitor of ATP (adenosine triphosphate)-regulated potassium channels in pancreatic beta-cells. Nateglinide produces an itch as a side effect in some patients through a mechanism that may involve *MRGPRX4*. A study in models of cholestatic itch, often observed in jaundice patients, revealed that MRGPRX4 is activated by bilirubin that is enriched in patient blood (Meixiong et al. 2019). Inhibition of MRGPRX4 may be a strategy to relieve pruritus associated with jaundice and other conditions activating this receptor (Meixiong et al. 2019).

The exonic variation rs7102322, associated with preference for menthol smoking, induces a point mutation (N245S) in the third extracellular loop of the MRGPR receptor (Figure 3.13) (Kozlitina et al. 2019). In many GPCRs, this loop is involved in ligand binding. In a function test of beta-arrestin recruitment, nateglinide clearly activated heterologously expressed MRGPRX4 receptors (Kozlitina et al. 2019). The mutant showed strongly diminished responses to nateglinide (64% reduction). Menthol, at 100 µM (micromolar) concentrations, had a modest inhibitory effect on activation of MRGPRX4 by nateglinide, but 300 µM of menthol concentration diminished activation by 40–50%. Menthol also affected basal activity of MRGPRX4, increasing basal signaling (Kozlitina et al. 2019). These findings suggest that menthol may be a partial agonist of MRGPRX4.

The variation rs7102322 in the *MRGPRX4* gene, found solely in individuals of African ancestry, has the highest odds ratio among the genetic variations associated with disparities in menthol smoking, increasing the odds of menthol use 5- to 8-fold among people who smoke cigarettes (Kozlitina et al. 2019). The localization of *MRGPRX4* gene transcription in peripheral sensory neurons suggests that the receptor may be involved in the sensing of exogenous or endogenous stimuli associated with smoking and/or in the sensing of menthol. The concentrations of menthol required to inhibit receptor activation, or increase basal activity, are comparably high (100 µM or higher). The discovery of bilirubin, which is elevated in jaundice, as a potential endogenous agonist of MRGPRX4 is intriguing, but its agonist activity is weaker than that of nateglinide. Studies of levels of bilirubin in relation to smoking have shown that blood levels of bilirubin are lower in people who smoke than in people who do not smoke. Low levels of bilirubin indicate a slower onset of chronic obstructive pulmonary disease but are correlated with a higher likelihood of developing lung cancer in people who smoke (Apperley et al. 2015; Wen et al. 2015; Kodal et al. 2020). Further screens are needed to identify additional ligands of MRGPRX4, which should include the testing of flavors for tobacco products and their constituents. It is also critical to characterize the sensory nerve subtypes in which MRGPRX4 is expressed, the endogenous signaling pathways engaged by this receptor, and the coupled ion channels that may further integrate menthol signaling. Because of the rapid evolutionary divergence of MRG receptor genes, MRGPRX4 in humans has no clear species ortholog in rodents, complicating the analysis of this pathway in model systems. Humanized transgenic systems may be needed to facilitate further studies of the role of this key receptor in determining menthol preference.

Summary of the Evidence

This chapter summarizes the current knowledge about the chemosensory and physiological mechanisms through which menthol and other flavor chemicals in tobacco products act, and the genetic factors that may influence these mechanisms and may contribute to flavored tobacco product use disparities. This research may help to explain the appeal of flavored tobacco products that elicit multisensory experiences among youth, women, and certain racial and ethnic groups. Scientific data suggest that a consumer's use of flavored tobacco products, including menthol, is not arbitrary. Instead, use of flavored tobacco products can be explained by a range of factors, including prior conditioning to prefer certain flavors, differences in taster status and genetics, and targeted marketing. The review in this chapter, in conjunction with prevalence data and marketing data presented elsewhere in this report, provides a greater understanding of why certain groups of people may be more likely to use flavored tobacco products than other groups and how this use influences tobacco-related health disparities along the tobacco use continuum.

Research and regulation of tobacco products that are menthol flavored, a known flavor of concern in tobacco products, could serve as models to address other tobacco product flavorants, including the many minty and cooling agents that have been developed by the flavor industry. Varying levels of natural or synthetic coolers and refreshers, in combination with different chemicals, can have long-lasting effects on various parts of the body, even different parts of the oral cavity. The combination of some cooling chemicals can invoke more intense cooling. Additionally, cooling chemicals at different levels can invoke fruity notes or prolong sweetness (Table 3.4).

Menthol and other chemicals in tobacco products act on the trigeminal and vagus nerves and activate various receptors to induce cooling, pain, irritant, and heat sensations. TRPM8, a TRP receptor, is activated by cold, menthol, and numerous other cooling agents used as additives in tobacco products. TRPA1, another TRP receptor, is activated by chemicals found in tobacco smoke and by numerous flavor additives, including menthol and methyl salicylate.

Depending on taster status, some groups of people are more likely than other groups to like particular flavor experiences, including menthol and the bitter taste of nicotine, resulting in different flavor preferences among gender, age, and racial and ethnic groups. In addition, the tobacco industry's use of synthetic and natural sweeteners makes tobacco products less aversive among people with different taste sensitivities. Along with the physiological, chemosensory, and genetic influences on menthol cigarette use, social factors, such as decades of targeted marketing, also influence initiation and maintenance of smoking menthol-flavored tobacco products. Individual-level biological factors combined with additional factors at the individual, interpersonal, community (e.g., retailers), societal (e.g., tobacco manufacturing, marketing and distribution) and policy (e.g., regulation of sale, manufacturing, and marketing) levels influence tobacco-related health disparities.

As of 2022, variations in three genetic loci—*TRPA1*, *TAS2R38*, and *MRGPRX4*—have been identified that may contribute to differences in menthol preference and, potentially, to disparities in menthol preference in people who smoke. The odds ratio—the likelihood a certain behavior, such as menthol preference, is observed if the determining genetic variation is present or absent—is less than two-fold for the variations in the *TRPA1* and *TAS2R38* genes in the cohorts investigated (White people who smoke heavily and Hispanic women who smoke, respectively). For the polymorphism in the *MRGPRX4*, the odds ratio associated with menthol smoking is higher, with 5- to 8-fold increased odds of menthol smoking in the investigated cohorts of Black or African American people who smoke. However, to date, these genetic studies are restricted to small cohorts, and, thus, more expansive and diverse samples are needed to extrapolate to the population level.

The *MRGPRX4* gene polymorphism associated with menthol preference was present in about 7–10% of people who smoked menthol cigarettes in the investigated cohorts of people of African ancestry (Kozlitina et al. 2019). The prevalence of this MRGPRX4 variant in people of African ancestry who smoke menthol is substantially lower than (a) the prevalence of menthol cigarette smoking African American people who smoke (88.1%) and (b) the overall prevalence of menthol smoking among all people who smoke in the United States (42.1%) (see Table 2.6 in Chapter 2), suggesting that additional factors may contribute to menthol preference (Kozlitina et al. 2019). A genuine big data approach with large cohorts is needed to explore multigenic linkages (He et al. 2017). Large scale genetic studies are likely to increase understanding of underlying genetic determinants that interact with other factors—such as marketing, cigarette engineering, and physiological factors—to influence the use of menthol cigarettes and the behaviors toward other flavors and additives. Underlying genetic factors should be studied in context with pharmacological data and marketing influences to obtain a comprehensive understanding of how flavors influence tobacco use and tobacco-related health disparities, as such factors may interact to explain the disproportionate use of menthol among African American people, Native Hawaiian and Pacific Islander people, youth, women, people who identify as LGBTQI+, and population groups with lower incomes. Future research that examines genetic, pharmacologic, and marketing influences together would help the field to understand the mechanisms and pathways to tobacco-related health disparities.

Additional research on these topics could further elucidate underlying genetic, biological, physiological, and chemosensory mechanisms of flavor and other chemicals on tobacco use and tobacco-related diseases and conditions. However, the scientific evidence to justify prohibiting the marketing, sales, and distribution of menthol tobacco products and flavored cigars has been both substantial and sufficient for years.

Menthol in tobacco smoke has pharmacological effects beyond the somatosensory effects discussed in the context of the TRPA1 and TRPM8 ion channels. First, the counterirritant effects of menthol on respiratory sensory innervation could partly explain why menthol increases the likelihood of smoking initiation among adolescents. Second, new data suggest that menthol can reach sufficient concentrations in the central nervous system to affect the dopaminergic reward circuitry by interacting with nicotinic acetylcholine receptors. Third, menthol acts as a cue and reinforcer of nicotine intake. These effects may partly explain why people who smoke menthol cigarettes have more difficulty quitting smoking and have higher relapse rates after quitting menthol smoking than people who smoke nonmentholated cigarettes. Accumulating evidence demonstrates that the effects of menthol extend to both smokeless tobacco products and e-cigarettes that are flavored with menthol.

This chapter discussed a range of existing natural and synthetic flavor chemicals, factors that contribute to multisensory experiences, and other physiological and genetic factors that influence flavor and sensory detection and reactions. The tobacco industry uses flavors—including menthol—in their products; the flavors help to increase the appeal of tobacco products, especially among individuals and groups with higher aversions to the effects of tobacco smoke. Industry documents described in this chapter demonstrate that tobacco companies have known for decades that the sensory (e.g., cooling, numbing) properties of menthol play a central role in increasing the appeal of smoking. Together, the findings in this chapter can help to inform local, state, and federal efforts to regulate flavors in tobacco products, as described in Chapters 7 and 8.

As discussed in Chapters 6 and 7, prohibiting flavored tobacco products, including menthol, would reduce the overall prevalence of tobacco product use and particularly menthol tobacco product use, especially among individuals and groups with higher aversions to the effects of tobacco smoke. However, efforts to prohibit menthol tobacco products without considering alternative natural cooling agents (e.g., eucalyptol, isopulegol, carvone); synthetic cooling agents (e.g., WS series and other coolants), some of which have little or no taste or odor; noncooling or minimally cooling mint flavorants, such as menthone; and other multisensory chemical additives may compromise efforts to reduce tobacco-related health disparities. Synthetic cooling agents recently detected in combustible cigarettes and nicotine pouches and openly marketed by vendors of e-liquids mimic the cooling and counterirritant effects of menthol and allow combination within non-mint-flavored products, especially fruit- and candy-flavored products that are popular with adolescents and young adults.

In addition, the use of highly potent synthetic sweeteners in tobacco products raises concerns about cumulative intake of sweeteners. Smokeless tobacco products are intensely sweetened to help mask the aversive tastes during oral consumption of such products. Synthetic sweeteners can also be found in high concentrations in the mouthpieces of cigars and cigarillos which are marketed in sweet, candy, and fruit flavors. Because children and adolescents exhibit stronger preferences for sweet tastes compared with adults, considering sweetness as a flavor and eliminating all sweeteners in tobacco products would be expected to reduce the likelihood of youth initiation and transition to tobacco dependence, protect certain population groups from tobacco-related health disparities, prevent potential chronic metabolic effects of artificial sweeteners, and limit exposure to sweeteners at potentially adverse effect levels.

Many chemical additives that have been identified in tobacco products—such as WS-3, WS-23, and other synthetic cooling agents—are devoid or nearly devoid of taste and odor and thus might not be considered flavors under a narrow definition that looks at only taste and odor. Comprehensive efforts to address the appeal of tobacco products could maximize public health benefits and minimize risks by considering odorless flavorants (such as sweeteners), synthetic cooling agents, and the pharmacologic actions of flavorants and chemical additives. Importantly, FDA identified, under its proposed menthol cigarette and flavored cigar product standards in 2022, several factors that are relevant in determining whether a cigarette or cigar would have a characterizing flavor: the presence and amount of artificial or natural flavoring ingredients in a tobacco product, including its components or parts; the multisensory experience (i.e., taste, aroma, and cooling or burning sensations in the mouth and throat) of a flavor during use of a tobacco product, including its components or parts; implicit or explicit flavor representations, including descriptors, on packaging and in advertising; and any other means that impart flavor or represent that the tobacco product has a characterizing flavor.

Science-based regulations of flavors that make tobacco products more palatable to new and existing consumers are important for protecting the public's health. Regulatory frameworks that consider the pharmacological effects of menthol and other flavorants; cooling and refreshing or pain-desensitizing chemicals; sweeteners; and the emerging genetic evidence for the disparate pharmacological actions of flavorants in youth, women, and racial and ethnic population groups could help to reduce tobacco-related health disparities. The biological mechanisms of action of chemical additives—as an odorant, tastant, somatosensory agent, sensory modulator, modulator of reward circuitry, or toxicant—create opportunities to further investigate additives, compounds, constituents, and other ingredients that facilitate tobacco use. This could include considering how genetic modifications of tobacco to include flavors and the processing of tobacco—such as bending various types of tobacco and adding flavor chemicals to the casing (sugar, licorice, cocoa) and other dressings (spices, sweeteners)—contribute to the taste, odor, attractiveness, and multisensory experiences of people who use tobacco products or who may be vulnerable to tobacco use. Notwithstanding, scientific evidence from multiple disciplines justifies comprehensive prohibitions on the manufacturing, distribution, marketing, and sales of flavored tobacco products.

Conclusions

1. The evidence is sufficient to infer that some natural and synthetic chemicals and flavorants that are added to tobacco products have pharmacological effects; act as cues and reinforcers; and, in some cases, act centrally to modulate the brain reward circuitry.

2. Natural and synthetic chemicals and flavorants added to tobacco products elicit multisensory experiences, including odorant (olfactory) effects; basic taste perceptions (e.g., sweet, bitter); and somatosensory effects, such as cooling.

3. Sweeteners are used in tobacco products to mask aversive tastes and have been detected at high levels in certain oral tobacco products. Sweet taste appeals more to young people than to older people.

4. Smoking status; use of flavored tobacco products; and related disparities by age, gender, and race and ethnicity result from multilevel influences. Targeted marketing, societal and cultural factors, and genetic variations that affect underlying chemosensory and physiological mechanisms result in differences in the appeal of and ability to perceive certain flavor qualities, such as bitter taste.

5. Determinations that flavorants are "generally recognized as safe" for use in foods are not applicable to the inhalation of tobacco products. These ingredients, when inhaled, may be directly toxic to the lungs or could result in higher absorption of toxicants. Commonly used natural and synthetic chemicals and flavorants may be safe to ingest in foods but might be harmful when inhaled.

6. Animal studies suggest that menthol and sweeteners influence nicotine uptake. Menthol and other flavorants, such as farnesene and farnesol, directly affect the dopaminergic reward circuitry and may potentiate the addictive effects of nicotine.

7. Natural and synthetic cooling agents that have been found in some tobacco products (a) act on different parts of the oral cavity and the respiratory system to enhance the experience of smoking or use of other tobacco products and (b) can mimic the pharmacological and somatosensory effects of menthol but may not have a distinguishing taste or odor. Cooling agents, even those without a taste or odor, have the potential to increase the appeal of tobacco products, facilitate their use, and contribute to tobacco-related health disparities. Comprehensive flavor policies that account for these agents will better protect public health.

8. Genetic studies provide suggestive evidence that variations in genes involved in sensory mechanisms and taste perception may influence menthol smoking in youth, women, and some minoritized racial and ethnic groups. The emerging science on the role of genes in flavor experiences should be understood in context with multilevel commercial, societal, and cultural factors that influence tobacco-related health disparities.

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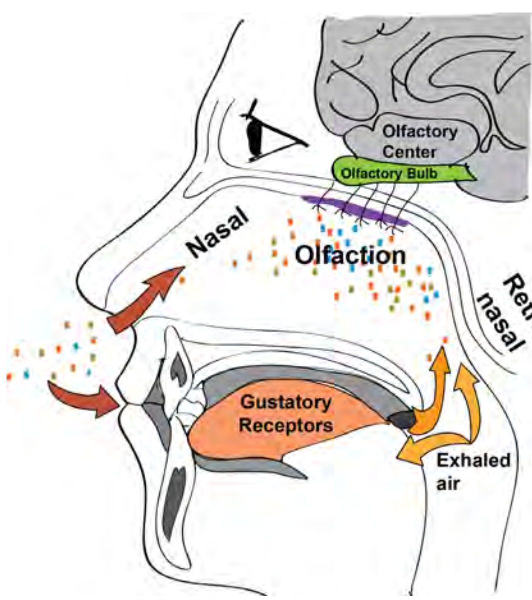
Appendix 3.1: Underlying Mechanisms and Physiology of Flavor Perceptions

Sense of Smell (Olfaction)

The human nose can discriminate between a wide variety of different odors. Extrapolations from psychophysical tests have determined that humans are theoretically capable of discerning 1 trillion different odors (Bushdid et al. 2014). Volatile odorant chemicals are detected by olfactory sensory nerve endings in the olfactory epithelium of the nose, either after inhalation through the nose or after retronasal olfaction following ingestion or inhalation (Figure 3A.1). The olfactory epithelium is covered in nasal mucus that dissolves odorants and, in some cases, modifies odorants through enzymatic reactions (Nagashima and Touhara 2010). Once activated, the olfactory sensory nerves signal to second-order neurons in the olfactory bulb that in turn send projections to the olfactory cortex, where odor perception is produced (Maresh et al. 2008; Murthy 2011).

Figure 3A.1 Smelling and tasting flavors in tobacco products



Notes: The olfactory epithelium contains nerve endings of olfactory neurons expressing olfactory receptors for volatile flavor chemicals inhaled through the nose or exposed through retronasal olfaction from the oral cavity or the airways when exhaling. Taste cells on the tongue, localized to taste buds and innervated by the lingual nerve, express the receptors for the basic taste qualities: sweet, bitter, umami, sour, and salty.

The olfactory system was the first chemosensory system for which dedicated chemoreceptors were identified. In 1991, Buck and Axel became the first researchers to describe a large family of G-protein-coupled receptors (GPCRs)—the Olfactory Protein Family—whose expression was highly restricted to olfactory sensory neurons (Buck and Axel 1991). Later, Axel (2005) elaborated on this process. Olfactory receptors represent the largest receptor family in the mammalian genome. Humans express approximately 400 different olfactory receptor genes, but rodents express 1,300 genes (Touhara and Vosshall 2009; Jiang and Matsunami 2015; Keller and Vosshall 2016). Olfactory receptors couple to Golf, an olfactory-specific G-protein that activates adenylate cyclase, forming cAMP (cyclic adenosine monophosphate). This second messenger binds to a cyclic nucleotide-activated cation channel that depolarizes and allows calcium ions to flow into the cell. Calcium influx activates a chloride channel that further depolarizes and excites the olfactory sensory neurons.

Of the approximately 400 olfactory receptor genes, each olfactory sensory neuron expresses only one (Serizawa et al. 2004). Expression is monoallelic, expressing just one of the two receptor gene copies. This highly exclusive control of the expression of olfactory receptor genes has been the subject of intense research efforts (Serizawa et al. 2004).

Since odorant receptors were first identified in 1991, cognate odorants for only about 15% of the receptors have been identified (Geithe et al. 2017). Expression of odorant receptor genes in cells other than olfactory sensory neurons is technically difficult, prohibiting standard screening approaches, and many cognate odorants in the natural environment have not been identified (Krautwurst et al. 1998, 2008; Matsunami 2005; Geithe et al. 2017). However, advances in molecular biology, genetics, chemistry, and structural modeling have enabled new approaches to deorphanizing odorant receptors (Jiang and Matsunami 2015; Keller et al. 2017; Bushdid et al. 2018; Hu and Matsunami 2018; Kida et al. 2018). These studies revealed that some olfactory receptors are broadly tuned to respond to several chemically distinct odorants, and others respond only to a single known odorant chemical. A single odorant may activate several receptors with differing potency and efficacy across separate olfactory sensory neurons, a multitude of combinatorial input options are represented as distinct odors (Bushdid et al. 2014).

Mechanisms of Taste Perception (Gustation)

The five taste qualities (sweet, bitter, sour, salty, and umami) are sensed by taste receptor cells on the tongue (Witt and Reutter 2015). Groups of 60–100 taste receptor cells form the taste buds, which are onion-like structures with a pore on the surface that are exposed to saliva and tastants (i.e., substances eliciting taste sensations) in the oral cavity (Figure 3A.1). Taste buds are found in the papillae of the tongue, soft palate, cheeks, upper esophagus, and epiglottis. The average human has 5,000–7,500 taste buds, with a range of 2,000–10,000 (Daly et al. 2012). Contrary to an old misperception, the surface of the tongue does not contain specific regions that are dedicated to sensing single taste qualities (Feeney and Hayes 2014).

Taste receptor cells have an average life span of 10 days, after which they are replaced by new taste cells (Beidler and Smallman 1965; Conger and Wells 1969; Farbman 1980; Mistretta and Hill 2003). Some studies suggest that some taste receptor cells can last more than 3 weeks (Cho et al. 1998; Hamamichi et al. 2006). Each cell is specialized to sense only a single taste quality. When activated, the taste cells release ATP (adenosine triphosphate), a neurotransmitter that excites and activates purinergic P2X2 and P2X3 receptors on the ends of the underlying gustatory nerves (Finger et al. 2005; Kinnamon and Finger 2013). The taste buds of the tongue are innervated by nerve fibers originating in the chorda tympani and by the glossopharyngeal nerve. The palate is innervated by cranial nerve VII, and taste information from the epiglottis and larynx is relayed by cranial nerve X, also known as the vagus nerve (Erman et al. 2009). Taste information is then transmitted to the gustatory division of the nucleus tractus solitarius (NTS) in the brain. NTS neurons project into the thalamic region, further connecting with the primary (orbitofrontal) and secondary gustatory (insular-opercular) cortices (Scott and Verhagen 2000).

Sweet and Umami Taste Receptors

As its name indicates, sweet taste signals the presence of sugars in food, beverages, and tobacco products. Physiological studies in the 1990s revealed that both sweet and bitter taste transduction rely on G-protein signaling in taste cells, suggesting that taste receptors might be GPCRs. Two particular G-proteins, alpha subunit of transducin and gustducin, were identified in taste cells that were found to be essential for sweet and bitter taste transduction (Wong et al. 1996). A differential cloning strategy identified two novel GPCRs with expression restricted to taste cells, suggesting that these receptors might be taste receptors (Hoon et al. 1999). Genetic studies in mouse strains with large differences in the perception of sweet taste provided more insights into the role of these receptors. The polymorphic genetic locus responsible for these differences contained a gene encoding for a third GPCR with significant homology to the initial receptors (Max et al. 2001; Montmayeur et al. 2001). Together, this family of receptors was named T1R or TAS1R, with three members. The third receptor, TAS1R3, when co-expressed with the second receptor, TAS1R2, produces functional sweet-sensitive responses to sugars, such as sucrose, fructose, and many artificial sweeteners (Nelson et al. 2001; Li et al. 2002; Zhao et al. 2003). Surprisingly, when the first member of the gene family TAS1R1 was co-expressed with TAS1R3, the resulting receptor did not respond to sugars but instead to the amino acid glutamate, revealing that this combination constitutes the receptor for umami taste (Li et al. 2002; Nelson et al. 2002; Zhao et al. 2003). The TAS1R2/R3 sweet receptor proteins are found exclusively in sweet taste receptor cells, but the TAS1R1/R3 combination is found only in umami taste receptor cells, supporting the idea that taste receptor cells are specialized for only one of the five basic taste qualities (Zhang et al. 2003; Zhao et al. 2003).

Bitter Taste Receptors

Bitter perception is thought to have developed as a mechanism to avoid toxic chemicals in food, especially from certain toxic plants (Wooding 2006). Plant toxins—such as strychnine and ricin—are extremely bitter, and evolutionary mechanisms may have selected for traits that detect such toxins and signal intense bitter perception to produce avoidance behavior.

Individual differences in bitter perception of certain chemicals were first reported in a study by Fox (1932), in which phenylthiocarbamide (PTC) was perceived as extremely bitter by some test participants but not by others. This difference was subsequently identified as a heritable Mendelian trait, suggesting that genetic variations determine differences in taste perception (Snyder 1931; Wooding 2006). PTC non-taster status was found to be a recessive trait. The PTC-taster–non-taster duality was found to extend to other primate species, such as the chimpanzee. Subsequent studies investigated correlations between PTC-taster status and aversion to bitter chemicals occurring naturally in foods and in certain food categories. Similar genetic associations were found for PROP, another bitter tastant used in experimental studies. Gene loci associated with the polymorphisms determining sensitivity to PTC or PROP have been mapped to human chromosomes 7 and 5, respectively (Reed et al. 1999; Kim et al. 2003). Earlier, studies in mice revealed genetic determinants of sensitivity to certain bitter tastants (Capeless et al. 1992).

In 2000, a new gene family of GPCRs was identified with expression localized to taste cells of the tongue and palate (Adler et al. 2000; Chandrashekar et al. 2000; Matsunami et al. 2000). These receptors were localized in the same taste cells expressing gustducin, a taste-specific G-protein that is essential for bitter taste perception (Wong et al. 1996). Some of the genes encoding for these receptors mapped close to the PTC/PROP genetic loci in humans and to a gene locus in mice that determines bitter sensitivity (Capeless et al. 1992; Reed et al. 1999; Kim et al. 2003). This gene family was named *T2R* or *TAS2R*, and functional studies revealed that some TAS2R receptors responded to bitter tastants when expressed in heterologous cells (Chandrashekar et al. 2000; Bufe et al. 2002; Kuhn et al. 2004). Genetic studies of mice confirmed the essential roles of TAS2R receptors in bitter perception in vivo by specifically ablating sensitivity to selected bitter chemicals and by converting bitter aversion into a preference by expressing a TAS2R receptor in sweet taste cells (Mueller et al. 2005).

The human genome encodes for 25 *TAS2R* bitter receptor genes and additional pseudogenes (Behrens and Meyerhof 2009). In contrast, rodent genomes encode for 37 *TAS2R* bitter receptor genes (Behrens and Meyerhof 2009). Similar to the case with other sensory receptor genes, bitter receptor genes appear to have diverged rapidly over time, as their numbers, sequences, and pseudogenes vary widely among species (Behrens and Meyerhof 2009). The small number of receptors is dwarfed by the thousands of known bitter chemicals, suggesting that bitter receptors are broadly tuned to detect multiple bitter agents. Although bitter chemical activators for more than half the number of human bitter receptors have been found, natural bitter ligands often remain elusive (Behrens and Meyerhof 2009). Based on the discovery of TAS2 bitter receptors, the flavor industry is developing bitter blockers to inhibit certain TAS2 receptors to, in effect, increase the palatability of pharmaceutical formulations and food products.

Further confirmation for the role of TAS2 receptors in bitter sensing comes from human genetic studies that have narrowed down the polymorphic genetic region responsible for variations in the bitter perception of PTC. The gene associated with PTC taster–non-taster status has been mapped to human chromosome 7 (Reed et al. 1999; Kim et al. 2003). Positional cloning revealed that the gene encodes for TAS2R38, a member of the *TAS2* bitter taste receptor gene family (Kim et al. 2003; Wooding et al. 2006). The key single nucleotide polymorphisms (SNPs) associated with the taster and non-taster haplotypes are RS713598, RS1726866, and RS10246939—all of which are located in the protein-coding region of the *TAS2R38* gene. The variations in protein sequence resulting from these SNPs are PRO49ALA, ALA262Val, and VAL296ILE (PAV [taster] to AVI [non-taster]). The *TAS2R38* haplotypes comprised of these SNPs (PAV and AVI) differentiate tasters of PTC bitterness (PAV/PAV and PAV/AVI genotypes) from non-tasters (AVI/AVI homozygotes).

Sour Taste Receptors

Sour taste, elicited by ingesting acidic foods, is an aversive taste quality thought to serve as a warning signal for spoiled foods. Similar to the other taste qualities, sourness is transduced by specialized taste receptor cells in the taste buds of the tongue. These cells express two specialized ion channels, PKD1L3 and PKD2L1. Both ion channels open in response to acidic stimuli and excite the taste cells (Huang et al. 2006; Ishimaru et al. 2006; Chang et al. 2010). PKD1L3 and PKD2L1 channels respond to acid solutions between pH 2.5 or 2.6, including H2SO4, phosphoric acid, succinic acid, tartaric acid, citric acid, hydrochloric acid, and malic acid (Inada et al. 2008). In imaging experiments for Ca^{2+}, HEK 293T cells transfected with PKD1L3 and PKD2L1 responded to sour tastant, like citric acid and hydrochloric acid, and malic-like somatosensation may also play a significant role in acid detection, since low pH may cause pain sensation (Ishimaru and Matsunami 2009).

In 2018, OTOP1 was identified as a sour taste receptor (Tu et al. 2018) and confirmed in other studies (Teng et al. 2019; Zhang et al. 2019). The OTOP1 ion channel is activated by lowering pH (Teng et al. 2019). Other receptors may be involved in sour taste and in the interaction of sour with sweet taste.

Of note, PKD1L3 and PKD2L1 are transient receptor potential (TRP) ion channels and belong to the corresponding *TRP* family of ion channel genes (Huang et al. 2006; Ishimaru et al. 2006). TRP ion channels are present in all sensory systems and play essential roles in sensing and signal transduction (Liedtke and Heller 2007; Wu et al. 2010). *TRP* is a gene family with more than 30 members in mammals (Ramsey et al. 2006; Wu et al. 2010). TRP ion channels were initially identified in the photoreceptor cells of the fruit fly (*Drosophila melanogaster*), where these ion channels contribute to light signaling downstream of photopigment (rhodopsin) activation by light (Montell and Rubin 1989; Wes et al. 1995). As an example of the essential roles TRP ion channels play in sensing and signal transduction in mammals, mice deficient in TRPC2 are incapable of detecting pheromones and fail to discriminate between male and female cagemates (Stowers et al. 2002; Zufall 2005). TRPM5 is expressed in taste cells in the taste buds of the tongue and palate, where it is involved in the signal transduction mechanism downstream of the primary taste receptors (Perez et al. 2002, 2003; Liu and Liman 2003).

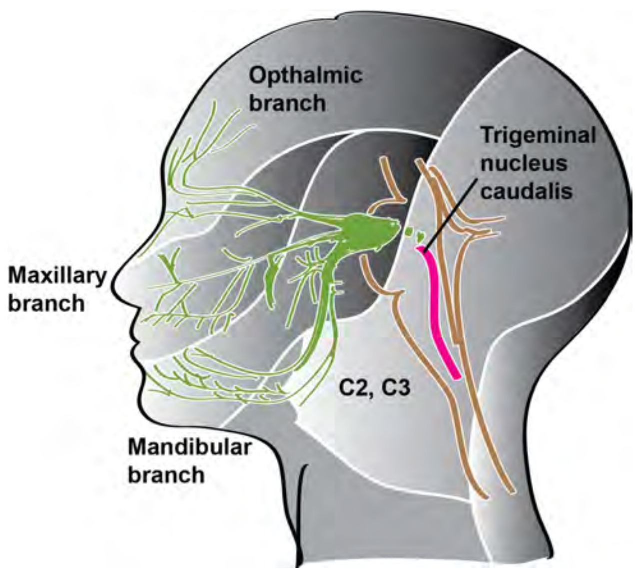
Salty Taste Receptors

Salty taste can stimulate appetite but also cause aversion. Similar to sweet, umami, and sour taste, appetitive salt taste is transduced by a specialized population of taste cells in the taste buds of the tongue (Chandrashekar et al. 2010). The transducer for salt taste is an ion channel, the epithelial sodium channel EnaC, which is expressed in the salt taste cells (Chandrashekar et al. 2010). In contrast to the sweet and bitter receptors, EnaC is expressed in many organs of the human body, including the kidneys. EnaC is the target of amiloride, a diuretic that is known to reduce salt taste (Heck et al. 1984; Brand et al. 1985). EnaC conducts sodium ions from salt that flow into the cell, which excites and releases neurotransmitters to activate the underlying gustatory nerve (Heck et al. 1984; Brand et al. 1985; Eylam and Spector 2003). High concentrations of salt generate both astringent and aversive sensations (Chandrashekar et al. 2010; Oka et al. 2013). Experiments in mice have shown that high concentrations of salt create an aversive effect by activating both bitter and sour taste pathways (Oka et al. 2013). Coolants—such as Frescolat ML [(-)-Menthyl lactate] that are used in oral care, food, and cosmetics (PubChem 2004)—can increase saltiness of a product at different levels (Table 3.4).

Somatosensory Perception of Flavor Chemicals: Hot, Warm, Cold, Texture, Pain, and Irritation

In addition to the olfactory and gustatory systems, many flavorants elicit sensations by activating nerves of the somatosensory system. These nerves transduce physical stimuli, such as temperature (hot, cold); mechanical stimuli (pressure, stroking, texture); pain; and irritation. The oral cavity and nasal passages are innervated by one type of cranial nerve, namely, trigeminal sensory nerves in the head (Figure 3A.2). Inhaling heated smoke activates C-fibers, a subset of trigeminal nerves that mediates warmth perception, heat-induced pain, and the sensation of itching and coarseness. Activation of trigeminal nerves by irritants in the nose triggers the sneezing reflex and nasal secretions. These nerves are activated by pungent spices, such as black pepper, mustard, and wasabi. Trigeminal nerves also contain a nerve subpopulation activated by cooling, such as by drinking cold water or eating ice cream. This nerve population is sensitive to menthol and other cooling agents. The back of the throat, larynx, trachea, bronchi, and lungs are innervated by sensory neurons of a different cranial nerve, namely, the vagus nerve, which originates in the nodose and jugular ganglia. When activated by an irritant stimulus, these neurons can trigger the cough reflex and the perception of burning, bronchoconstriction, and secretions (Figure 3A.3).

Figure 3A.2 Sensing tobacco chemicals and physical stimuli by trigeminal nerve endings

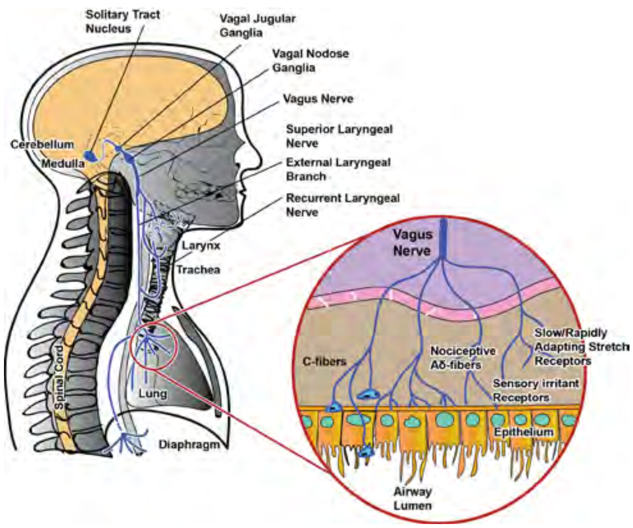


Notes: The sensory nerves innervating the head structures, including the oral cavity and nasal passages, originate in the trigeminal ganglion. These nerves sense irritants in smoke; irritant flavors; menthol and other cooling agents; physical stimuli (e.g., heat, cooling); and mechanical stimuli that contribute to perceptions of viscosity and texture.

Transient Receptor Potential Ion Channels as Sensors for Chemical and Thermal Stimuli

Since the late 1990s, molecular cloning efforts have led to the discovery of unique receptors for chemical and physical stimuli in sensory nerves. One class of receptors consists of members of the TRP ion channel family that respond to both chemical and thermal stimuli (hot, cold). (As noted previously, TRP ion channels are present in, and appear to play a role in, all sensory systems.) These receptors play important roles in sensing the chemesthetic (burning, cooling) properties of flavorant chemicals added to tobacco products, irritants produced during tobacco curing or combustion, and thermal (heat) stimuli associated with tobacco smoke inhalation.

Figure 3A.3 Responses by airway nerves to stimuli from chemicals in tobacco products



Notes: The chemosensory nerves innervating the larynx, trachea, bronchi, and lung originate in the vagal sensory ganglia (nodose, jugular). When excited, these neurons trigger the cough reflex and the perception of burning, and they trigger glandular secretions. When stimulated, these neurons release neuropeptides that promote and maintain inflammation during infections and in chronic conditions, such as asthma.

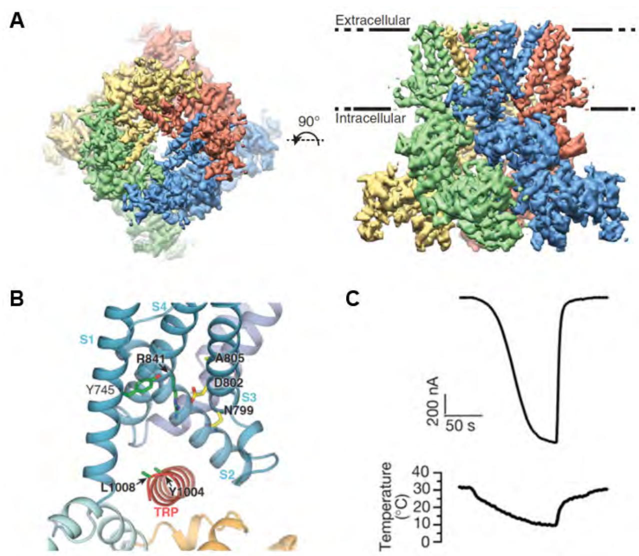
TRPM8: The Cold and Menthol Receptor

The sensation of cooling is initiated when cold-sensitive sensory nerve fibers are excited by cooling or a cooling chemesthetic agent. Hensel and Zotterman (1951) first described cold-sensitive nerve fibers, demonstrating that these fibers are also sensitive to menthol, the cooling chemesthetic natural product of peppermint. In 2002, researchers identified TRP melastatin 8 (TRPM8), a cold- and menthol-sensitive receptor in trigeminal sensory neurons (Figure 3A.4) (McKemy et al. 2002; Peier et al. 2002; Jordt et al. 2003; McKemy 2018). TRPM8 is also activated by numerous other cooling compounds that are used as additives, including AG-3-5 (also called icilin), Coolact P, Cooling Agent 10, FrescolatMGA, FrescolatML, Geraniol, Hydroxycitronellal, Linalool, PMD38, WS-3, and WS-23 (Table 3.4) (Chuang et al. 2004; McKemy 2007). L-menthol stimulates TRPM8 severalfold more than other menthol stereoisomers do (Behrendt et al. 2004; Bandell et al. 2006).

Mice deficient in TRPM8 have deficits in cold sensing and in the excitability of their cold-induced neurons (Bautista et al. 2007; Colburn et al. 2007; Dhaka et al. 2007). Such mice fail to discriminate between warm and cool temperatures in the range of 15°–25°C. Expression profiling of TRPM8 transcripts revealed that TRPM8 is strongly expressed in the trigeminal neurons that innervate the oral cavity and nose (Figure 3A.2) (McKemy et al. 2002; Peier et al. 2002).

The analgesic effects of menthol and other cooling agents, such as icilin and WS-12, occur when TRPM8 is activated in peripheral sensory nerves and, subsequently, central inhibitory circuits that suppress sensory input from nociceptors are activated (Galeotti et al. 2002; Proudfoot et al. 2006; Liu et al. 2013). A mechanism mediated by TRPM8 and initiated by exposure to vapor from menthol inhibits respiratory irritation responses in mice to several irritants in tobacco smoke (Willis et al. 2011). Intriguingly, menthol has not only analgesic effects but

Figure 3A.4 Structure of TRPM8, the menthol and cold receptor



Notes: **A.** Top-down view of the central ion pore (left) and side view (right) of the tetrameric ion channel (Yin et al. 2018). **B.** Transmembrane structural segment of TRPM8 shows the putative menthol binding site (green) coordinated by amino acid residues in transmembrane domain 4 and adjacent domains. Side view (left) and top-down view (right) of the TRPA1 ion channel, a major irritant receptor in peripheral sensory neurons, resolved by cryo-electron microscopy. TRPA1 has a tetrameric structure with a central ion-conducting pore, allowing sodium and calcium ions to flow into sensory nerve endings when the channel is activated by an irritant. Regulatory sites, including irritant binding sites, are localized to the large cytosolic domain of the protein (Yin et al. 2018). **C.** Activation of TRPM8 ion channel by cold temperature. Increase in currents conducted by a TRPM8 expressing cell (top) upon perfusion with gradually cooling physiological buffer (McKemy et al. 2002). A large inward current (top) developed when the bath temperature was reduced and reversed when the bath temperature was increased again. **TRPA1 =** transient receptor potential ankyrin 1; **TRPM8 =** transient receptor potential melastatin 8.

also suppresses itching (Kardon et al. 2014; Stander et al. 2017; Liu and Jordt 2018; Palkar et al. 2018). Similar to the case with pain and respiratory irritation, TRPM8 in cold-sensitive nerve fibers is essential for menthol to act as an antipruritic (i.e., anti-itch) treatment (Liu and Jordt 2018; Palkar et al. 2018). TRPM8-expressing fibers have been shown to connect to inhibitory circuits in the spinal cord that dampen input from nociceptors when menthol or a cool stimulus is applied (Liu and Jordt 2018; Palkar et al. 2018).

TRPA1: The Receptor of Reactive Irritants from Smoke

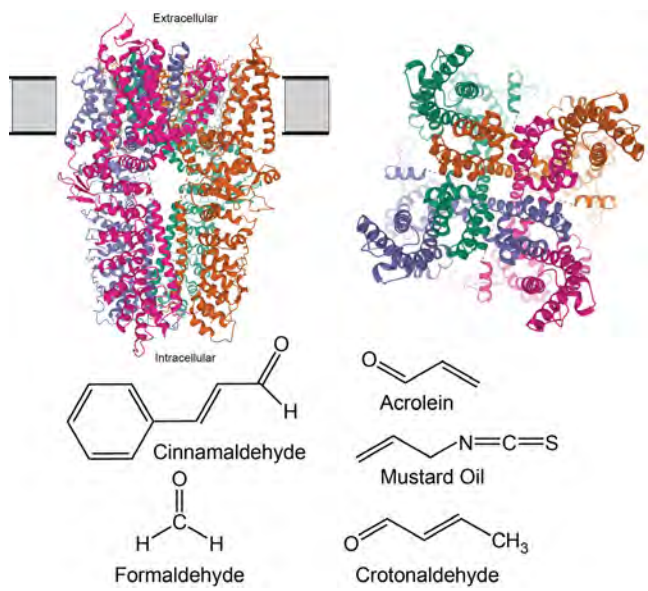
The lungs are highly sensitive to reactive airborne chemicals, which can damage the delicate respiratory epithelia and alveolar structures that are essential for gas exchange (Bein and Leikauf 2011; Conklin et al. 2017). Tobacco smoke, smoke from fires, and smog contain high concentrations of airborne electrophilic volatile chemicals known to cause lung disease. Acrolein, an unsaturated aldehyde, is produced by the combustion of organic matter and is the major electrophile in tobacco smoke; concentrations of acrolein in mainstream cigarette smoke can exceed 50 parts per million (Brunnemann et al. 1990). Acrolein is on FDA's list of HPHCs in tobacco products (FDA 2012). Acrolein has strong irritant effects, causing stinging and burning sensations in the eyes, nose, mouth, and throat (Achanta and Jordt 2017). These sensations originate in the somatosensory nerve endings in the cornea of the eye, nose, mouth, throat, and trachea. Acrolein triggers sneezing and cough, both of which are defensive reflexes designed to clear the airway of potentially injurious irritants, to preserve respiratory function, and to initiate evasive and avoidance behavior (Alarie 1973; Willis et al. 2011). Acrolein stimulates vagal lung-innervating sensory nerves, causing reflex apnea and triggering inflammatory responses through the release of neuropeptides (Lee et al. 1992; Turner et al. 1993).

TRP ankyrin1 (TRPA1) was identified in 2006 as a receptor for acrolein in sensory neurons (Figure 3A.5) (Bautista et al. 2006; Bessac and Jordt 2008). TRPA1 was initially discovered in nociceptors, which are pain-transducing sensory neurons, as a sensor for painfully cold temperatures and a target for mustard oil (allyl isothiocyanate), the pungent ingredient in mustard, horseradish, and wasabi (Jordt et al. 2004). Similar to acrolein, mustard oil is a small reactive chemical (an isothiocyanate) that reacts with proteins to form a chemical bond. For decades, neuroscientists used mustard oil and similar natural pain-inducing products to study pain mechanisms and to develop new analgesic treatments (Jordt et al. 2004; Bautista et al. 2005). When mustard oil binds to TRPA1, the channel opens and allows sodium and calcium ions to permeate the nerve endings, triggering an action potential that propagates along the nerve fiber toward the spinal cord.

Nerve connections in the spinal cord integrate the pain signal and transduce it to the brain, where pain is represented in the somatosensory cortex (Basbaum et al. 2009). The discovery of TRP ion channels in pain-sensing nerves was a breakthrough in the neuroscience of pain, initiating many follow-up studies that investigated the roles of ion channels in chemical sensing and acute and chronic pain conditions.

Subsequent studies identified many other electrophilic and oxidizing activators of TRPA1, including croton aldehyde and methacrolein, which are also found in tobacco smoke and ozone and chlorine gas, and are all strongly noxious irritants (Bessac et al. 2008; Escalera et al. 2008; Taylor-Clark and Undem 2010). Structure–function analysis revealed that TRPA1 is not a receptor

Figure 3A.5 Structure of TRPA1, the major irritant in smoke and aldehyde receptor

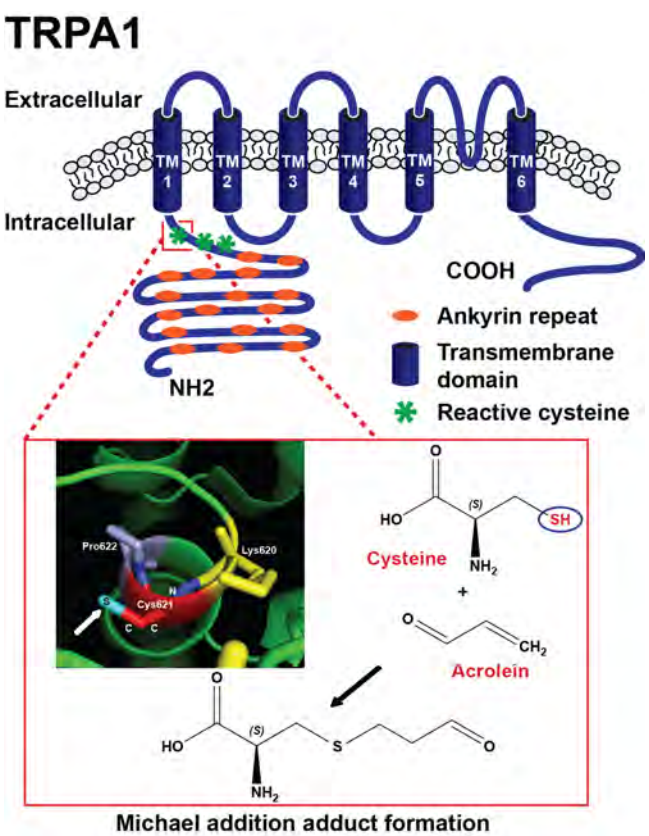


Notes: Side view **(left)** and top-down view **(right)** of the TRPA1 ion channel, the major irritant receptor in peripheral sensory neurons, resolved by cryo-electron microscopy (Suo et al. 2020). TRPA1 has a tetrameric structure with a central ion-conducting pore, allowing sodium and calcium ions to flow into sensory nerve endings when the channel is activated by an irritant. Regulatory sites, including irritant binding sites, are localized to the large cytosolic domain of the protein. TRPA1 is activated by noxious natural products, such as mustard oil (allyl isothiocyanate), the pungent ingredient in mustard. It is the primary target of the major irritants in smoke, acrolein and croton aldehyde, and formaldehyde. Aldehyde flavor chemicals in tobacco products, such as cinnamaldehyde, activate TRPA1 and may cause irritation. **TRPA1 =** transient receptor potential ankyrin 1.

in the classical sense; instead, it is a sensor for chemical reactivity that is activated by electrophiles and oxidants through covalent modification (Hinman et al. 2006; Macpherson et al. 2007). A cluster of cysteine residues in the cytosolic N-terminus of TRPA1 is essential for activation by electrophiles; C621, a highly reactive cysteine residue, is the likely reactive center (Hinman et al. 2006; Macpherson et al. 2007; Bahia et al. 2016) (Figure 3A.6).

Many of the flavor chemicals added to tobacco products are aldehydes. These aldehydes usually have a pleasant smell, but when concentrations exceed certain levels, flavor aldehydes can be irritating, eliciting burning sensations in the eyes and airways (Bandell et al. 2004). One example is cinnamaldehyde, the flavor aldehyde in cinnamon flavors. Cinnamaldehyde is an alpha-beta-unsaturated aldehyde and has chemical reactivity similar to the irritating smoke aldehydes: acrolein and croton aldehyde (Figure 3A.6). Cinnamaldehyde has been identified as a TRPA1 agonist, causing both pain and respiratory irritation (Bandell et al. 2004). Benzaldehyde, vanillin, and acetaldehyde—listed on FDA's list of HPHCs in tobacco products (FDA 2012)—and other fragrant and flavor aldehydes have been shown to activate TRPA1 (Bang et al. 2007; Mihara and Shibamoto 2015; Erythropel et al. 2017). TRPA1 is also activated by reaction products of flavor aldehydes and propylene glycol, the e-cigarette solvent. For example, benzaldehyde propylene glycol acetal, formed from benzaldehyde and propylene glycol in chemically unstable e-liquids, is a more efficacious TRPA1 agonist than benzaldehyde, suggesting these chemicals act as irritants (Erythropel et al. 2019).

Figure 3A.6 Mechanism of irritant activation of TRPA1



Notes: TRPA1 is activated by irritants in smoke and other irritating airborne chemicals that covalently react with the receptor on electrophile binding sites that are clustered within the cytosolic N-terminus of the channel protein. Cysteine 621 **(inset)** is a key site highly sensitive to electrophile modification (Paulsen et al. 2015). The Michael addition reaction of cysteine with the major smoke irritant, acrolein, is shown. **TRPA1 =** transient receptor potential ankyrin 1.

L-menthol has been identified as a TRPA1 agonist, suggesting that TRPA1 may mediate its irritant effects (Bandell et al. 2004; Macpherson et al. 2006; Xiao et al. 2008). The binding site for menthol has been mapped to the fifth transmembrane domain of the TRPA1 peptide (Xiao et al. 2008). Higher concentrations of L-menthol are required to activate TRPA1 than those that are required to activate TRPM8, and significant differences in sensitivity have been reported across species (Macpherson et al. 2006; Karashima et al. 2007; Xiao et al. 2008).

Methyl salicylate, the wintergreen flavor, is also an agonist of TRPA1, as is eugenol, which is found in clove and is also a flavor chemical (Bandell et al. 2004; Inoue et al. 2012; Chung et al. 2014). Both methyl salicylate and eugenol are used as topical analgesics and counterirritants at high concentrations, likely acting through receptor desensitization.

TRPV1: The Heat or Acid Receptor

TRP vanilloid 1 (TRPV1) was the first sensory neuron-specific TRP ion channel discovered, identified through its interaction with capsaicin, the pungent ingredient in chili peppers (Caterina et al. 1997). TRPV1 is also activated by noxious heat, mediating heat pain, and by acidity that potentiates its sensitivity to thermal and chemical stimuli (Tominaga et al. 1998; Jordt et al. 2000). Similar to TRPA1, TRPV1 is activated by methyl salicylate, the wintergreen flavor, and by eugenol, the clove flavor (Ohta et al. 2009). TRPV1 was identified as a target of flavorant-solvent reaction products—including vanillin-propylene glycol acetal (Erythropel et al. 2019)—that are vaporized from chemically unstable e-liquids, likely contributing to their irritant effects. TRPV1 is sensitized by nicotine, increasing sensitivity to chemical agonists (Liu et al. 2004).

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Chapter 4
Social and Environmental Influences on Tobacco-Related Health Disparities

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Introduction

This chapter describes the evidence for many of the multifaceted influences on tobacco-related health disparities that go beyond individual factors. The evidence draws heavily on a socioecological model that situates individual behaviors within a multilevel framework of interpersonal, community, or neighborhood environments and larger societal and policy contexts (McLeroy et al. 1988). It also draws on the premise that individual tobacco use is heavily influenced by the social determinants of health: "conditions in the environments in which people are born, live, learn, work, play, worship and age, that affect a wide range of health, function and quality-of-life outcomes and risks" (Office of Disease Prevention and Health Promotion n.d.). Accordingly, this chapter builds on the following conclusion from the 1998 Surgeon General's report:

> "No single factor determines patterns of tobacco use among racial/ethnic minority groups; these patterns are the result of complex interactions of multiple factors, such as socioeconomic status [SES], cultural characteristics, acculturation, stress, biological elements, targeted advertising, price of tobacco products, and varying capacities of communities to mount effective tobacco control initiatives" (U.S. Department of Health and Human Services [USDHHS] 1998, p. 6).

This chapter goes beyond diverse racial and ethnic populations to examine the social and environmental factors that influence tobacco-related health disparities among a broader set of population groups, including sexual orientation and gender identity groups and socioeconomically disadvantaged populations. The chapter also examines social and environmental influences on tobacco-related health disparities by age, sex, geographic location, and occupation as data are available.

Figure 4.1 provides a causal loop diagram (CLD) and theoretical model that visualizes the complex, interconnected structural, environmental, individual, and root causes of smoking that lead to tobacco-related health disparities (Mills et al. 2023). This model developed by Mills and colleagues (2023)—based on existing conceptual and empirical theories of smoking, social stress theories, and fundamental cause theory—was revised with feedback from researchers and tobacco control stakeholders (Link and Phelan 1995; Phelan et al. 2010; Phelan and Link 2015). The CLD model is intended to identify variables that are positively or negatively correlated with smoking (or quitting) and generate hypotheses of both intended and unintended consequences of interventions as they pertain to tobacco-related behavioral outcomes (Mills et al. 2023).

This chapter, together with Chapter 5, builds on this CLD model (Figure 4.1) to show that these nested systems—the social, environmental, and commercial influences including those from the tobacco industry—are complex and interrelated. Early life experiences and chronic stressors, such as discrimination, can influence the tobacco use continuum, including initiation; current use and the frequency and intensity of use; quitting and relapse; exposure to secondhand tobacco smoke; and ultimately, morbidity and mortality. Social, environmental, and tobacco industry influences can affect patterns of tobacco product use over time at the individual level and at the societal level.

Leveraging the CLD model, this chapter reviews the scientific literature published between 2008 and 2021 on how social and environmental factors influence tobacco use among diverse populations (Box 4.1). While addressing a wider variety of tobacco products than cigarettes, this chapter seeks to add to but not duplicate evidence published in National Cancer Institute (NCI) Tobacco Control Monograph 22, which included related searches of literature typically published between 2000 and 2011 (NCI 2017b). This chapter includes scientific findings from systematic literature reviews conducted before 2008 to provide context and understanding of historical trends in effects between social influences and tobacco-related health disparities.

Box 4.1 Social and environmental influences on disparities in tobacco product use explored in this chapter

Social influences:

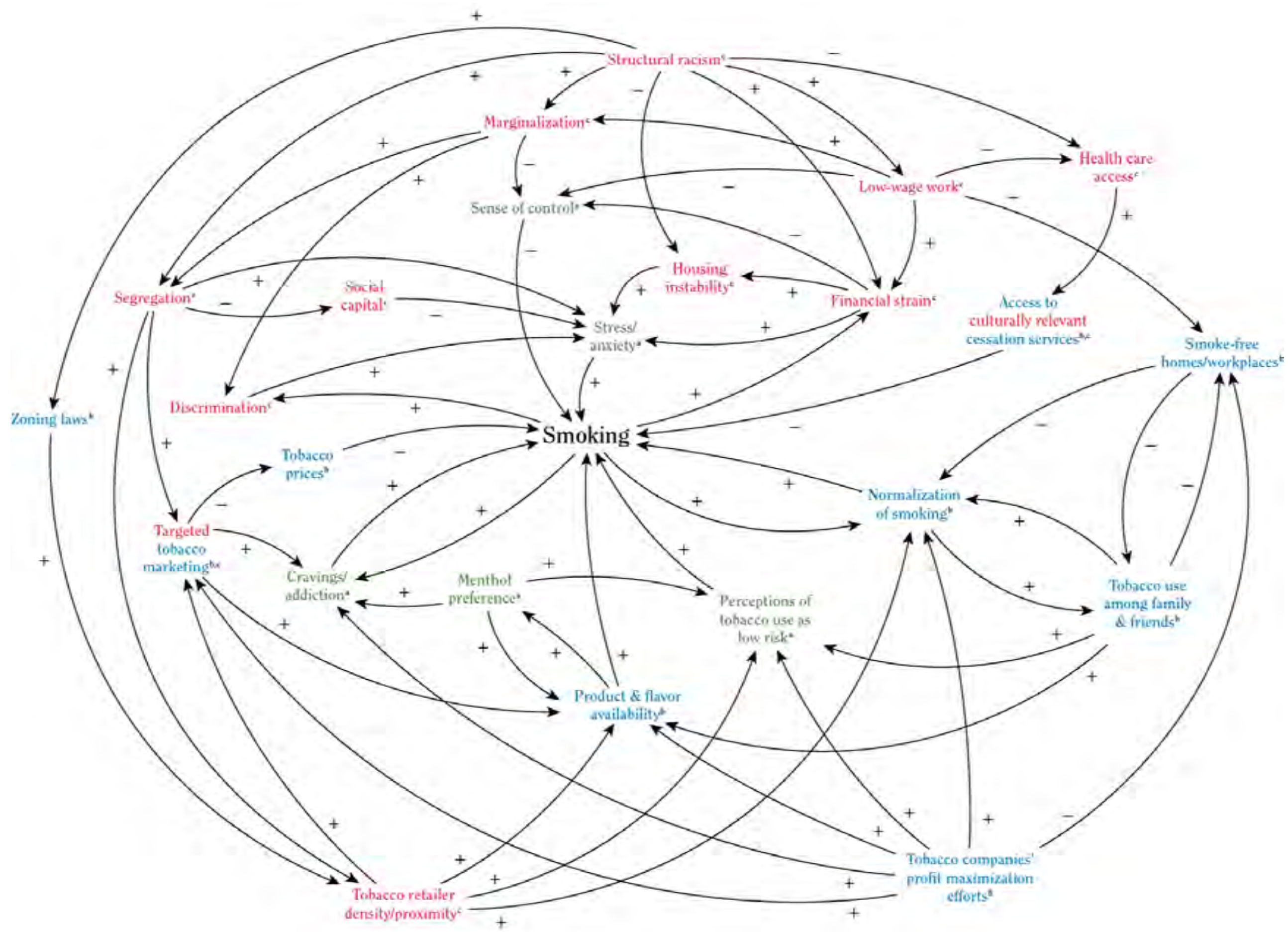
- Family and peer influences and their interactions
- Religion
- Discrimination
- Acculturation

Environmental influences:

- Home
- School
- Work environments
- Healthcare

Figure 4.1 shows how social factors, environmental influences, and activities of the tobacco industry combine to influence smoking and individual risk of tobacco-related health disparities. To the extent possible, this

Figure 4.1 Causal loop diagram that links structural, environmental, and individual causes of racial and ethnic and socioeconomic disparities in smoking



[a]Green:	Individual factors
[b]Blue:	Environmental factors
[c]Red:	Root causes or fundamental factors
+ sign	Variables move in the same direction
– sign	Variables move in the opposite direction

Source: Figure 2 in Mills and colleagues (2023); adapted with permission.

chapter focuses on how various influences may contribute to the generation or persistence of tobacco-related health disparities rather than simply on how each factor may influence tobacco use in general. Where possible, this chapter focuses on systematic literature reviews of studies that compare demographic groups within the U.S. context or examine differences within population groups experiencing tobacco-related health disparities. Chapter 7 more fully addresses the impact of interventions and policies on tobacco-related health disparities.

Social Influences

Social influences on tobacco use include interpersonal influences, such as peers, family members, and other members of a person's social network; religious and cultural influences, which inform acculturation status and ethnic identity; and adverse interpersonal influences, such as experiences with discrimination. The 2012 Surgeon General's report, *Preventing Tobacco Use Among Youth and Young Adults*, identified social influences as "among the most robust and consistent predictors of adolescent smoking" (USDHHS 2012, p. 563). The studies in this section were examined to determine whether the strength of the association between particular social influences and tobacco product use or tobacco-related health disparities varies across other demographic groups beyond adolescents.

Literature Review Methods

Studies reviewed for this section were initially identified in 2018 and updated in December 2021 through a literature search of several databases, including PubMed, ABI Inform, EBSCO, PsycINFO, and Web of Science. Specific search terms are listed in Table A4.1 (Appendix 4.1). The search was restricted to peer-reviewed empirical studies that were published in the English language between 2008 and December 2021. The search prioritized systematic reviews but also included relevant peer-reviewed studies not in reviews (e.g., findings from randomized controlled trials). Studies were excluded if they did not address a tobacco-related disparity (e.g., prevalence of tobacco use, tobacco-related morbidity or mortality that occurs at a disproportionately higher rate in a social or demographic group in the United States) in their examination of the association between social influence and tobacco use. Articles that included only the "main effect" of a related social influence on tobacco use not focused on a disparity group were generally excluded, as were non-U.S. studies. Included articles were divided into six categories: family and peers; religion and culture; discrimination; acculturation; ethnic identity; and trauma, violence, or adverse childhood events.

Family and Peer Influences

Social influences from family and peers are associated with tobacco product use (Hoffman et al. 2006; Simons-Morton and Farhat 2010; Cengelli et al. 2012; Seo and Huang 2012; Agaku et al. 2013; Wellman et al. 2016; Perikleous et al. 2018). In the CLD model (Figure 4.1), tobacco use among family and friends reinforces the normalization of smoking and perception of tobacco use as low risk, which encourages smoking behavior among other family and friends. Several studies have examined whether the effects of family and peer characteristics on tobacco use differ between specific groups of populations to a greater or lesser extent than among other population groups.

Family Influences

Studies of family influences on tobacco use focus on family members' smoking behaviors and characteristics of the parent–adolescent relationship, including parenting behaviors. This section is organized according to these types of family influences. More specifically, this section breaks down the comparative analytic procedures that are used to determine associations between sociodemographic characteristics and tobacco-related health disparities (e.g., race and ethnicity, SES, sex/sexual orientation and gender identity, or age). Parental smoking has been shown to predict adolescent smoking in longitudinal studies (Vuolo and Staff 2013; Vandewater et al. 2014). In a study examining associations between parent and adolescent smoking, Kandel and colleagues (2015) used 2004–2012 data from the National Survey on Drug Use and Health (also see Appendix 2.1, Chapter 2) to compare intergenerational patterns of lifetime smoking and nicotine dependence among a sample of 35,000 parent–adolescent dyads. Current smoking by parents was found to be a risk factor for adolescent lifetime smoking regardless of the level of parental nicotine dependence, and this association did not differ by race or ethnicity. However, White youth and their parents were more likely to smoke and have nicotine dependence than African American or Hispanic youth and their parents (Kandel et al. 2015).

Studies have investigated the effect of parental psychosocial factors on adolescent smoking behaviors. For example, Mahabee-Gittens and colleagues (2012) assessed the association between various parenting behaviors and cigarette smoking among 6,426 African American, Hispanic, or White adolescents in the National Survey of Parents and Youth, a longitudinal, nationally representative household survey of parent–adolescent dyads. The study analyzed data from 7,620 youth who were interviewed in Round 1 of the study; data were collected from November 1999 through June 2001. Parenting factors included family influences—which grouped together connectedness, shared activities, parental monitoring, intention to monitor, attitudes toward monitoring, and antismoking communication—and parental punishment. After controlling for various individual (e.g., age, gender, peer smoking) and parent–family (e.g., parent education, parent smoking status, family income, family structure) covariates, higher levels of family influences and parental punishment were protective against ever and recent smoking among youth in all three racial and ethnic groups. However, all adjusted odds ratios (ORs) reflected relatively small effects.

In a similar study, Bohnert and colleagues (2009) used a representative sample of 572 Black and White children from a large Midwest metropolitan region to examine racial differences in the association between parental monitoring and adolescent smoking initiation. This longitudinal study found that close parental monitoring of 11-year-old children predicted a reduced likelihood of smoking initiation when those children reached 17 years of age; this effect was seen among White children but not among Black children. The authors found no evidence that parental monitoring influenced escalation to daily smoking among Black or White youth who had experimented with smoking. These findings align with previous studies suggesting a greater protective effect of parental monitoring in White youth than in Black youth (Griesler et al. 2002; Nowlin and Colder 2007; Ramchand et al. 2007).

Stanton and colleagues (2014) surveyed 459 eighth graders from Hispanic, African American, White, and mixed ethnic backgrounds to determine the association between smoking among youth and authoritative parenting styles and parental communication that includes antitobacco communication (things parents do or say to reduce the likelihood of their child using tobacco). Parental antitobacco communication was inversely associated with smoking overall, as youth were less likely to use tobacco if their parents discouraged such use. This association did not vary by race and ethnicity, even though the study design allowed for testing hypothesized differences in effects by racial and ethnic group. The authors speculated that an authoritative parenting style might reduce tobacco use in youth across racial and ethnic groups. Future research could clarify this mechanism for racial and ethnic groups.

Elsewhere, Gutman and colleagues (2011) compared cigarette smoking among 1,102 African American families and White families by examining the trajectories of cigarette use in 13- to 19-year-old adolescents. Their longitudinal study focused on shared parent–adolescent decision making, negative family interactions, and identification with parents. Family relations differentially affected cigarette use depending on race and sex. Shared parent–child decision making appeared to decrease cigarette smoking among boys but increase smoking among girls. The association between negative family interactions and cigarette smoking was stronger among African American boys than among White boys but was stronger among White girls than among African American girls.

An analysis of data from the 2002–2003 National Latino and Asian American Study examined the relationship between different dimensions of social capital and the prevalence of smoking among 998 Chinese, Filipino, and Vietnamese American men (Li and Delva 2012). Social capital was measured by self-report and included family and friend connections, neighborhood and family cohesion, and family conflict. For Asian American men overall in the study, neighborhood cohesion was inversely related to smoking, but the other social capital variables were not. In an analysis stratified by Asian ethnic group, neighborhood cohesion was significantly inversely associated with smoking only among Vietnamese American men; the direction of the association for the other Asian ethnic subgroups was similar. Further, family cohesion was associated with increased odds of smoking among Filipino American men. The authors speculated that neighborhood social norms might have protective effects against smoking for Vietnamese men and that traditional Filipino family values may influence positive attitudes toward smoking for men. It is important to note that similar gendered family values reported in the study for Filipino culture are also prevalent in Chinese and Vietnamese cultures, but the study found no significant associations among these groups.

In summary, an evaluation of the limited available evidence on the effects of family psychosocial factors on smoking suggests that the effects of parental tobacco use, parental beliefs, and parent–child communication on adolescent tobacco use exist but are small and somewhat mixed across racial and ethnic groups. Further understanding of family-level protective factors that influence adolescent tobacco use can inform intervention efforts.

Peer Influences

According to the 2012 Surgeon General's report, "smoking by one's peers is a robust predictor of current smoking, regular smoking, and the transition to regular smoking and has a strong influence in adolescence" (USDHHS 2012, p. 559). The 2012 Surgeon General's report further states that,

> "Peer influences seem to be especially salient, perhaps because adolescence is a time during which school and peer group affiliations take on particular importance. Adolescents tend to overestimate the prevalence of smoking among their peers, and perceptions that one's peers smoke consistently predict use of tobacco. Another well-established finding is that adolescents are more likely to smoke if they have friends who smoke" (p. 563).

Given that the 2012 Surgeon General's report provides strong evidence of the primary effect of peer influences on adolescent smoking initiation, this section highlights (1) studies that assess the relationship between peer smoking and smoking behaviors among adolescents from minoritized racial and ethnic groups and (2) evidence that explains how peer social norms shape smoking behaviors.

This section examines studies from the National Longitudinal Study of Adolescent to Adult Health (referred to as the Add Health cohort in this report), a nationally representative sample of 20,745 U.S. students in Grades 7–12 recruited from 132 schools in 1994–1995 (Wave I). The Add Health cohort has been followed across five waves (Add Health n.d.). Although the Add Health cohort predates electronic cigarettes (e-cigarettes) and some other currently available tobacco products commonly used by youth, the nationally representative sample enables within-person comparisons over time and allows for inference about peer influences regarding smoking.

Amin and Lhila (2016) applied a nonlinear decomposition method to data from Wave III (2001–2002 data collection) of the Add Health cohort, which resulted in a final sample of 14,679 adolescents. The study sought to determine the extent to which exposure to peer smoking or smoking in the home accounted for racial gaps in the prevalence of smoking among adolescents or the probability of smoking in young adulthood (18–24 years of age), while controlling for not smoking in adolescence and other sociodemographic variables. Results showed that White adolescents had the highest probability of having a mother who smokes, having cigarettes available in the home, and having a larger percentage of friends who smoke; they were also more likely to smoke themselves than were Black and Hispanic peers in adolescence and young adulthood, which the authors refer to as a "gap." The authors found that peer social norms and exposure to smoking in the home accounted for 26–50% of this gap in smoking prevalence during adolescence and young adulthood between White and Black people and between White and Hispanic people in the cohort. The study authors noted a limitation of this study, namely that other unmeasured endogenous variables are potentially correlated with outcomes and may underestimate the effect of peer smoking. This study suggests that exposure to peer smoking or smoking in the home account for some of the racial and ethnic gaps observed in rates of smoking among youth. Future research could consider the typical later onset of smoking among Black people and the light daily smoking pattern among Hispanic American people who smoke.

Social popularity among teens has been hypothesized to influence adolescent smoking. In another analysis of data from the Add Health cohort from 1995 (Wave I), Robalino and Macy (2018) examined how smoking among popular adolescents in a particular grade influenced future prevalence of smoking among their peers. To measure the popularity of students in a grade, the authors analyzed school social network data for 7,500 students and calculated a smoking propensity score for students according to quintiles of popularity. The study found that greater popularity of students who smoked increased the probability of individual smoking for other students in the same grade level. Specifically, the results showed that if the top 20% of the most popular teens in a grade smoked, then the probability of nonsmoking youth trying cigarettes the following year increased by 17.8% ($P = .01$). In contrast, to reduce the probability of future smoking, 80% of the least popular teens would need to not smoke. These peer-related effects persisted 7 years (Wave III) and 14 years (Wave IV) later. Although this analysis did not focus on disparities, the authors reported that correlates of unpopularity included being Black, Hispanic, overweight, and being an immigrant youth. These results suggest that smoking among a small proportion of popular teenagers can inform social norms in favor of smoking among other youth. It is possible that social influences on tobacco use patterns for youth from minoritized racial and ethnic groups and other groups (e.g., youth who identify as lesbian, gay, bisexual, transgender, queer, or intersex [LGBTQI+]) are mechanistically different from those of their popular and nonpopular peers, which warrants further research.

Many studies on how social factors affect adolescent smoking rely on self-reports of tobacco use among members of one's own social network, which is subject to recall bias and social desirability effects. To help overcome this limitation, Hatzenbuehler and colleagues (2015) conducted a social network analysis using Add Health cohort data on 14,319 adolescents. Their analysis of adolescents' reported friendship networks, which was matched with the friends' reported tobacco use, resulted in an objective measure of the number of people who used tobacco in each friendship network. Consistent with past studies (Hoffman et al. 2006), Hatzenbuehler and colleagues (2015) found that adolescents' smoking intensity correlated positively with the smoking intensity of other adolescents in their friendship network. A separate analysis found no significant moderation by LGBT status; the association between friends who smoked and smoking by the respondent was equally as strong among adolescents who were LGBT as it was among adolescents who were heterosexual.

In a longitudinal study that followed 1,950 students in 9th and 10th grades from Southern California schools for 2 years, Valente and colleagues (2013) conducted a social network analysis on perceived peer smoking and the influence of popular peers on adolescent smoking. Data were collected from seven urban schools with predominantly Hispanic students. Given that youth may overestimate their peers' smoking behaviors, the authors tested the hypothesis that egocentric measures of friends' smoking (i.e., perceptions of friends' smoking behaviors) are more strongly associated with individuals' smoking behavior than with sociometric measures (i.e., friends' self-report of smoking behaviors). Models were adjusted for sociodemographic variables. As hypothesized, an egocentric measure of perceived friend smoking was positively and consistently associated with individual smoking. The sociometric measure of friends' self-reported smoking was associated only with smoking in the ninth grade (based on a cross-sectional analysis). Finally, increased popularity was associated with adolescents' becoming people who smoke (based on a longitudinal analysis). Adolescents tended to inaccurately estimate their friends' smoking status. Findings suggest that peer influence and social context affect adolescent smoking behavior among Hispanic adolescents in urban school settings. Findings may not generalize to social dynamics at nonurban schools with low enrollment of Hispanic students or for adolescents not in school. Future research could identify mechanisms of peer influence and social context among popular teens and how they influence the use of a range of tobacco products among adolescents and additional groups by race, ethnicity, sexual orientation and gender identity, and other factors.

It is also important to understand social influences, including descriptive norms, on adolescents' beliefs, by race and ethnicity, about e-cigarettes. Agaku and colleagues (2020) utilized the cross-sectional data from the National Youth Tobacco Survey (NYTS) from 2016 to 2017 to examine associations between exposure to secondhand e-cigarette aerosol and secondhand tobacco smoke in public places and (a) overestimation of peer e-cigarette use (a measure of descriptive norms), (b) harm perceptions of e-cigarettes, and (c) susceptibility to e-cigarette use among 24,353 U.S. middle and high school students who had never used tobacco products. Among all youth in this analysis, exposure to secondhand e-cigarette aerosol and secondhand tobacco smoke was associated with increased adjusted odds of overestimating peer e-cigarette use and decreased odds of perceiving e-cigarettes to be harmful, compared to those not exposed to secondhand e-cigarette aerosol or secondhand tobacco smoke. Compared to White youth, Hispanic youth had higher adjusted odds of overestimating peer vaping, curiosity, and susceptibility to vaping and lower adjusted odds of reporting harm perceptions. Black youth had lower harm perceptions and greater curiosity about vaping relative to White youth.

In an online survey of 1,549 U.S. teens (13–18 years of age) who had ever tried e-cigarettes or other electronic nicotine delivery systems (ENDS), Groom and colleagues (2021) found that the odds of reporting a friend as the source of their first ENDS product differed significantly by race and ethnicity, urbanicity of residence, and level of family income. The odds of trying their first ENDS product while "hanging out with friends" was significantly higher among teens who were non-Hispanic White, Hispanic, members of higher income families, and had received ENDS advertising and marketing through social media than it was among teens who were non-Hispanic Black, members of lower income families, and had received ENDS advertising and marketing through nonsocial media sources.

Hong and colleagues (2012) also explored, through a survey of African American and White 9th- and 12th-grade students in Louisiana, descriptive social norms and injunctive social norms on tobacco use. Descriptive social norms were defined by how many friends of a person smoked cigarettes, and injunctive social norms involved how the friends of a person would react if that person smoked cigarettes. Race moderated the relationship between descriptive norms and smoking behavior for students in 12th grade but not in 9th grade. At high levels of endorsement of descriptive norms, White students in 12th grade had a significantly higher prevalence of smoking than their African American counterparts. In contrast, injunctive norms did not influence smoking behavior in either group.

Studies examining peer influences on smoking tend to focus on adolescents. However, a study of urban, African American adults who smoked (Crossnohere et al. 2020) examined, with stratification by gender (n = 200 women, n = 335 men), the association between nicotine dependence and cessation norms and quitting behaviors. The term *descriptive social norms* was defined as having friends who quit smoking, and the term *injunctive social norms* was defined as having friends who disapproved of smoking. Findings showed that the inverse relationship between nicotine dependence and quitting behavior was attenuated for African American men with moderate-to-high dependence if they had friends who quit smoking; quit attempts by African American men were not influenced by friends' disapproval of smoking, controlling for having friends who quit smoking. However, quit attempts by African American women were not influenced by type of social norm or level of nicotine dependence, suggesting different environmental or social factors influence quitting behaviors among Black men and women. Results emphasize the importance of stratification by gender when examining the role of social norms on smoking, particularly among African American people.

In summary, peers exert strong influences on smoking during adolescence. White adolescents may be particularly influenced by the social context in which smoking occurs. Additional cultural variables might also influence smoking trajectories for adolescents from minoritized racial and ethnic groups. Future studies could identify the factors and mechanisms driving the use of multiple tobacco products and the smoking cessation behaviors of youth and adults from groups that are disproportionately affected by tobacco-related health disparities.

Interaction of Family and Peer Influences

Research into factors that influence adolescent smoking has focused primarily on either family influences or peer influences. Family and peer influences are not truly independent, however, because family factors can affect peer interactions and vice versa. To begin to address this gap, Brook and colleagues (2010) followed a school-based sample of 475 African American and Puerto Rican adolescents living in Harlem, New York City, from adolescence to their mid-20s. The study tested a theoretical model positing that parent–child conflict during adolescence leads to (a) cigarette smoking during adolescence and (b) affiliation with peers who use drugs and exhibit antisocial behaviors in early adulthood. The positive association the authors found between parent–child conflict during adolescence and smoking status during early adulthood was mediated by children's involvement in antisocial behavior and affiliation with peers who used drugs; however, this association did not differ between African American and Puerto Rican people or by sex. A statistically significant association was also found between affiliation with peers who used drugs in early adulthood and smoking status during that period, but again, did not differ between African American and Puerto Rican people or by sex. Findings from this longitudinal study show that characteristics of parental and peer relationships during adolescence can influence young adult cigarette smoking for African American and Puerto Rican people.

Summary and Future Research

The evidence reviewed in this section demonstrates that social influences from family members and peers are associated with adolescent smoking, and there may be important differences in these associations by race and ethnicity and by sex. Studies reviewed in this section demonstrate that parental smoking is associated with adolescent smoking, and this relationship is consistent across adolescents from various racial and ethnic groups. The findings from cross-sectional and longitudinal studies also suggest a relationship between parenting behaviors and characteristics (e.g., connectedness, monitoring, punishment, antitobacco communication, parent–adolescent decision making, negative family interactions) and adolescent smoking. However, there may be differences in some of these associations by race and ethnicity and by gender.

Data from the studies reviewed in this section demonstrate that peer smoking is associated with smoking among White, Black, and Hispanic American adolescents, and that greater exposure to peer and family smoking among White adolescents may help to account for gaps in smoking prevalence observed between White youth and youth from other racial and ethnic groups. Additional peer influences that may be associated with adolescent smoking include the prevalence of smoking among the most popular students at school, friends' smoking intensity, and peer social norms. Some of these relationships also vary by race and ethnicity among adolescents.

A limitation of the literature to date is its emphasis on cigarette smoking behaviors. Although cigarette smoking has declined since 1991, data from the NYTS show that the prevalence of use of other forms of tobacco has increased among youth, and e-cigarettes have been the most commonly used tobacco product among middle and high school students since 2014 (Gentzke et al. 2019; National Academies of Sciences, Engineering, and Medicine 2020). Furthermore, the prevalence of cigarette and cigar use has been similar among youth in recent years (Gentzke et al. 2020; Park-Lee et al. 2022), but this is not consistent across population groups. For example, in 2020, the prevalence of cigar use was more than twice as high among Black youth (6.5%; 95% confidence interval [CI], 5.2–8.2) than White youth (2.8%; 95% CI, 2.1–3.7) (Gentzke et al.

2020). Most of the studies reviewed in this section that examined disparities in peer and parental influences on tobacco product use among adolescents included data that preceded the use of e-cigarettes by adolescents. Furthermore, much of the literature did not account for multiple tobacco product use. Thus, more research is needed to determine whether disparities exist in (a) the strength of family and peer influences on tobacco product use across the lifespan (from adolescence into older adulthood), as people transition from infrequent use to heavier use and develop nicotine dependence; and (b) the relationship between family and peer influences and e-cigarette use, as well as the use of multiple types of tobacco products among adolescents from various racial and ethnic groups. Finally, additional research is needed that examines the impact of family and peer influences on tobacco product use among American Indian and Alaska Native adolescents and among adolescents by other demographic characteristics, such as sexual orientation and gender identity, SES, and geographic region.

Tobacco Product Use, Religion, and Culture

Religious influences are part of the larger social environment in which individuals, families, and peers may develop perceptions about tobacco use and beliefs about its social and physical effects (USDHHS 2012). Religions generally constrain the use of tobacco, despite large variations in their doctrines, and some forbid it altogether—such as Islam (Garrusi and Nakhaee 2012) and the Church of Latter-day Saints (Merrill and Thygerson 2001). Some populations of American Indian communities view tobacco as sacred, preserving its use for healing and ceremonial purposes. Chapter 1 of this report outlines the history of the commercialization of sacred and ceremonial tobacco.

Use of certain tobacco products has also been linked to cultural practices. In parts of South Asia and the Pacific Islands, crushed areca nut (also called betel nut, betel quid, or betel paan) is typically used as part of a mixture that often contains tobacco and other additives or flavorants (e.g., cardamom, sugar), which is chewed and has stimulant effects on the nervous system via absorption through the buccal mucosa (IARC Working Group on the Evaluation of Carcinogenic Risks to Humans 2004). Betel nut, which is also referred to as cultural smokeless tobacco (CST) when used for cultural practices among aggregate populations of Asian American people in the United States, can also be used as part of Hindu practices or social customs among people with ties to South Asia, the Middle East, or the Pacific Islands (Niaz et al. 2017; Mukherjea et al. 2018). In the 2004 cross-sectional California Asian Indian Tobacco Use Survey of 1,618 South Asian people surveyed in California, factors associated with CST use included being male, being 50 years of age and older, being an immigrant, speaking an Asian Indian language at home, having attained a higher level of education (i.e., high school/some college), having a higher income, identifying as non-Sikh, and disagreeing that spiritual beliefs are the foundation of life (Mukherjea et al. 2018). Health effects from frequent betel nut use include having discolored teeth and gums, activating the sympathetic nervous system, and developing oral cancers (IARC Working Group on the Evaluation of Carcinogenic Risks to Humans 2004). The causal relationship between the use of smokeless tobacco (with or without areca nut) and oral cancers has been consistently supported in the literature (NCI 2014; Niaz et al. 2017), and such use is associated with the high incidence of oral cancers in India (Mishra et al. 2012; Mukherjea et al. 2014).

Although the prevalence of the use of smokeless tobacco with or without areca nut is estimated to be the highest in India (25.9%) and Bangladesh (27.2%), rates are notable across the Middle East, North Africa, and the Pacific Islands (Niaz et al. 2017). Among a population-based sample of self-identified immigrants from India (analytic sample of 2,140 participants) to the United States (California), 65% had ever used a CST product, whereas only 25% had ever used commercial tobacco (cigarettes, cigars, pipes, chewing tobacco, snuff) (Patel et al. 2018). Practices and social customs involving the use of CST warrant further investigation; such information might be integrated into culturally sensitive tobacco prevention and treatment interventions for people from racial and ethnic groups who are known to use CST.

The Role of Religion in Differences in the Prevalence of Smoking Between Black or African American and White People

The 2012 Surgeon General's report, *Preventing Tobacco Use Among Youth and Young Adults* (USDHHS 2012), described several studies in which the prevalence of smoking was lower among people who participated in religious activities compared with those who did not, or in which religious traditions served as protective factors against escalation of smoking. In a cross-sectional analysis of 4,776 Black and White 11th graders enrolled in a longitudinal study, findings showed that although Black adolescents had stronger religious beliefs against smoking than White adolescents, the protective effects of religion against smoking were stronger for White adolescents than Black adolescents (Alexander et al. 2016). The effect may be attributable to private religiosity (e.g., frequency of prayer), role modeling or monitoring by parents, less tobacco use among religious peers, or other factors (USDHHS 2012).

Although several studies have examined the role played by religion and cultural identity in the prevalence of smoking within a population, few studies have considered how the association may widen or diminish gaps in tobacco use between population groups. In one such study, Holt and colleagues (2015) examined a nationwide sample of 2,370 African American adults and found that religious behaviors, such as church attendance, were protective against current smoking, but religious beliefs and spiritual locus of control (i.e., beliefs in the role of a higher power on health, which can have an active or passive dimension) were not protective against current smoking. This pattern was similar in men and women. Findings suggest that aspects of church fellowship might discourage smoking more than religious beliefs for African American adults. In another study, Horton and Loukas (2013) found in a group of 984 community college students in Texas that positive religious coping (e.g., mobilizing resources in times of stress, such as by seeking spiritual support) decreased the likelihood of smoking cigarettes and cigars or cigarillos among White, but not African American, students. Negative religious coping (e.g., spiritual struggles or discontent with God) increased the likelihood of cigarette smoking among White students and cigar or cigarillo smoking among both White and African American students. One implication from this study is that training counselors whose practice is based on religious theology in evidence-based tobacco treatments and increasing their knowledge of cessation resources might discourage smoking among college students who engage in religious coping.

Future research could investigate how religious factors that discourage smoking can best be applied to community prevention and treatment intervention materials for people from racial and ethnic groups who use tobacco products and are oriented closely to a religion.

Discrimination and Racism

Discrimination—the prejudicial treatment of individuals based on their actual or perceived membership in a minoritized, lower SES, or stigmatized group—has been associated with adverse health outcomes and health behaviors, including smoking (Pascoe and Smart Richman 2009; Williams et al. 2019). In the CLD model (Figure 4.1), experiences with discrimination are considered a fundamental factor that leads to an increased stress response and symptoms of anxiety, which, in turn, positively correlate with smoking (Mills et al. 2023). The transactional theory of stress, appraisal, and coping undergirds most of the research examining the relationship between discrimination and smoking (Lazarus and Launier 1978; Lazarus and Folkman 1984). When applying this model to tobacco-related health disparities, social stressors, such as discrimination experiences, may create a causal pathway to smoking for people who experience discrimination. The CLD model encompasses stress and coping theory by visually depicting the positive feedback loop of discrimination experiences as an acute or chronic stressor and coping through smoking or use of other tobacco products. The model also shows the association between experiences with discrimination and structural racism that can occur through a process of marginalization for people from racial and ethnic groups (Williams et al. 2019; Mills et al. 2023).

The 1998 Surgeon General's report on *Tobacco Use Among U.S. Racial/Ethnic Minority Groups* identified racism as contributing to "different rates of illness across racial/ethnic groups" (USDHHS 1998, p. 11). Through a review of empirical studies, the report also noted that "experiences with discrimination and racism" (USDHHS 1998, p. 11) were explanatory factors for the different rates of tobacco-related disease that occur by race and ethnicity. However, the authors of the report determined that scientific methods had yet to delineate the role of acculturation, SES, and societal problems such as racism, prejudice, and discrimination in shaping tobacco use patterns among Black or African American, Asian American, Pacific Islander, Hispanic or Latino, or American Indian and Alaska Native people. Since the publication of the 1998 Surgeon General's report, research studies have sought to elucidate the role of discrimination and acculturation on racial and ethnic disparities in tobacco use and disease. This research is reviewed in the next two sections.

A 2019 review of the literature examined how racial discrimination functions at three levels (individual, institutional, and cultural) to affect physical and mental health outcomes among racial and ethnic groups in the United States. The review concluded that, interactively, these three levels of discrimination "are a fundamental cause of adverse health outcomes for racial/ethnic minorities and racial/ethnic inequities in health" (Williams et al. 2019, p. 105). Numerous studies of diverse groups have demonstrated that perceived discrimination is associated with an increased risk of tobacco use, even after controlling for sociodemographic covariates. For example, Brondolo and colleagues (2015) reviewed 15 studies published between 1996 and 2010 for the association between discrimination and tobacco use; 12 of the 15 studies reported a positive association (i.e., experiencing discrimination was associated with greater tobacco use), and the other 3 studies did not report an association between discrimination and tobacco use.

It is important to understand whether the association between discrimination and tobacco use is stronger among some groups than among others. If the effects of discrimination on tobacco use are stronger among some groups, then the experience of discrimination could create or widen tobacco-related health disparities.

As such, this section summarizes findings from research published between 2008 and 2019 on the effects of discrimination on tobacco use and tobacco-related health disparities, starting with a discussion about discrimination measures commonly used in tobacco prevention and treatment research. The section only includes studies that examined differences in the association between discrimination and tobacco use across groups, either by testing discrimination–group interaction terms or initially stratifying the sample by group (e.g., race or ethnicity, sex) and then examining the association between discrimination and tobacco use separately within groups. Most relevant studies examined associations across racial or ethnic groups, but several examined associations across sex or sexual orientation and gender identity. References to discrimination in this section generally refer to discrimination on the basis of race and ethnicity, unless otherwise stated.

Measurement of Discrimination

Many survey studies of discrimination assess major lifetime experiences of unfair treatment and everyday experiences of chronic, routine, and relatively minor unfair treatment (Williams et al. 1997). The frequency of such experiences is assessed based on a variety of characteristics (e.g., race, ethnicity, gender, age, religion, physical attributes, sexual orientation, or other characteristics) and across varied life domains (e.g., receiving poorer service than other people at restaurants or stores; being unfairly fired or denied promotion; not being hired for a job; being unfairly stopped, searched, questioned, physically threatened, or abused by the police; being treated with less courtesy than other people; or people acting as if someone is not smart). Underlying this and other discrimination measures is a self-appraisal of how stressful the experience was and the pervasiveness of experiences across the lifespan (Williams et al. 1997). Studies measuring the discrimination construct tend to use terms interchangeably, such as self-reported discrimination, perceived discrimination, and discrimination experiences.

Additionally, self-reported types of discrimination may differ by race and ethnicity. In an online cross-sectional panel survey of 2,376 adults who smoked, Kendzor and colleagues (2014) measured perceived everyday discrimination by the Everyday Discrimination Scale (Short Version; Sternthal et al. 2011). Discrimination on the basis of race, ancestry, national origin, physical appearance, and age were reported by African American and Hispanic people as the most common perceived reasons for experiences with discrimination; however, physical appearance, age, gender, and weight were reported by White people as the most common perceived reasons for experiencing discrimination.

Discrimination and Smoking

Differences by Race and Ethnicity

Several studies have found racial and ethnic differences in the association between experiences of discrimination and tobacco use, but the findings have not been consistent. In most of the reviewed studies that examined differences by race and ethnicity, the authors found a statistically significant association between discrimination and tobacco use behaviors among African American respondents but not among Hispanic respondents, while associations among White respondents and respondents from other racial and ethnic groups were mixed (Okechukwu et al. 2010; Nguyen et al. 2012; Horton and Loukas 2013; Brondolo et al. 2015; Chavez et al. 2015). For example, analyzing data from the 2004–2010 Behavioral Risk Factor Surveillance System (BRFSS) (pooled n = 70,080), Chavez and colleagues (2015) found a statistically significant association between experiencing workplace discrimination in the past year and current smoking (every day or some days) among White people (adjusted odds ratio [aOR] = 1.34; 95% CI, 1.19–1.53) and African American people (aOR = 1.32; 95% CI, 1.08–1.62) but not among Hispanic people (aOR = 0.92; 95% CI, 0.57–1.49) or people classified as "other" race or ethnicity (aOR = 1.57; 95% CI, 0.95–2.60). Purnell and colleagues (2012) also analyzed pooled data from the 2004–2008 BRFSS administrations (n = 85,130) to examine the association between discrimination in the workplace and healthcare domains and current smoking. Although this study found that current smoking was higher among people who reported being treated worse because of their race or ethnicity in healthcare settings (aOR = 1.18; 95% CI, 1.09–1.26) or in the workplace (aOR = 1.13; 95% CI, 1.03–1.23), the interaction between discrimination and race or ethnicity was not statistically significant. Stone and Elbers-Carlisle (2020) also found that, among 3,098 U.S. adults who participated in the Reactions to Race Module of the 2014 BRFSS, experiencing negative emotions based on treatment due to race was associated with current cigarette smoking in non-Hispanic Black adults. Given these inconsistent findings, future analysis of population survey data examining the discrimination–smoking association in healthcare and workplace settings could stratify results by race or ethnicity, consider intersectionality (e.g., of race and ethnicity with SES), and identify other explanatory variables.

In another study of 518 African American and Hispanic ambulatory care patients in New York City, Brondolo and colleagues (2015) found that the association between perceived recent discrimination and daily smoking was statistically significant among African American patients (OR = 2.08; 95% CI, 1.18–3.66) but not among Hispanic patients. Furthermore, Horton and Loukas (2013) analyzed data from a cross-sectional study of 984 technical and vocational school students in Texas and found statistically significant associations between perceived discrimination and (a) frequency of cigarette smoking among African American students and (b) frequency of cigar and cigarillo use among White and African American students, but neither association was significant for Mexican American students.

In a cross-sectional survey of 1,282 working-class union members in Boston, Okechukwu and colleagues (2010) found an association between workplace racial discrimination and smoking in the past week among African American workers (OR = 1.12; 95% CI, 1.01–1.25) but not among White workers, Hispanic workers, or workers from other racial and ethnic groups. In addition, this study found that workplace discrimination was associated with past-week cigarette use among immigrants (OR = 1.13; 95% CI, 1.03–1.24) but not among U.S.-born workers. However, the discrimination–group interaction terms were not statistically significant, suggesting a potential role of acculturation (as measured by nativity status) in the discrimination–smoking relationship. The acculturation–smoking relationship is discussed later in this chapter.

In a cross-sectional study of smoking among pregnant African American and Hispanic women in Boston (N = 677), Nguyen and colleagues (2012) found that African American women were more likely to smoke during pregnancy (OR = 3.36; 95% CI, 1.23–9.19) if they experienced discrimination in three or more of eight settings (in school, getting hired, at work, in housing, in medical settings, getting services, in public settings, or from the police/courts) than if they experienced discrimination in two or fewer settings. In models examining the relationship between discrimination and smoking by race and ethnicity, this association was only statistically significant for Black women (Nguyen et al. 2012). The authors reported this as the first study that found a link between experiences with discrimination and increased risk of smoking among pregnant women from racial and ethnic groups. Future research could use models stratified by race and ethnicity when examining other explanatory variables that interact with experiences with discrimination and tobacco use.

Most studies of racial and ethnic disparities have combined immigrants and U.S.-born respondents, which could introduce confounding because most Black or African American and White people in the United States are U.S.-born, and a large segment of U.S. Hispanic, Asian, and Pacific Islander populations are more recent immigrants (López and Radford 2017). In a cross-sectional study that focused on immigrants from Africa, Southeast Asia, and Latin America who were currently living in Minnesota (N = 1,387), Tran and colleagues (2010) found that the association between discrimination and current smoking was statistically significant among Southeast Asian immigrants (aOR = 1.60; 95% CI, 1.02–2.51) but not among Black people born in Africa or among Hispanic people. However, among Hispanic people, the association between discrimination and current smoking was significant for those who had lived in the United States for more than 7 years but not for recent Hispanic immigrants, suggesting that risk for tobacco use increases as Hispanic immigrants acculturate over time. Future longitudinal studies are needed to monitor how experiences with discrimination and smoking change over time as immigrants acculturate to life in the United States.

Discrimination, Nicotine Dependence, and Cessation

Few studies have focused on nicotine dependence or quitting and experiences with discrimination. Kendzor and colleagues (2014) measured the association between perceived everyday discrimination based on the Everyday Discrimination Scale (Short Version; Sternthal et al. 2011) and nicotine dependence and heavy smoking. Everyday discrimination was positively associated with dependence for Hispanic, African American, and White people, but the association was stronger among Hispanic people than it was among those in the other two groups. Everyday discrimination was positively associated with heavy smoking for Hispanic people but not for African American or White people. Findings suggest that everyday experiences with discrimination on the basis of race and ethnicity may lead to greater nicotine dependence and possibly a harder time quitting, particularly for Hispanic people who smoke cigarettes (Kendzor et al. 2014). Reinforcing these findings, Bello and colleagues (2021) found that, among 607 non-Hispanic African American adults in California who smoked cigarettes daily, increased perceived exposure to discrimination was associated with increased urges to smoke to alleviate negative moods. Furthermore, among 360 unemployed adults who lived in California and currently smoked, Fielding-Singh and colleagues (2020) found significant associations between experiencing stigma related to both unemployment and smoking and readiness to quit smoking.

In a longitudinal study of 190 Spanish-speaking people who smoked, identified as Mexican American, and were motivated to quit within a month, experiencing a greater number of major discrimination events was associated with a reduced likelihood of 7-day point-prevalence abstinence at 26 weeks post-quit date (Kendzor et al. 2014). Findings suggest that Mexican American people who experience discrimination may struggle with smoking cessation.

Webb Hooper and colleagues (2020) identified racial and ethnic differences in the relationship between perceived discrimination and smoking abstinence in a treatment-seeking sample of 347 non-Hispanic White, non-Hispanic African American/Black, and Hispanic (of any race) people who smoked and participated in a randomized controlled trial testing the effects of a group cessation intervention plus pharmacotherapy. In adjusted models, irrespective of race or ethnicity, past-year perceived discrimination, measured by the General Ethnic Discrimination scale (Landrine et al. 2006), was inversely associated with biochemically verified 7-day point-prevalence abstinence for African American/Black people and non-Hispanic White people, but not for Hispanic people, immediately post-intervention. At the 6-month follow-up, past-year discrimination predicted worse cessation outcomes for Black people only. Findings suggest that some experiences of racial and nonracial discrimination may disrupt the cessation process for people across all racial and ethnic groups who want to quit (Webb Hooper et al. 2020). Future research could examine the role of acute and chronic discrimination over time in the quitting process and measure sociocultural variables that could affect both perceived discrimination and smoking cessation outcomes.

Differences by Gender

Most studies on discrimination and smoking have focused on differences by race or ethnicity, but a few studies have focused on differences by gender. Brondolo and colleagues (2015), in their study of 518 African American or Hispanic ambulatory care patients in New York City, found that the association between discrimination and smoking was statistically significant among men (OR = 2.63; 95% CI, 1.33–5.16) but not among women. Earlier, a 5-year follow-up survey of African American and Hispanic adolescents enrolled in the Moving to Opportunity for Fair Housing study by Wiehe and colleagues (2010) found differences by gender in the association between racial or ethnic discrimination and past-month smoking. Adolescent boys who reported discrimination in any setting (e.g., at school or work, in the neighborhood, in shops, or by law enforcement) had significantly higher odds of past-month smoking (OR = 2.0; $p < 0.05$). However, adolescent girls who reported discrimination had significantly lower odds of past-month smoking (OR = 0.5; $p < 0.05$), which, in post hoc analyses, was driven by pregnancy status; girls who had been pregnant were significantly less likely to report smoking in the context of discrimination experiences (OR = 0.30; 95% CI, 0.10–0.92), whereas girls who had never been pregnant had no statistically significant discrimination–smoking relationship. This research highlights the need for future studies to identify other potential explanatory variables that relate to gendered experiences with discrimination and smoking.

Differences by Sexual Orientation and Gender Identity

This section examines the relationship between discrimination and smoking among people who identify as LGBTQI+ and focuses on differences in tobacco use by sexual orientation and gender identity. In an analysis of data from the 2012–2013 National Epidemiologic Survey on Alcohol and Related Conditions, a nationally representative, cross-sectional sample of noninstitutionalized U.S. adults, approximately half of people who identified as lesbian or gay and one-fourth of people who identified as bisexual reported past-year sexual orientation discrimination (McCabe et al. 2019). People who identified as lesbian, gay, or bisexual and who experienced high levels of past-year discrimination based on sexual orientation had a statistically significantly greater probability of past-year cigarette smoking, any tobacco/nicotine use, and having a tobacco use disorder based on criteria from the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (American Psychiatric Association 2013) compared with their counterparts who experienced lower levels of discrimination or no discrimination based on sexual orientation.

Most of the social science research on this topic has focused on self-reported perceptions of discrimination; however, the field is beginning to examine structural social determinants of stigma as potential contributors to the discrimination–smoking relationship. In a longitudinal study of 16,882 U.S. youth from the Growing Up Today Study, Hatzenbuehler and colleagues (2014) found that youth who identified as lesbian, gay, or bisexual and lived in states with substantial structural stigma—as measured by a multidimensional structural stigma index score that accounted for school-level social support resources for lesbian, gay, and bisexual youth; prevalence of same-sex partner households; public opinion toward people who identify as lesbian, gay, and bisexual; and statewide protective policies for lesbian, gay, and bisexual youth—were more likely to smoke in the past year than their counterparts who resided in states with a lower structural stigma index score. Residing in a state with a higher structural stigma score was a unique risk factor for smoking among lesbian, gay, and bisexual youth; their heterosexual counterparts residing in states with high levels of structural stigma were no more likely to smoke than those living in states with low levels of structural stigma. However, this study did not assess transgender identity. Additionally, the study population included the children of women who participated in the national Nurses' Health Study II cohort, which consisted of a sample of mothers, most of whom were White, in the nursing workforce and their children. Therefore, findings do not fully represent the diversity of adolescents from racial and ethnic groups and may not be generalizable to those whose parents do not work in the healthcare industry.

In an analysis of a national, probability-based sample of 11,949 LGBT adults and 352,343 non-LGBT adults in the United States (Hatzenbuehler et al. 2017), LGBT respondents were more likely to smoke and to report fair or poor self-rated health compared with non-LGBT respondents. Further, when structural stigma—measured by county-level attitudes toward same-sex marriage (i.e., in favor of vs. opposed to)—was included in multivariate models, results showed that higher levels of local approval of same-sex marriage were associated with a lower probability of LGBT and non-LGBT adults reporting smoking and fair or poor self-rated health. However, this study reported only an 11% response rate overall, and race and ethnicity were controlled in models, thus restricting identification of possible racial and ethnic differences in the association between attitudes toward same-sex marriage and smoking among LGBT and non-LGBT adults.

Elsewhere, Blosnich and Horn (2011) examined the association between discrimination and smoking status among 11,046 lesbian, gay, and bisexual college students and their heterosexual counterparts, 18–24 years of age. Although the prevalence of smoking and the prevalence of discrimination were both higher among the lesbian, gay, and bisexual group than among heterosexuals, the association between discrimination and smoking was not statistically significant in either group. This study measured discrimination with a single-item dichotomous measure, which might have been less sensitive than the multi-item measures used in other studies.

Finally, Lipperman-Kreda and colleagues (2019) examined the role of perceived stigma among 227 adults in California who identified with a *sexual and gender minority population* (the term used in the study). The study found interacting effects between perceived stigma related to smoking and adults of African American race who were experiencing housing insecurity. More specifically, among adults who currently or formerly smoked and were experiencing housing insecurity, those who identified as African American and with a sexual and gender minority population were more likely to experience perceived stigma related to smoking than were non-African American adults who identified with a sexual and gender minority population.

Overall, the evidence from these studies suggests that measures of social determinants of health can add a multidimensional perspective on the effect of discrimination on smoking among people from sexual orientation and gender identity groups. The evidence also suggests that the minority stress model (Hamilton and Mahalik 2009), which asserts that racial discrimination contributes to stress-related cigarette smoking, could be extended to understand the link between discrimination and smoking among sexual orientation and gender identity groups. Future research could consider the interactive effects of individual-level perceptions of discrimination and social determinants of health to inform culturally tailored prevention and cessation interventions for this population.

Discrimination and the Use of Other Tobacco Products

Few studies have examined the discrimination–tobacco use association for tobacco products other than cigarettes. One such cross-sectional study used an online sample of 1,068 U.S. adults and examined associations between perceived discrimination and use of six tobacco products (cigarettes, e-cigarettes, cigars, pipe tobacco, hookah, and smokeless tobacco) (Unger 2018). Perceived discrimination was a risk factor for current use of all the products except smokeless tobacco, with aORs ranging from 1.42 to 1.77. However, none of the interaction effects between discrimination and demographic characteristics (race and ethnicity, sex, age group, level of educational attainment, and level of income) were statistically significant, indicating that the associations between discrimination and current use of each product were similar across demographic groups. Rogers and colleagues (2018) analyzed the same dataset of 1,068 U.S. adults and assessed racial and ethnic differences in the association between measures of two stress domains—discrimination and financial strain (e.g., difficulty paying bills, difficulty making ends meet, putting off buying needed items, and other indicators)—and the use of combustible tobacco or e-cigarettes. They found that the association between discrimination and use of combustible tobacco products (i.e., cigarettes, cigars, pipe tobacco, or hookah) was statistically significant among African American (aOR = 1.97;

95% CI, 1.17–3.32), Hispanic (aOR = 2.81; 95% CI, 1.74–4.54), and Asian American and Pacific Islander people (aOR = 3.13; 95% CI, 1.57–6.22) but not among White people. Conversely, the association between discrimination and use of e-cigarettes was statistically significant among White (aOR = 1.23; 95% CI, 1.02–1.47), Hispanic (aOR = 2.58; 95% CI, 1.61–4.13), and Asian American and Pacific Islander people (aOR = 3.66; 95% CI, 1.74–7.70) but not among African American people. The association between financial strain and combustible tobacco use was significant for White (aOR = 1.27; 95% CI, 1.15–1.39) and Black people (aOR = 1.59; 95% CI, 1.14–2.22), but not Hispanic or Asian American and Pacific Islander people. Financial strain was associated with higher odds of e-cigarette use for White (aOR = 1.13; 95% CI, 1.02–1.25) and Black people (aOR = 1.44; 95% CI, 1.06–1.97) and with lower odds of e-cigarette use among Asian American and Pacific Islander people (aOR = 0.50; 95% CI, 0.26–0.97); financial strain was not associated with e-cigarette use among Hispanic people. Both analyses (Rogers et al. 2018; Unger et al. 2018) are limited in that most survey participants were White (79%) and had at least some college education (58%), and subgroup analysis included small samples of other racial and ethnic groups and people of lower SES. Thus, sample size may have been too small and may have lacked the statistical power to detect effects for some demographic groups. This precludes more definitive statements of whether racial or ethnic differences exist in the relationship between discrimination and other tobacco product use in the United States. Longitudinal studies that oversample diverse racial and ethnic, socioeconomic, and sexual orientation and gender identity groups are needed to examine the relationship between discrimination and the use of noncigarette tobacco products.

Earlier, a study by Nollen and colleagues (2016) used an intersectionality approach to identify the high-risk population groups (defined by membership in two or more disparity groups) that were most likely to use other tobacco products (e.g., cigars, cigarillos, little cigars, smokeless tobacco, pipes, hand-rolled cigarettes, and hookah) in addition to cigarettes. In an online survey panel of 1,584 people who smoked cigarettes, the groups with the highest likelihood of using one or more other tobacco products in addition to cigarettes were (a) women younger than 45 years of age who were Hispanic or African American and had experienced high levels of discrimination (62% used other tobacco products in addition to cigarettes) and (b) men with alcohol use disorders (74% used other tobacco products in addition to cigarettes). People who smoked cigarettes with all other combinations of these factors were less likely to use other tobacco products than the people who smoked cigarettes in the aforementioned two high-risk groups. Although this study indicates that noncigarette tobacco product use is associated with experiences with discrimination for women from racial and ethnic groups, the study did not assess e-cigarette use, which is an important limitation.

Summary and Recommendations

Studies have found a strong and consistent positive association between discrimination and tobacco product use among Black or African American people, but inconsistent effects among Hispanic or Latino and White people. Further, the relationship between discrimination and smoking may vary by immigration status, as one study found a strong association among immigrants from Southeast Asia. The studies reviewed in this section also demonstrated that the association between discrimination and smoking may differ across genders and races and ethnicities. Structural stigma related to same-sex marriage and experiences of discrimination on the basis of sexual orientation are also associated with an increased likelihood of smoking among LGBTQI+ people. Finally, evidence suggests that experiences of discrimination may have adverse consequences for smoking cessation among people who smoke. Although the findings were not consistent, this relationship may vary by race and ethnicity.

One limitation of the literature reviewed in this section is that because most studies used cross-sectional data to examine cigarette smoking among adults, the evidence is not sufficient to determine the causal role of discrimination in disparities in tobacco product initiation, use, and cessation across a person's lifespan. For some groups, experiences of discrimination can fluctuate during a person's lifespan, while other groups may have chronic experiences of discrimination that persist across the lifespan. Because tobacco product initiation typically occurs during adolescence and young adulthood, longitudinal studies are needed to identify populations that are most strongly impacted by discrimination at each stage of the tobacco use continuum during adolescence and adulthood. It is also important to determine whether these patterns are consistent across other types of tobacco products in addition to cigarettes. Data from one cross-sectional study suggest that there may be an association between discrimination and use of other tobacco products, such as e-cigarettes, cigars, pipe tobacco, and hookah. However, additional observational studies are needed to examine (a) the association between discrimination and all current and emerging tobacco products and (b) any potential disparities that persist in these relationships.

Another limitation of the literature reviewed in this section is that many studies have examined individual-level experiences of racial discrimination. Research rarely examines the effects of institutional-level discrimination on tobacco product-related outcomes, which is an area for future study. Examining the mechanisms through which discrimination within and across systems, institutions, and policies can affect tobacco product initiation, use, and cessation will foster a more complete understanding of the causes of tobacco-related disparities. Future research could utilize multilevel studies to investigate the impact of discrimination experienced across the life course among people with multiple and intersectional identities. Furthermore, although a few studies have looked at the impact of discrimination in the workplace or when receiving healthcare, additional research is needed to elucidate the associations between discrimination experienced in various settings across the life course and tobacco-related health outcomes. Future research could also use external measures of discrimination and compare them with psychometrically rigorous, self-reported survey responses to enhance the reliability and validity of the discrimination construct as it relates to elucidating the field's understanding of pathways from experienced discrimination to tobacco use and tobacco-related health disparities.

Acculturation

The 1998 Surgeon General's report concluded, "the data in general suggest that acculturation influences smoking patterns in that individuals tend to adopt the smoking behavior of the current broader community; however, the exact effects of acculturation on smoking behavior are difficult to quantify because of limitations on most available measures of this cultural learning process" (USDHHS 1998, p. 94). This review updates the literature examining the relationship between acculturation and smoking for immigrants and nonimmigrants who identify as Hispanic American, Asian American, or African American based on advances in the field in subsequent decades. This section begins by introducing the acculturation concept. Next, it discusses the measurement of the acculturation concept. This section also reviews diverse approaches to disentangling the relationship between acculturation and smoking-related behaviors, with consideration of interactions with gender and other sociocultural factors relevant to smoking for racial and ethnic populations. Findings are reported for disparity groups based on the available U.S. data, with a focus on peer-reviewed systematic reviews. Studies examining the relationship between acculturation and smoking cessation had small sample sizes and are only included because cessation trials with larger samples have yet to be published. The section includes an overall summary and recommendations for future research examining relationships between acculturation, smoking, and tobacco-related health disparities.

The Acculturation Concept

Acculturation represents the changes in individuals' practices, values, and identifications that occur as a result of contact with culturally dissimilar people, groups, or social influences (Schwartz et al. 2010). It is widely regarded as an important area of study for smoking prevention and treatment research focused on racial and ethnic groups in the United States (Li and Wen 2015; Webb Hooper et al. 2018). The majority of acculturation- and tobacco-related studies focus on changes in the prevalence of cigarette smoking as it relates to acculturation among immigrants who are permanently living in the United States. Additionally, substantial literature exists on acculturation and cigarette smoking for African American people.

A four-level descriptive model has been widely used in the literature to represent the acculturation process for racial and ethnic groups (Berry 1997, 2022). According to this model, *integration* represents a person's orientation to their ancestral culture or country of birth and the mainstream or dominant culture that prevails where they live (Berry 1997). The process of retaining practices, values, and social norms associated with the country of birth or ancestral culture is referred to as retaining culturally *traditional* identity; whereas, *acculturation* and *assimilation* are used interchangeably to describe movement toward the practices, values, and social norms of the dominant culture (Berry et al. 2006). To fully capture the complexity of the multiple bidirectional relationships that can occur during the acculturation process for racial and ethnic groups, descriptive terms such as integration, separation, marginalization, multiculturalism, biculturalism, melting pot, segregation, and exclusion are also used in the literature (Berry et al. 2006).

Measurement of Acculturation

Acculturation studies use varied self-report measurement approaches that range from a bidimensional, single-item proxy measure to multi-item, multidimensional self-report surveys. Multidimensional surveys typically consider the intersection of practices, values, social norms, and self-identity associated with a heritage culture and receiving culture (Schwartz et al. 2010).

Research on acculturation typically uses the following self-report proxy measures: preferred language and language ability, nativity (U.S.-born vs. foreign-born), time living in the United States, and generational status (e.g., immigrant or child of an immigrant). Longer acculturation measures assess multiple domains (e.g., practices, values, self-identities) and dimensions (e.g., level of acculturation to mainstream American culture and orientation to the heritage culture) of acculturation (Schwartz et al. 2010). For more than 30 years, extensive research has been conducted to examine relationships between acculturation proxies and smoking, as well as to develop psychometrically rigorous, multidimensional acculturation self-report surveys for racial and ethnic groups. However, multidimensional acculturation assessments can place a significant burden on participants because of their length, particularly as such scales are usually embedded within a larger survey instrument used in clinical and community-based research. Multidimensional acculturation surveys also are limited by reflecting the practices, values, norms, and identities of the time when researched and are less flexible to changes in cultural phenomena over time for racial and ethnic groups. The assessment and comprehension of acculturation reflects the complexity of human behavior, as some individuals within a racial or ethnic group may respond differently to cultural practices, values, and identities that are typically shared within a group (Berry 2003).

Findings from NCI Tobacco Control Monograph 22 and Subsequent Systematic Reviews

NCI Tobacco Control Monograph 22 reviewed and summarized 59 studies that were published between 2000 and 2011 and examined smoking behavior among immigrants; most studies documented an association between acculturation and smoking behavior (NCI 2017b). Most studies examined this relationship among Asian American or Hispanic American populations using a cross-sectional design. The report noted that "in general, foreign-born men are more likely to smoke than their U.S.-born counterparts; conversely, foreign-born women are less likely to smoke than U.S.-born women" (NCI 2017, p. 261). In the reviewed studies that had adolescent samples (n = 9), the acculturation–smoking association was usually indirect, with associations diminishing after controlling for such other variables as parental monitoring or access to cigarettes. In contrast, the smoking–acculturation association was typically stronger and more persistent in studies of adults. Associations also differed by gender and by ethnicity. For example, in a 2005 systematic review (Bethel and Schenker 2005), acculturation and smoking status were positively correlated among Hispanic American women (nine studies) but negatively correlated among Hispanic American men (one study). A significant inverse association was found between acculturation and tobacco dependence among Arab American men and women, among whom the heritage countries often have high smoking prevalence (Al-Omari and Scheibmeir 2009).

At least two systematic reviews examining the relationship between acculturation and cigarette smoking among racial and ethnic populations have been published since NCI Tobacco Control Monograph 22. A 2015 systematic review of the acculturation and smoking relationship in North American people of Chinese ancestry included 14 quantitative studies (11 adult and 3 adolescent studies; 11 U.S.-based studies and 3 Canadian studies) published between 2005 and 2013 and included 14,875 Chinese immigrants across all studies (Gotay et al. 2015). Language used in the home and duration of stay in North America were the most frequently used acculturation measures in this review (Gotay et al. 2015). The main effects from 10 of the 11 adult studies identified significant relationships (all in the same direction), suggesting that men who were more acculturated smoked less than their respective countrymen and women who were more acculturated smoked more than their respective countrywomen. The main findings from the three studies of North American youth of Chinese ancestry varied. For example, one study found that acculturation measured using the Short Acculturation Scale for Hispanics (i.e., an assessment of language use, media consumption, and ethnic social relations) (Marin et al. 1987) was not related to smoking for Chinese youth in Los Angeles County (Weiss and Garbanati 2006), and another found that acculturation measures did not explain the lower rates of smoking among Chinese youth compared to other groups of Toronto youth (Asbridge et al. 2005). Another study found that country of origin was related to smoking, as U.S.-born youth of Chinese ancestry were more likely to report smoking than were foreign-born youth of Chinese ancestry (Kaplan et al. 2008). None of the youth-focused studies in this review examined data separately for boys and girls, nor did they report on length of stay in North America (Gotay et al. 2015). Although this review identifies acculturation as measured by language use and time in a new country as important correlates of smoking for Chinese immigrants in the United States and Canada, it is limited by the reliance on self-reported, cross-sectional data collection methods, which can be influenced by social desirability effects (e.g., women of Chinese ancestry might experience more social pressure to report their status as a person who does not smoke compared with men of Chinese ancestry) and recall bias (Bethel and Schenker 2005).

A systematic review of 27 quantitative studies published between 1998 and 2013 focused on the acculturation–smoking relationship among adult immigrants (foreign-born) from non-Western countries (Western countries defined in this study as United States, Canada, Ireland, Germany, the Netherlands, Norway, the United Kingdom, and Australia). Sample sizes in these studies ranged from 96 to 16,738 people. Lower prevalence of smoking for men and higher prevalence of smoking for women among acculturated immigrants suggested movement toward social norms of the host country (i.e., United States) (Reiss et al. 2015). The direction of effects was the same in U.S.- and non-U.S. based studies. The review also considered the phase of the smoking epidemic in the immigrants' country of origin at the time of migration (Lopez et al. 1994). The smoking epidemic concept is represented by a four-stage descriptive model developed by Lopez and colleagues (1994) that contextualizes shifts in the prevalence of smoking at the population level over time for men and women in the country of origin according to a measure of country-level economic development. The model was updated in 2012 to allow for different stages of the smoking epidemic to be described separately for male and female people (Thun et al. 2012). For example, China's growing cigarette consumption after 1975 was at least partially influenced by cultural and social norms that encouraged smoking among men (Corrao et al. 2000). Consideration of where a country is in the smoking epidemic while examining other social and health-related correlates has been widely studied (Lopez et al. 1994; Chen et al. 1997; Pampel 2005; Ward et al. 2006; Singh et al. 2009; Narain and Sinha 2011; Reiss et al. 2015).

Role of Gender in the Acculturation and Smoking Relationship

NCI Tobacco Control Monograph 22 (NCI 2017b) found that the relationship between acculturation and smoking for immigrants in the United States is associated with gendered social norms for smoking from the country of origin, a finding upheld in more recent literature reviews (Gotay et al. 2015; Reiss et al. 2015). Given that differences in the prevalence of smoking by gender are established before people immigrate to the United States (Zhang and Wang 2008), it is important to stratify studies of the acculturation–smoking relationship by gender or to ensure that study designs give consideration to baseline gender differences in the prevalence of smoking rather than controlling for gender or identifying gender differences only during the analysis phase.

Since the release of NCI Tobacco Control Monograph 22, a meta-analysis was published that examined the acculturation–smoking relationship in 39,777 Hispanic American adult women and adolescent girls, which included 26 quantitative studies published between 1990 and 2010 that used various measures of acculturation (Kondo et al. 2016). Findings showed a consistent positive association between immigration status and cigarette smoking in Hispanic women, which was moderated by age (i.e., a larger effect in adults versus adolescents); country of birth; and if analysis included dichotomous or multivariable measures of acculturation. The average unstandardized effect size of acculturation on smoking was modest (OR = 1.81; 95% CI, 1.57–2.07) across all studies. Studies that included Mexican American women had the largest effect between an acculturation measure and current smoking compared to studies of women from other Latin American countries, underlying the importance of disaggregated measures of Hispanic American ethnic groups in acculturation studies (Rodriquez et al. 2019).

Acculturation and Smoking Among Black or African American People

For Black or African American people, a heterogeneous racial group consisting of people of African descent living in the United States, the most widely used self-report measures of acculturation are unidimensional and multidimensional scales that assess orientation to the traditions, values, social norms, and self-identity linked to African American culture (Landrine and Klonoff 1994; Snowden and Hines 1999; Klonoff and Landrine 2000; Obasi and Leong 2010). Survey items tend to be oriented to the descendants of enslaved African people with centuries of generations living in the United States rather than those of African immigrants. Acculturation surveys for African American people have undergone rigorous psychometric testing and received scientific support for cultural construct validity (Mills et al. 2017). One systematic review focused on the effect of acculturation for African American people (Mills et al. 2017). This review included 21 quantitative studies published between 1992 and 2012 on the relationship between acculturation and one or more of six different health behaviors (i.e., tobacco use, alcohol use, illicit drug use, risky sexual behavior, health-promoting behaviors such as physical activity, and cancer screening). Among the nine studies focused on the acculturation–smoking relationship, sample sizes ranged from 35 to 2,118 African American participants. Findings from this review indicated that less acculturated African American people had a higher prevalence of smoking than their more acculturated counterparts, which was consistent across studies testing this relationship (Klonoff and Landrine 1996, 1999; Landrine and Klonoff 1996; Guevarra et al. 2005; Fernander et al. 2008; Webb Hooper et al. 2012; Landrine and Corral 2016). Potential gender differences in the acculturation–smoking relationship were examined in the review; however, the impact of gender on acculturation and smoking for African American people was inconsistent across studies (Klonoff and Landrine 1996, 1999, 2000; Snowden and Hines 1999; Landrine and Corral 2016; Mills et al. 2017).

Measures of acculturation for African American people with rigorous psychometric support include 40–74 survey items and can take a long time to deliver in clinical and community-based research settings. The conceptualization and measurement of acculturation needs to be modernized to include the fluid nature of current intersectional identity perspectives (i.e., identifying in two or more risk groups) and the synergistic effects of identifying with other groups (e.g., people who identify as LGBTQI+) and self-identification as African American. Reducing participant burden and time to complete surveys also needs to be considered during the development of and revisions to acculturation measures. Proxy measures that represent current culture change processes for African American people and relate to the use of multiple tobacco products are warranted.

Acculturation and Smoking Cessation

The available evidence on the relationship between acculturation and smoking cessation among racial and ethnic groups is reviewed here. Studies on this topic have focused on Hispanic and African American people who smoke cigarettes. Disparities in access to individual-level tobacco cessation treatment for racial and ethnic groups are reviewed in the "Healthcare Environment" section of this chapter and in Chapter 7.

Among a pooled sample of 6,398 Hispanic American adults who reported smoking 100 or more cigarettes in their lifetime in the 2008–2011 Hispanic Community Health Study/Study of Latinos population-based surveys, identifying as culturally traditional was associated with better odds of quitting smoking and sustaining abstinence among Hispanic American women but not among Hispanic American men (Merzel et al. 2015). A significant age, gender, and acculturation interaction was found, namely that acculturated women younger than 40 years of age had lower odds of sustaining cessation than women older than 40 years of age who identified as culturally traditional. This survey included Hispanic American people of diverse nativity, with participants identifying as Mexican, Puerto Rican, Cuban, Central American, Dominican, or South American.

In an analysis of data from 123,574 White and Hispanic participants in the 2011–2015 National Health Interview Survey (NHIS), socioeconomic factors had a stronger association with self-reported smoking cessation (i.e., formerly smoking) than acculturation proxies (i.e., language ability, nativity, years of U.S. residency) (Castro et al. 2018). One randomized controlled trial of 271 Hispanic American adults who smoked cigarettes and sought cessation treatment found that greater acculturation (measured as language ability, years of U.S. residency, immigration status, and preferred media language) predicted higher self-reported 7-day point-prevalence abstinence rates for men (all *ps* <.05) but not for women (Castro et al. 2009). Research on acculturation and smoking typically has examined cross-sectional relationships between categorically independent and dependent variables (e.g., the relationship between an acculturated or traditional orientation with smoking or not smoking), which limits examination of orientation toward both a heritage and mainstream American culture. An analysis of 199 Mexican American people who spoke Spanish, smoked cigarettes, sought cessation treatment, and were enrolled in a longitudinal cohort study examined independent and interaction effects of gender and acculturation on smoking cessation, revealing that people with a strong orientation toward both Mexican and American cultures (i.e., biculturalism) were most likely to quit smoking (Castro et al. 2019). Future acculturation–smoking research could consider models that allow for an examination of the effects of biculturalism on tobacco use and cessation outcomes.

The relationship between acculturation and smoking cessation among African American people has received limited attention from the field. In a small sample (N = 140) of treatment-seeking African American people who smoked and were enrolled in a cessation pilot trial (Webb Hooper et al. 2012), acculturation, which was measured using the 47-item African American Acculturation Scale-Revised (Klonoff and Landrine 2000), predicted 7-day point-prevalence abstinence (biochemically confirmed) at the end of treatment and 3-month follow-up. Intent-to-treat analysis revealed that African American people who smoked and identified as culturally traditional had a lower likelihood of quitting smoking compared with their more acculturated counterparts. Webb Hooper and colleagues (2018) launched a randomized cessation trial that was the first study focused on African American adults who smoke cigarettes and that was powered to detect the moderating role of acculturation in smoking outcomes with biochemical feedback at 6-month follow-up. This study did not have published outcomes at the time that this report was prepared. Additional longitudinal research is needed to elucidate how acculturation helps or hurts the cessation process for Black or African American people.

Other Considerations for Acculturation and Smoking Research

Potential effect sizes in the acculturation–smoking relationship have been less frequently emphasized in systematic reviews on the cultural influences of smoking. One meta-analysis calculated a combined measure of effect for 12 studies (published between 1994 and 2005) and examined the acculturation and smoking relationship among Asian American people (Choi et al. 2008). In this review, the average OR for men was 0.53 (95% CI, 0.28–0.99) suggesting, according to study authors, that acculturated Asian American men were 47% less likely to smoke cigarettes than their culturally traditional counterparts. Among Asian American women, the average OR was 5.26 (95% CI, 2.75–10.05), suggesting that acculturated women were more than five times more likely to smoke than culturally traditional women. Although an average of ORs can be a potential guide of effect across studies, it is an unstandardized effect size, such that the magnitude and direction of relationships are contingent on the units of measurement in the model, which limits comparisons with other reviews that include studies with different acculturation measures. Future studies could use a standardized statistic for effect size (e.g., Cohen's d or standardized ORs) to increase comparability of the acculturation–smoking relationship across varied measurement approaches (Cohen 1988).

The inclusion of multiple sociocultural correlates of tobacco use for racial and ethnic groups raises important measurement considerations. One study used a random, statewide sample of 2,118 U.S.-born African American adult residents of California; stratified models by gender; and included measures of acculturation, racial discrimination, and SES. The study found that the discrimination–smoking relationship failed to reach statistical significance; however, the acculturation–smoking relationship remained statistically significant for women but not for men (Landrine and Corral 2016). In the examination of independent and combined effects of acculturation, racial discrimination, SES, and gender, low acculturation was associated with smoking for women, but not for men. This finding calls for consideration of multicollinearity of discrimination and acculturation measures in models that include both sociocultural constructs and examine the relationship to smoking status.

Summary and Recommendations

The studies reviewed in this section document an association between acculturation and smoking among adults but not among youth. Among Asian American and Hispanic adults in the United States, men who are more acculturated are less likely to smoke, and women who are more acculturated are more likely to smoke. The literature suggests that social norms related to smoking in one's country of origin impact the relationship between acculturation and smoking. Among African American adults, there are inconsistent findings by gender in the association between acculturation and smoking. Finally, the association between acculturation and sustained smoking cessation appears to vary by race and ethnicity.

How acculturation is measured informs which groups of people are studied and how cultural issues are framed in tobacco control research focused on racial and ethnic groups. Acculturation is not measured consistently and is often assessed using single-item measures (i.e., proxies) or time-intensive multi-item surveys. The acculturation construct can fluctuate over the lifespan, with expected shifts during child and adolescent development and during self-identity development. Self-reported responses to acculturation measures can vary when assessed in the same person at different developmental phases in their life, which suggests innovation is needed to assess acculturation using flexible and age-appropriate (or generation-appropriate) methods. Furthermore, although psychometrically rigorous, multidimensional scales of acculturation exist for Hispanic, Asian, and African American people, multidimensional acculturation surveys do not exist for use across racial and ethnic groups (Sodowsky et al. 1991; Stephenson 2000; Malcarne et al. 2006), and group-level perceptions of cultural practices, values, and social norms can change over time. Measures that can capture the influence of dynamic and intersectional cultural factors on tobacco use are needed. Furthermore, research is warranted that focuses specifically on refugee populations, including people from Middle Eastern countries where smoking is especially prevalent.

Additionally, measures of acculturation that place mainstream American practices, values, and social norms at one extreme and those of another culture at the other assume that acculturation is a linear movement in one direction that occurs along a continuum. However, acculturation can be a nonlinear process, occurring in various phases across the life course and evolving as individuals define their identities at the intersection of multiple social or cultural identities. To fully understand tobacco product-related health disparities, future research is needed that incorporates longitudinal study designs that investigate the dynamic effect of acculturation across a person's life course on tobacco use, especially among people with intersectional identities.

Finally, most studies on this topic have focused on cigarette smoking without incorporating measurements for noncigarette tobacco product use. Additional research is needed that examines the impact of acculturation on initiation, use, and cessation of the increasingly diverse tobacco product landscape.

Environmental Influences

As shown in Figure 4.1, individual smoking behaviors and risks of tobacco-related health disparities are influenced by the intersection of the complex environments in which individuals live, learn, work, socialize, and access healthcare services. This section examines environmental influences on tobacco-related health disparities in several environments, including housing, school, work, and healthcare. Given the relative scarcity of literature in these areas compared with the literature on social influences, this section focuses on differences in exposure to environmental influences across disparity populations, disparities in outcomes between groups, and differences in the strength of the association between particular environmental influences and tobacco product use between demographic groups (Ward et al. 2019).

Housing Environment

This section examines the extent to which differences in (a) exposure to secondhand tobacco smoke in the housing environment, (b) distribution of smokefree home rules, and (c) exposure to secondhand tobacco smoke in multi-unit housing exist in populations experiencing disparities.

Literature Review Methods

The search strategy for this review involved two PubMed searches, one on smokefree homes and one on smokefree multi-unit housing, for peer-reviewed research published between January 1, 2008, and December 31, 2021 (see Appendix 4.1 for search terms). To gain a broad understanding of the contribution of the housing environment to tobacco-related health disparities in the United States, this section focuses on results from national-level studies rather than those from studies of local-level areas.

Exposure to Secondhand Tobacco Smoke in Homes

Indoor public spaces have increasingly become smokefree. As a result, the home has become a primary source of exposure to secondhand tobacco smoke for both children and nonsmoking adults (USDHHS 2006). An analysis of data from the 2017 and 2018 National Health and Nutrition Examination Survey (NHANES) found that 87.8% of nonsmoking persons 3 years of age and older who lived with someone who smoked inside the home were exposed to secondhand tobacco smoke, as indicated by serum cotinine[1] values of 0.05–10 nanograms/milliliter, compared with 21.4% of nonsmoking persons 3 years of age and older not living with someone who smoked inside the home (Tsai et al. 2021). The data related to living with someone who smoked inside the home were not analyzed by age, race or ethnicity, or income level. In another study based on NHANES data from 2011 and 2012, Homa and colleagues (2015) found that people who rented a home and did not smoke were more likely to be exposed to secondhand tobacco smoke than were those who owned a home and did not smoke (36.8% vs. 19.0%, respectively). Furthermore, Tsai and colleagues (2021) found no significant change in the prevalence of exposure to secondhand tobacco smoke from 2011–2012 to 2017–2018 among people who rented (from 36.8% to 36.6%) and who owned (from 19.0% to 18.6%) their home.

Among U.S. middle and high school students who participated in the 2011–2019 administrations of the cross-sectional NYTS, 20.8% of nonsmoking youth reported exposure to secondhand tobacco smoke in the home (Walton et al. 2020). A significantly greater proportion of non-Hispanic Black youth (24%) and non-Hispanic White youth (23%) compared with Hispanic (16%) and non-Hispanic youth of other races (18%) reported exposure to secondhand tobacco smoke in the home. Additional analysis of this sample revealed that from 2011 to 2018, exposure to secondhand tobacco smoke in the home or vehicle declined overall for youth but exposure to secondhand tobacco smoke in the home did not change for non-Hispanic Black youth, suggesting a sustained tobacco-related health disparity for this population group. A study using data from Wave 1 of the adult sample of the Population Assessment of Tobacco and Health (PATH) Study (data collection: September 2013–December 2014) (Assari and Bazargan 2019) found that, in main effects analysis, the odds of exposure to secondhand tobacco smoke at home were higher for Black adults than for White adults and higher for LGBT adults than for heterosexual adults. However, the odds of exposure to secondhand tobacco smoke at home were lower among adults with more education and those not living in poverty compared with people living in households with incomes under the federal poverty level. In an analysis of interactions by SES indicators and race or ethnicity, significant interactions between Hispanic ethnicity and SES

[1]Cotinine is a metabolite of nicotine that is widely used to measure exposure to tobacco smoke. The established range definition for exposure to secondhand smoke is 0.05–10 nanograms/milliliter.

indicators (high educational attainment and living out of poverty) suggested that the "protective" effect of higher SES against exposure to secondhand tobacco smoke was attenuated among Hispanic adults. Similar interactions between Black race and SES were not observed in this analysis (Assari and Bazargan 2019). Future studies that analyze risk of exposure to secondhand tobacco smoke by race and ethnicity and SES or structural determinants of health have the potential to elucidate intersectional issues linked to the relationship between exposure to secondhand tobacco smoke and tobacco-related health disparities.

Exposure to secondhand tobacco smoke in the home (based on self-reports) is much less common when smokefree rules are in place in that home. Using data from the 2009–2010 National Adult Tobacco Survey (NATS), King and colleagues (2013b) found that the prevalence of exposure to secondhand tobacco smoke varied considerably by the presence (or absence) of smokefree rules in the home. Overall, just 1.4% of people who did not smoke and had a smokefree rule at home were exposed to secondhand tobacco smoke in the home during the past 7 days, compared with 43.9% of people who did not smoke and did not have a smokefree rule at home. This pattern persisted across age groups, race and ethnicity, and levels of education, as shown in Table 4.1. Notably, compared with White people, a higher percentage of Black and Hispanic people

Table 4.1 Percentage of nonsmoking adults who reported exposure to secondhand tobacco smoke in their homes[a] during the previous 7 days, by smokefree rule status and selected characteristics, National Adult Tobacco Survey (NATS) 2009–2010[b]

Characteristic	Smokefree home rule (n = 91,273) (95% CI)	No smokefree home rule (n = 9,591) (95% CI)	Overall (n = 101,370)[c] (95% CI)
Sex			
Male	1.4 (1.1–1.7)	43.9 (40.7–47.1)	6.6 (6.0–7.2)
Female	1.4 (1.2–1.6)	44.2 (41.5–46.9)	5.5 (5.1–5.9)
Age (in years)			
18–24	2.9 (2.0–4.0)	63.6 (56.8–69.9)	12.7 (11.0–14.5)
25–44	1.1 (0.9–1.4)	49.7 (45.5–54.0)	5.1 (4.6–5.7)
45–64	1.4 (1.1–1.7)	41.1 (38.1–44.1)	5.7 (5.2–6.2)
≥65	1.0 (0.8–1.3)	24.0 (21.3–26.9)	3.8 (3.4–4.2)
Race and ethnicity			
Asian, non-Hispanic	0.9 (0.4–1.7)	29.5 (16.0–47.9)	3.0 (1.8–5.1)
Black, non-Hispanic	2.9 (2.0–4.1)	58.3 (52.0–64.4)	11.4 (10.0–13.0)
Hispanic	1.7 (1.1–2.5)	47.8 (38.2–57.5)	5.3 (4.2–6.6)
Other, non-Hispanic	3.1 (1.5–6.0)	41.1 (30.6–52.5)	8.4 (6.3–11.0)
White, non-Hispanic	1.1 (0.9–1.2)	40.9 (38.7–43.1)	5.3 (4.9–5.6)
Education			
0–12 years (no diploma)	2.8 (2.0–4.0)	51.2 (44.8–57.6)	10.1 (8.7–11.8)
GED	3.2 (1.6–6.2)	55.5 (43.4–67.0)	11.8 (8.7–15.9)
High school graduate	1.6 (1.3–2.1)	48.4 (44.6–52.2)	8.1 (7.3–8.9)
Some college (no degree)	1.3 (1.0–1.8)	51.1 (46.4–55.8)	6.5 (5.8–7.4)
Associate degree	1.1 (0.8–1.5)	37.8 (33.1–42.7)	4.5 (3.9–5.1)
Undergraduate degree	0.8 (0.6–1.1)	26.0 (22.1–30.3)	2.6 (2.2–3.0)
Graduate degree	0.5 (0.4–0.8)	22.8 (17.9–28.5)	1.9 (1.5–2.4)
All	1.4 (1.2–1.6)	44.0 (41.9–46.1)	6.0 (5.7–6.3)

Source: Adapted from Table 3 in King and colleagues (2013b).

Notes: **CI =** confidence interval; **GED =** General Educational Development.

[a]Defined as a response between 1 and 7 to the question, "Not counting decks, porches, or garages, during the past 7 days, on how many days did someone other than you smoke tobacco inside your home while you were at home?"

[b]All estimates were calculated among landline and cellular-telephone respondents.

[c]Includes 506 respondents whose home smoking rule was unknown.

but a lower percentage of Asian people were exposed to secondhand tobacco smoke in homes with and without smokefree home rules. Similarly, more high school graduates and those with a General Educational Development (GED) certificate were exposed to secondhand tobacco smoke than were those with undergraduate degrees or higher in homes with and without smokefree rules. Although the presence of smokefree home rules is associated with less exposure to secondhand tobacco smoke for some groups, the evidence points to a consistent pattern of Black people having higher exposure to secondhand tobacco smoke in the home than White people, which suggests that other factors, such as living in multiunit housing versus a single-family home, are related to exposure to secondhand tobacco smoke in the home for Black people.

Smokefree Homes and Smoking Cessation

In addition to reducing exposure to secondhand tobacco smoke, smokefree homes can support cessation. By removing social and physical environmental cues for smoking and increasing the inconvenience of smoking—for example, by requiring people to go outdoors to smoke—smokefree home rules can lead to decreased numbers of cigarettes smoked per day, delays in smoking the first cigarette after waking, and increased quit attempts and eventual cessation (Mills et al. 2009). In their study, Mills and colleagues (2009) reviewed studies that examined the impact of smokefree homes on the smoking behaviors of adults from 1990 to 2008. This review consistently found that people who currently smoke and lived in homes that had smokefree rules at baseline were more likely to have made a quit attempt within the past year and to have achieved abstinence at follow-up than those who were allowed to smoke in the home at baseline. Later, in an analysis of longitudinal data from the 2002–2003 and 2010–2011 Tobacco Use Supplement to the Current Population Survey (TUS-CPS), Vijayaraghavan and colleagues (2018) found that the prevalence of smokefree homes differed by income group over time and also accounted for 36% of the income disparity in achieving 30 or more days of continuous abstinence from tobacco use. In an earlier analysis of data from the 2006–2007 TUS-CPS, Vijayaraghavan and colleagues (2013) found that rules for smokefree homes were associated with both lower consumption of cigarettes and sustained smoking cessation among people with lower incomes who smoked compared with people with lower incomes who smoked and lived in homes without smokefree rules.

In contrast, relatively little research has been conducted on associations between smokefree homes and noncigarette tobacco product use and cessation. In a cross-sectional analysis of data from the 2010–2011 TUS-CPS, Zhang and colleagues (2016) found that having a smokefree home rule was associated with decreased odds of current use of other tobacco products, including smokeless tobacco, tobacco pipes, water pipes, and cigars (aOR = 0.80; 95% CI, 0.77–0.83). This study did not include e-cigarettes. A second study found that both full bans on vaping in the home (aOR = 0.07; 95% CI, 0.05–0.09) and partial home vaping bans (defined as vaping allowed in some places or at some times) (aOR = 0.51; 95% CI, 0.40–0.66) were associated with lower odds of current e-cigarette use compared with no restrictions on vaping in the home (Azagba et al. 2020). However, the adjusted ORs for both cross-sectional studies represent relatively small effects; longitudinal studies with larger samples are needed to examine associations between smokefree home rules and (a) quitting smoking behaviors and (b) use of noncigarette tobacco products.

Two studies examined the relationship between smokefree home interventions and quitting in racial and ethnic groups. In an analysis of pooled data across three randomized controlled trials of a brief smokefree home intervention with a sample consisting predominantly of African American (73%) and lower income (81%) people, Haardörfer and colleagues (2018) found that at the 6-month follow-up, those who had created smokefree homes were significantly more likely to be abstinent from smoking than those who had not created smokefree homes (aOR = 6.56; 95% CI, 4.12–10.42).

In a study of 2003 California Health Interview Survey data on Asian American respondents, having smokefree rules in the home was associated with former smoking for recent immigrants and lighter smoking for long-term residents. The study's authors speculated that acculturation influences different social norms for smoking among males in the United States compared with males in Asian countries, and these norms are associated with the smoking patterns observed in this study. The finding of increased cessation efforts in the presence of a smokefree home rule is consistent with associations found in the general population that having a smokefree home rule is associated with less exposure to cigarette smoke among Asian American people (Tong et al. 2008).

Research focused on the link between smokefree homes and smoking cessation has focused primarily on income-related disparities, but such research has rarely examined the effects of smokefree homes on cessation within or across disparate groups. Future research could examine the independent and combined effects of smokefree homes and structural determinants of health on tobacco cessation in groups most affected by tobacco-related health disparities.

Smokefree Homes and Smoking Behaviors Among Youth

Some research suggests that policies on smokefree homes may influence initiation of tobacco use among youth. In a review of 19 studies published between 1990 and 2010 that examined associations between smoking restrictions at home and smoking by youth, Emory and colleagues (2010) concluded that (a) the evidence was suggestive of an association between smoking restrictions at home and fewer youth initiating smoking but (b) more longitudinal research was needed to establish causality. More recent studies have not examined the potential impact of smoking restrictions at home on smoking initiation among youth by SES, race and ethnicity, or sexual orientation and gender identity (Mathur et al. 2014; O'Loughlin et al. 2014; Parks et al. 2019). Thus, it is not known whether disparities in rules for smokefree homes more broadly influence the initiation of tobacco use among youth or youth from disparity groups. Finally, more research is needed on the influence of smokefree homes on youth initiation of noncigarette tobacco products (Zhang and Pu 2016).

Voluntary Rules for Smokefree Homes and Risk of Exposure to Secondhand Tobacco Smoke in Multi-Unit Housing

Voluntary rules for smokefree individual units in multi-unit housing do not offer comprehensive protection from exposure to secondhand tobacco smoke for the 80 million Americans who live in this kind of housing (King et al. 2013a). Numerous studies have documented that secondhand tobacco smoke can travel through hallways and duct work into nonsmoking areas (Kraev et al. 2009; King et al. 2010; Arku et al. 2015; Snyder et al. 2016). In a study that compared low-income, multi-unit residential buildings with a smokefree policy to buildings without a smokefree policy in five developments managed by the Boston Housing Authority, Russo and colleagues (2015) studied the incursion of secondhand tobacco smoke by measuring fine particulate matter (PM2.5) in conjunction with airborne nicotine concentrations and smoking (based on self-reports) in 32 households with and without people who smoked, including four pairs of adjacent units. Units in smokefree buildings had lower levels of PM2.5 compared with units in buildings with no smokefree policy, and smoking activity in a unit was associated with higher levels of PM2.5 in adjacent units with no residents who smoked. A similarly designed study by Arku and colleagues (2015) documented variations in exposure to secondhand tobacco smoke in indoor common areas by season in six public housing buildings managed by the Boston Housing Authority. During winter months, PM2.5 and concentrations of nicotine were higher in indoor common areas in buildings that housed older adults and people with disabilities relative to buildings that housed individuals or families who were not older or had no disabilities, in buildings where smoking was permitted relative to smokefree buildings, and in high-rise buildings relative to mid- and low-rise buildings. The findings suggest that using an objective measure of exposure to secondhand tobacco smoke reveals greater exposure to PM2.5 from secondhand tobacco smoke during the winter for older people and those with disabilities who live in low-income, multi-unit public housing.

Disparities by race and ethnicity, age, income, and region exist in the incursion of secondhand tobacco smoke into multi-unit housing. For example, findings from a 2015 analysis of the 2013–2014 NATS based on self-reported data found that among residents of multi-unit housing with rules for a smokefree home, 34.4% reported the incursion of secondhand tobacco smoke into their homes. Incursion was higher among women compared with men and among Black and Hispanic people compared with White people but it was lower for people 65 years of age and older (reference group: 18- to 64-year-olds), for those with an annual household income of $100,000 or more (reference group: <$20,000), and for those living in the Midwest or South U.S. census region (reference group: Northeast) (Nguyen et al. 2016). The findings concerning the effect of exposure to secondhand tobacco smoke in older adults than younger adults may not be directly comparable between studies. For example, estimates of exposure to secondhand tobacco smoke as reported by Arku and colleagues (2015) were measured using an objective measure of exposure to PM2.5 in conjunction with airborne nicotine particulate matter in common areas of public housing buildings, whereas Nguyen and colleagues (2016) measured exposure to secondhand tobacco smoke using self-reported incursion from a national survey. Furthermore, the study by Nguyen and colleagues (2016) included a sample of adults with higher SES. Nevertheless, both objective and self-reported measures of secondhand tobacco smoke incursion can provide a comprehensive understanding of the disparity groups that are most affected by exposure to tobacco smoke in multi-unit housing.

In a nationally representative sample of U.S. adult residents of multi-unit housing who were surveyed in 2013 (Wilson et al. 2017), among nonsmoking residents with no smoking in the home for at least 3 months and a child in the home, 25.2% reported a recent incursion of secondhand tobacco smoke into their unit; 99.0% of these residents were bothered by the incursion, and among those who were bothered, 74.8% did not report the problem to a landlord or property manager. Reasons for not reporting the problem to a landlord included concerns about upsetting neighbors and retaliation. In the total analytic sample, 91.3% agreed that tenants have a right to live in a building free of tobacco smoke. Incursion was associated with living in a region other than the South, living in public versus private multi-unit housing, and living in buildings with six or more units. Incursion was not associated with race or ethnicity or level of education and income. This study highlights how easy it is for a secondhand tobacco smoke incursion to occur despite a home rule prohibiting indoor smoking. Furthermore, this study demonstrates that power imbalances exist between tenants of multi-unit housing and their property management.

Elsewhere, Licht and colleagues (2012) reported on a 2010 nationally representative sample of adults that combined two random-digit-dial surveys of residents of multi-unit housing and found that 44% of residents with a smokefree home rule experienced incursion of secondhand tobacco smoke into their unit during the past 12 months. Incursion was associated with being female, being younger than 65 years of age, and living in a building without a smokefree policy. Later, Snyder and colleagues (2016), in a review of literature about smokefree multi-unit housing published from 2001 to 2014, identified 12 studies reporting incursion of exposure to secondhand tobacco smoke, with prevalence ranging from 26% to 64%. The review assessed incursion with a range of measures, complicating comparisons across the studies. Regardless, recent national studies have generally been consistent in documenting that incursions of exposure to secondhand tobacco smoke are higher in government-subsidized housing (Wilson et al. 2014, 2017), suggesting a clear direction for efforts to reduce SES-related disparities in exposure to secondhand tobacco smoke among residents of multi-unit housing, as explained in the following section.

Smokefree Policies in Multi-Unit Housing

Given the higher rates of both smoking and exposure to secondhand tobacco smoke in lower SES populations and among residents of multi-unit housing (Wilson et al. 2014, 2017; Nguyen et al. 2016), initiatives to establish smokefree government-subsidized housing are a priority for reducing exposure to secondhand tobacco smoke in the home environment. Indeed, as of July 2018, federal government public housing in the United States is covered by smokefree policies as a result of a rule issued by the U.S. Department of Housing and Urban Development (HUD) (*Federal Register* 2016). This rule covers 2 million people who live in properties supported by Public Housing Agencies out of approximately 10 million people who receive housing assistance from HUD (Geller et al. 2016). Almost 90% of households receiving federal rental assistance include children or vulnerable populations (Center on Budget and Policy Priorities 2017). Chapter 7 describes what is known about (a) the impact of the HUD rule on tobacco-related disparities and (b) opportunities for addressing current gaps that leave 5–8 million residents of federal government-subsidized housing unprotected (*Federal Register* 2016).

Owners and property management companies that oversee privately owned affordable housing can voluntarily implement smokefree policies. In a sample of residents in market-rate and subsidized housing in six communities in 2012, 24.4% of residents in market-rate housing reported that smoking was prohibited in all areas, compared with 21.5% of residents in public or affordable housing (Gentzke et al. 2018b). Similarly, more residents of market-rate housing (82%) reported voluntary smokefree home policies than did residents of subsidized housing (69%). Elsewhere, in a 2013 survey of all affordable multi-unit housing properties in North Carolina, Stein and colleagues (2015) found that 16.5% of the properties prohibited smoking in residential units. Newer properties were more likely to restrict smoking, and properties with a greater number of children per unit were less likely to restrict smoking.

Prevalence of Smokefree Home Rules

The 2012–2013 NATS revealed that an estimated 83.7% of adults had a smokefree home rule (Kruger et al. 2015). Among racial and ethnic groups, rates of smokefree homes were highest among Asian American people (91.5%) and lowest among African American people (75.6%); rates also varied by level of educational attainment and annual household income. Among adults with no high school diploma or a GED, 75.1% and 67.6%, respectively, reported living in a home with a smokefree rule, compared with 93.1% of adults with a graduate school degree. Similarly, 72.3% of adults with an annual household income of less than $20,000 reported having a smokefree home rule compared with 93% of adults with an annual household income of $100,000 or more.

Rules for smokefree homes also varied by sexual orientation, as an estimated 74.9% of adults identifying as lesbian, gay, and bisexual had a rule about a smokefree home, compared with 84.0% of heterosexual adults (Kruger et al. 2015). Similar associations were documented by others after analyzing (a) data from the 2010–2011 TUS-CPS and (b) data from the 2014–2015 TUS-CPS specifically for single-parent families (Zhang et al. 2015; Mai et al. 2018). Among households with one parent who smoked and a child 17 years of age and younger, rules for a smokefree home were less common in households with children whose parents were single, were non-Hispanic African American, had not completed high school, or were 40 years of age and older. Households with a child 6 years of age and older and households with incomes less than $25,000 were also less likely to have smokefree home rules (Zhang et al. 2015).

Cross-sectional studies in a variety of specific populations and communities have found similar correlates for the presence (or absence) of smokefree homes, such as smoking status, SES, and young children living in the home. For example, in their analysis of data from the Cherokee Nation American Indian Adult Tobacco Survey, Comiford and colleagues (2018) documented associations between the presence of a smokefree home rule and numerous characteristics, including being of younger age, being female, having a higher household income, having higher levels of educational attainment, not smoking, having an awareness of the harms of exposure to secondhand tobacco smoke, making a recent visit to a healthcare provider, being in good health, and having children in the home. In other studies of American Indian households, people with college degrees and people who did not smoke were more likely to live in a smokefree home than were those who smoked or did not have college degrees (Kegler and Malcoe 2002; Berg et al. 2012). In addition, in a study of Mexico- and U.S.-born Hispanic mothers, Gonzales and colleagues (2006) found that being born in the United States, current smoking status, and having other people who smoke in the home were all associated with not having a smoking rule in households with children 2–12 years of age.

Findings from the 2013–2014 NATS revealed that rules for smokefree homes were more prevalent among adults living in single-family households (86.7%) than they were among those living in multi-unit housing (80.9%) (Nguyen et al. 2016). The same study also found that (a) tobacco use was higher among adults living in multi-unit housing compared with adults living in single-family housing (24.7% vs. 18.9%, respectively) and (b) use of combustible tobacco only was higher among adults living in multi-unit housing compared with adults living in single-family housing (19.8% vs. 13.6%, respectively). Elsewhere, in an analysis of NHANES data collected from 2001 to 2006, Wilson and colleagues (2011) found that among children who lived in a smokefree home, 11.6% lived in an apartment. In contrast, among children living where smoking did occur in the home, 16.7% lived in an apartment. In an analysis of cotinine levels among children living in homes where no person smoked indoors, the authors found that cotinine levels were 45% higher among children living in apartments compared with children living in single-family homes.

Prevalence of E-Cigarette-Free Home Rules

Few studies have examined whether the use of e-cigarettes, sometimes referred to as "vaping," was included in rules for smokefree homes. One national study conducted in 2017 examining voluntary rules on the use of e-cigarettes inside the home found that 58.6% of adults did not allow them in the home and 23.6% were unsure of the rules (Gentzke et al. 2018a). Individuals were more likely to restrict the use of e-cigarettes in their homes if they had a college degree (compared to adults with less than a high school diploma), had a child who lived in the home, and had an annual household income of $25,000 or greater (compared with those who had an annual household income of less than $15,000). By race and ethnicity, African American adults were less likely than White adults to restrict the use of e-cigarettes in their homes. Additionally, adults who currently used or who had previously used e-cigarettes and who currently used or who previously used cigarettes were less likely than adults who never used e-cigarettes and cigarettes, respectively, to restrict the use of e-cigarettes in their homes (Gentzke et al. 2018a).

A study using data from the 2018 TUS-CPS found that 89% of U.S. respondents 16 years of age and older indicated that no one was allowed to vape anywhere in their home, but only 32% of homes of individuals who currently used e-cigarettes had such restrictions (Azagba et al. 2020). Similarly, Li and colleagues (2020) found that, in Wave 3 of the PATH Study (2015–2016), 90% of people who never used e-cigarettes or smoked cigarettes had a rule prohibiting vaping in their homes, followed by people who formerly smoked cigarettes (86%), currently used e-cigarettes but never smoked cigarettes (56%), currently smoked cigarettes (54%), currently used both cigarettes and e-cigarettes (25%), and currently used e-cigarettes and formerly smoked cigarettes (21%). However, these two studies did not provide information on the presence or absence of home vaping rules by race and ethnicity or SES.

Housing Summary

Significant disparities in exposure to secondhand tobacco smoke in the home exist by race and ethnicity, SES, home ownership status, the presence or absence of smokefree policies in multi-unit housing, and whether voluntary rules for smokefree homes are in place. Smokefree home rules are differentially distributed across populations and are less common in Black or African American and lower SES households than in White and higher SES households, respectively. Multiple studies suggest that rules for smokefree homes vary by the sexual orientation and gender identity of the household members, composition of the household, presence of children, race and ethnicity, SES, and multi-unit housing. Despite an association between smokefree rules in the home and smoking among youth, few studies have examined potential disparities in this relationship among youth from diverse backgrounds.

The evidence suggests that maintaining smokefree homes reduces exposure to secondhand tobacco smoke, decreases tobacco product use, and aids in smoking cessation. However, because many of the studies in this section used cross-sectional data, future research is warranted that incorporates longitudinal study designs to determine the direction and temporality of the association between smokefree and e-cigarette-free rules in the home and cessation of tobacco product use.

Tobacco-related health disparities by SES are further compounded by the movement of secondhand tobacco smoke throughout multi-unit housing. In fact, people who live in multi-unit housing experience disparities in exposure to secondhand tobacco smoke by age, disability status, race and ethnicity, level of income, gender status, and geographic region. Inequitable smokefree protections for people living in public or multi-unit housing can exacerbate disparities in exposure to secondhand tobacco smoke. Given this evidence, public health practitioners could partner with community members to increase smokefree and e-cigarette-free protections in homes—for example, through focused outreach to multi-unit housing providers about the health and financial benefits of smokefree housing—and could couple such efforts by promoting evidence-based cessation approaches among residents (CDC 2015). Future studies can identify best practices for advancing equitable smokefree protections for residents of multi-unit housing.

In summary, the prevalence of smokefree and e-cigarette-free home rules can differ by race and ethnicity, education level, income level, and sexual orientation of residents and by housing type. The known dangers of exposure to secondhand tobacco smoke, coupled with the fact that aerosol from e-cigarettes can expose bystanders to toxicants (USDHHS 2016), warrants additional efforts to increase the adoption of smokefree and vape-free homes.

School Environment

Adolescents spend the majority of their waking hours in school, where they are situated in a unique physical environment that facilitates increased peer interactions under relatively limited adult supervision (Rutter 1982). The school environment may be defined broadly as what students are offered by schools in terms of the quality of teaching and mentoring, general guidance, teacher–student relationships, policies, services, systems of reward and punishment, and physical surroundings (Bonell et al. 2016). The school environment is a strong predictor of health risk behaviors, including the use of tobacco and other substances, among adolescents (Fletcher and Bonell 2013). In addition, the school environment influences tobacco use by interacting with such sociodemographic factors as race and ethnicity, SES, sex, and sexual orientation and gender identity (Bonell et al. 2016; Coulter et al. 2018). Thus, understanding how the school environment and sociodemographic factors interact to affect diverse groups of youth is warranted. This section focuses on the middle and high school environment and tobacco-related health disparities relevant to youth between 13 and 18 years of age.

The 2012 Surgeon General's report concluded that "socioeconomic factors and educational attainment influence the development of youth smoking behavior. The adolescents most likely to begin to use tobacco and progress to regular use are those who have lower academic achievement" (USDHHS 2012, p. 10). This section goes beyond the 2012 Surgeon General's report to provide evidence of how the school environment more broadly and differentially influences the risk of tobacco use among specific youth populations.

Literature Review Methods

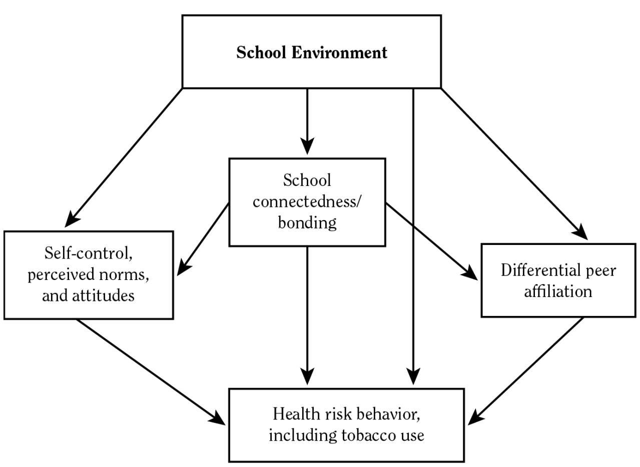
This review is based on a systematic literature search conducted across the PubMed, PsycINFO, and ERIC databases. These databases were selected because they are the ones most likely to index journals that publish peer-reviewed research on school-based tobacco and substance use among adolescents. See Appendix 4.1 for search terms. This section includes peer-reviewed publications, based on search criteria, in the literature from January 1, 2008, to December 31, 2021. Where noted, differences by gender are also provided, but neither boys nor girls were designated as a disparity population. This review does not include studies focused on the role of school tobacco policies in reducing exposure to secondhand tobacco smoke or e-cigarette aerosol across disparity populations.

Influence of the School Environment on Adolescent Health Behaviors, Including Tobacco Use

This section describes the mechanisms through which the school environment influences adolescent health behaviors, including tobacco use. Based on reviews of both empirical and qualitative studies, Bonell and colleagues (2013, 2016) developed a conceptual model that integrates several ways in which the school environment may influence tobacco use and other behaviors among adolescents. Illustrated in Figure 4.2, this model postulates that a positive school environment promotes better bonding with a school, which helps students learn better self-control skills, internalize prohealth norms and attitudes, and affiliate with prosocial peers (i.e., exerting a positive or helpful influence). These outcomes, in turn, protect students from engaging in health risk behaviors, including but not limited to tobacco use. The school environment may directly affect health risk behaviors, such as tobacco use, through health education programs or by enforcing tobacco-free campus policies (Bonell et al. 2016) and practices (e.g., through increased supervision) (Shackleton et al. 2016). The school environment may also influence tobacco use indirectly by creating feelings of school connectedness or attachment. This model may be extended to understand the influence of school environment on tobacco use and the other health risk behaviors of youth who are members of populations that are disproportionately affected by tobacco-related health disparities.

According to data from the 2021 Youth Risk Behavior Survey, 61.5% of U.S. high school students reported feeling connected to others at school. Feelings of school connectedness were lower among Black or African American students (53.9%) and Hispanic or Latino students (59.8%) than were such feelings among White students (65.2%) (Wilkins et al. 2023). School connectedness or school attachment reflects students' pride in their school, their feelings of bonding with the school and teachers, and their sense of school as a community (Shackleton et al. 2016). A demonstrated link exists between a school environment that promotes school bonding and the development among students of self-regulation skills and affiliation with prosocial peers (Markham and Aveyard 2003). The term *self-regulation* refers to the ability to regulate one's feelings, thoughts, and behaviors (Wills et al. 2013). Schools can help students develop effective self-regulation skills and prosocial affiliation through guidance and instruction and by providing opportunities to engage in activities that require teamwork, discipline, respect for one another, and respect for conventions and institutions (Hawkins and Weis 1985; Markham and Aveyard 2003). Research has shown that poor self-regulation and deviant peer affiliation (i.e., selecting friends who engage in problem behaviors) are two of the strongest predictors of substance use by adolescents (Wills et al. 2013).

Figure 4.2 Conceptual model of how school environment influences student behavior



Source: Adapted from Bonell and colleagues (2013, 2016).

Among younger African American adolescents in particular, greater school bonding has been found to be associated with better life skills (Booker 2006). Both the quality of teacher support and of peer relations appears to shape school bonding among African American children and early adolescents (Booker 2006). Additionally, Dotterer and colleagues (2009) found that, among African American youth, perceived discrimination was negatively associated with school self-esteem and school bonding. Experiencing racial or ethnic discrimination at school is associated with negative outcomes for youth who are African American (Thompson and Gregory 2011; Ispa-Landa 2013; Leath et al. 2019).

In addition, school environment can play a role in the development of factors that may be mediators of substance use among students from racial and ethnic groups, such as life skills. For example, in a study of elementary school-aged adolescents of African American or Puerto Rican descent, Brook and colleagues (2006) found that a poorer school environment—measured in terms of academic motivation, school pride, and learning environment—was associated with greater rebellious, deviance-prone behaviors among adolescents. The association was significant even after accounting for the effects of the child's personality characteristics, parent characteristics (including substance use), ethnic identification and perceived racial or ethnic discrimination, and peer affiliation. School environment was the only variable that significantly explained the variance in rebellious behaviors after adjusting for the child's personality attributes.

Overall, the influence of the school environment on tobacco use behavior and tobacco-related norms among youth from groups that are disproportionately affected by tobacco-related health disparities needs to be understood in terms of the intermediary roles played by the school's organization and physical environment, deviant peer affiliation, and tobacco control programs and policies in both the school and community context. The next section discusses research on the influence of school environment on tobacco use among students from racial and ethnic groups.

School Environment, Students from Minoritized Racial and Ethnic Groups, and Tobacco Use

Research examining the influence of the school environment on tobacco use or its antecedents among adolescents from racial and ethnic groups has focused primarily on African American and Hispanic youth (Robinson et al. 2003; Brook et al. 2006; Corona et al. 2009; Zhen-Duan and Taylor 2014; Dornbusch et al. 2016; Bersamin et al. 2017). These studies have primarily examined attachment to school, commitment to school, and academic orientation as variables that influence tobacco use (e.g., Gerrard et al. 2005; Brook et al. 2006; Zhen-Duan and Taylor 2014; Dornbusch et al. 2016). In a prospective study of African American preadolescents, Gerrard and colleagues (2005) found that greater school bonding (assessed as “academic orientation”) at baseline was associated with lower likelihood of cigarette smoking initiation 2 years later and contributed to beliefs and attitudes that smoking is not glamorous or attractive. In another study, Dornbusch and colleagues (2016) found that school connectedness (assessed in terms of a student’s sense of belonging to the school and of having strong relationships with teachers and classmates) was a protective factor against tobacco use among African American and Hispanic youth. Similarly, in the 2011 Healthy Kids Colorado Survey, Yang and Anyon (2016) found that school bonding mediated the relationship between race and ethnicity and cigarette smoking for all groups. However, compared with White youth, Black, multiracial, and Latino youth showed significantly lower levels of school bonding while Asian students showed higher levels of school bonding (Yang and Anyon 2016). Among a sample of Hispanic youth, positive school climate and bonding were associated with a perception that few peers engage in substance use, which, in turn, was associated with a lower likelihood of substance use, including tobacco (Bacio et al. 2015). Similarly, a study of Asian American youth found that a positive school climate had a protective effect on tobacco use intensity (Ryabov 2015). Lack of school attachment and commitment may also contribute to tobacco and other substance use as a form of anti-authority, anti-convention, or anti-school sentiment (Fletcher and Bonell 2013). Alternatively, tobacco and substance use may be the outward expression of anti-school cultural beliefs among adolescents (Bonell et al. 2019).

Higher perceived school bonding is also associated with proximal protective factors—such as higher academic achievement and better mental health—against tobacco and other substance use among youth from minoritized racial and ethnic groups (Stewart 2007; Corona et al. 2009). For example, among Hispanic adolescents, having better relationships with adults at school was a protective factor against poor mental health outcomes (Hall et al. 2018a). In general, it appears that school environments that foster healthy emotional engagement with a school, such as better bonding between peers and between teachers and students, are likely to protect youth, including youth from racial and ethnic groups, from health risk behaviors such as tobacco use (Li and Lerner 2011; Kim and Chun 2018). Additionally, a school environment that provides opportunities for positive behavioral engagement, such as participation in extracurricular activities, may be protective against high-risk behaviors, including tobacco use among adolescents from racial and ethnic groups (Corona et al. 2009; Li and Lerner 2011; Diaz 2016). In fact, higher participation in youth sports has been hypothesized to be one of the reasons for delayed onset of cigarette smoking among African American youth (Garrett et al. 2016). A review of studies of participation in high school and college sports found that 14 out of 15 studies that assessed cigarette smoking found an inverse relationship between sports participation and cigarette use; however, this review did not examine racial and ethnic differences in these relationships (Lisha and Sussman 2010). It is also important to note that engaging in extracurricular activities, especially academic activities (e.g., honor system, student newspaper) and athletics, is protective against deviant behavior and maladjustment among youth from racial and ethnic groups and White youth (Fredricks and Eccles 2010; Latimore et al. 2017). It is possible that physical activity reinforces a belief or attitude that smoking negatively affects breathing during exertion, which can hinder athletic performance and reduce the ability to compete with peers, and which might be a mechanism through which youth participation in athletics discourages tobacco initiation or regular use. Future studies could elucidate the mechanisms that reinforce the protective effects of youth athletics against smoking and other tobacco use. Unfortunately, research shows that participation in extracurricular activities is lower among adolescents from minoritized racial and ethnic groups than White youth (Brown and Evans 2002; Darling et al. 2005; Markstrom et al. 2005; Li and Lerner 2011; Peguero 2011).

Overall, some evidence suggests that school bonding—alternatively characterized as school attachment, school belongingness, and school connectedness—is an aspect of the school environment that affects tobacco use among youth who are members of racial and ethnic groups. At least one study (Gerrard et al. 2005) prospectively demonstrated the association between African American children feeling more connected to their schools and having negative beliefs about smoking, being less willing to smoke, and eventually reporting less smoking—an effect that held after controlling for neighborhood risk factors, family SES, and risk-taking tendencies. However, another study found that youth from families with lower income levels as well as African American and Latino youth were more likely to follow less favorable trajectories of emotional and behavioral engagement with school during a 4-year evaluation period compared with youth from families with higher income levels and European American youth; these types of trajectories were associated with greater rates of substance use including cigarette and smokeless tobacco use (Li and Lerner 2011).

Research shows that higher perceived racial or ethnic discrimination and bullying in school are also likely to result in greater substance use among adolescents from minoritized populations (Stone and Han 2005; Unnever et al. 2015). Feeling marginalized because of one's race or ethnicity is an important source of stress for youth (Benner and Wang 2015), which may promote tobacco use directly (e.g., through methods of coping) (Wills 1986) or indirectly through reduced school attachment (Dotterer et al. 2009; Benner and Wang 2015; Lorenzo-Blanco et al. 2016). Lorenzo-Blanco and colleagues (2016) found that, among a sample of Hispanic youth, odds of current cigarette smoking were highest among youth who experienced the highest levels of perceived ethnic discrimination and the lowest level of protective factors (i.e., low perceived school safety and social support) as well as youth who experienced very high bullying victimization in school and very high perceived ethnic discrimination compared with youth who had the highest protective and lowest risk factors (i.e., low perceived discrimination, low bullying victimization, and high perceived school safety and social support).

Although young people may use tobacco products in an attempt to cope with stressors, nicotine dependence is itself a source of stress given the symptoms of anxiety, depression, and irritability that can occur during withdrawal (USDHHS 2014). Efforts to promote healthy coping strategies among youth and to simultaneously eliminate sources of stress—such as bullying, discrimination, and institutional racism—are warranted to promote health equity.

School Environment, Adolescent Sexual Orientation and Gender Identity, and Tobacco Use

The 2019 U.S. National School Climate Survey indicated that a majority of students in U.S. middle or high schools who identify as LGBTQ experience harassment and discrimination (Kosciw et al. 2020). Among students who are LGBTQ, 86.3% reported experiencing harassment or assault based on sexual orientation or gender expression at school, and 59.1% reported experiencing discrimination in school because of their sexuality. In addition, 52.4% reported having encountered negative remarks about their sexuality from school staff, and 66.7% reporting hearing negative remarks about gender expression from school staff. The survey also found that LGBTQ students who experienced higher levels of harassment and discrimination were significantly more likely to report lower levels of self-esteem and higher levels of depression. For students from minoritized sexual orientation and gender identity groups, the U.S. school environment is associated with major stressors that foster a hostile environment and psychological distress (Gebrekristos 2012).

Harassment based on sexual orientation is a major stressor associated with disparities in tobacco use among students from sexual orientation and gender identity groups compared with heterosexual and cisgender students (cisgender denotes gender identity that coincides with the sex that a person was assigned at birth) (Day et al. 2017; Coulter et al. 2018). Based on their analysis of data from the 2013–2014 California Healthy Kids Survey, which used an analytic sample of 316,766 students who were in Grades 7, 9, and 11 in California, Coulter and colleagues (2018) found that reported experiences of gender- or sexuality-based harassment were associated with higher odds of past-month smoking or e-cigarette use among LGBTQ students compared to their heterosexual counterparts. Huebner and colleagues (2015) found that, in a sample of LGBT adolescents, anti-LGBT victimization in schools was associated with greater smoking frequency and this relationship was mediated through greater association with deviant peers but not with level of school bonding.

Reduced school commitment and attachment also exacerbate tobacco use disparities among transgender adolescents (Hatchel and Marx 2018). Harassment and discrimination negatively affect senses of school belonging among students who identify as LGBTQ (Kosciw et al. 2020). Conversely, positive senses of school belonging may be an important factor for reducing substance use, including tobacco use, among transgender youth (Hatchel and Marx 2018). Analyzing data from the National Longitudinal Study of Adolescent Health (Add Health) study, Russell and colleagues (2001) found that poor relationships with teachers were associated with problems in school among youth from sexual orientation and gender identity groups (e.g., not getting along with peers, not doing homework). Thus, any strategy to address tobacco use among youth from minoritized sexual orientation and gender identity groups in the school setting needs to address the widespread discrimination and marginalization experienced by this population in school.

School Environment, Socioeconomic Factors, Rurality, and Tobacco Use

The 2012 Surgeon General's report on tobacco use among youth and young adults concludes that "[t]he prevalence of cigarette smoking is also highest among lower socioeconomic status youth" (USDHHS 2012, p. 9) and that "[s]ocioeconomic factors and educational attainment influence the development of youth smoking behavior" (USDHHS 2012, p. 10). However, how the school environment affects the development of these types of disparities by SES is not specifically discussed in the 2012 Surgeon General's report. Beyond the influence of individual SES, smoking among youth is also influenced by school SES (i.e., aggregated measures of the socioeconomic status of students in particular schools). A national study found that odds of cigarette smoking among girls was related to attending schools of lower versus higher SES, but these relationships were stronger for American Indian and White girls than for girls of other racial and ethnic backgrounds (Wallace et al. 2009). In another study on school environment and SES factors, Wong and colleagues (2014) conducted a natural experiment to examine whether youth who attended high-performing schools in lower income neighborhoods were less likely than youth who did not attend such schools to engage in risky health behaviors. The study compared lower income youth who had been randomly selected to attend high-performing public charter schools in Los Angeles with lower income youth who had applied for but were not selected to attend such schools. This study found that, after controlling for individual student SES, exposure to a high-performing school environment was associated with increased test scores, but the study did not find differences in past-30-day cigarette use, suggesting that changing schools may not modify the risk of tobacco use among lower income students.

Isolation and rurality also influence tobacco use among adolescents. As described in Chapter 2 of the current report, the prevalence tobacco use, including cigarettes and smokeless tobacco products, is higher in rural areas than it is in urban areas in the United States. Furthermore, the prevalence of smokeless tobacco product use is higher among men than it is among women. A cross-sectional study examined tobacco use among youth in different rural contexts (e.g., communities of less than 50,000 people and youth living on farms, in the country but not on farms, or in towns) and included an analytic sample of 18,767 adolescents enrolled in 6th, 8th, 10th, and 12th grades at public schools (Rhew et al. 2011). Odds of lifetime and past-30-day smokeless tobacco use were greater among high school students living in the country or on a farm compared with their counterparts living in towns; however, odds of lifetime and past-30-day cigarette smoking did not differ significantly by residential context. The study also found that rural high school youth living in the country or on farms were exposed to fewer school protective factors (i.e., opportunities and rewards for prosocial involvement) and higher school risk factors (i.e., academic failure and low commitment to school) versus youth living in towns. Additionally, after adjusting for parental education, school risk factors were strongly associated with greater odds of lifetime and current smokeless tobacco use among high school and middle school students across rural contexts, and school protective factors were associated with lower risk of lifetime and current smokeless tobacco use among town residents but not among students living on farms. Although indirectly related to schools, more recent work has used alternative measures of geographic isolation. For example, Blank and colleagues (2022) used an isolation scale that measures access to health-related resources by ZIP code to evaluate associations between geographic isolation and patterns of tobacco use in a sample of high school students from north-central Appalachia. Adolescents with higher isolation scores were more likely to engage in polytobacco product use and experiment with cigarettes or e-cigarettes. Chapter 5 discusses targeted marketing by the tobacco industry, including such marketing targeted at rural populations.

Youth Exposure to Tobacco Prevention Policies and Programs in Schools

Another aspect of the school environment that is likely to influence adolescents' tobacco use behavior is school-level tobacco-free campus policies and tobacco prevention programs (Bonell et al. 2016). In a systematic review of 31 studies that examined the effects of school-level policies on students' smoking behavior, Galanti and colleagues (2014) found that comprehensive smoking bans, clear rules, strict policy enforcement, and the availability of prevention and cessation support were all associated with lower prevalence of smoking among students. However, the authors could not draw strong causal inferences because most studies in their review were qualitative or cross-sectional designs. Although most of the studies were based in the United States and Canada, the proportion of adolescents from minoritized racial and ethnic groups across study samples was unclear. One review highlighted the mechanisms through which successful school-level policies may affect student smoking behavior (Schreuders et al. 2017). This study found that adolescent smoking decreased if school policies made them (1) feel that they would be sanctioned for smoking, (2) feel less pressure to conform to attitudes and behaviors of their pro-smoking peers, and (3) feel that opportunities were provided to help with quitting smoking or remaining abstinent. However, only a few of the identified U.S. studies examined whether exposure to school-level tobacco policies differed across disparity groups or whether the effectiveness of such policies differed among youth from disparity populations.

One national-level study found that local tobacco prevention programs were less prevalent in schools where the student population was predominantly African American or Hispanic compared with schools where the student population was predominantly White (Kumar et al. 2013). Such programs were also less prevalent in schools of lower SES with higher percentages of students on free or reduced-price lunch than in more socioeconomically advantaged schools.

Further examination of the relationships between individual factors (i.e., age and Black or other versus non-Latino White) and neighborhood factors on racial disparities in smoking or receipt of youth tobacco prevention education in schools occurred in a 2010 analysis of student data from the 2005–2006 Virginia Youth Tobacco Survey (Kaestle and Wiles 2010). For this analysis, neighborhood characteristics were assessed by a neighborhood socioeconomic disadvantage variable, which included but was not limited to measures of poverty, unemployment, education, racial composition, and urban status. A neighborhood's urban status, proportion of Black residents, and social disorganization factors (e.g., measured in the study as single-parent family status, homes with no vehicle, and owner-occupied housing) were not associated with youth smoking or receipt of tobacco prevention education. Overall, adolescents living in socioeconomically disadvantaged neighborhoods had a significantly higher relative risk of light, medium, or heavy cigarette smoking than did youth from more advantaged neighborhoods. However, by race and ethnicity, Black adolescents had a significantly lower relative risk of heavy smoking than White adolescents. Adolescents in socioeconomically disadvantaged neighborhoods also had significantly lower odds of having received tobacco prevention education in school. This study shows how socioeconomic disadvantage at the neighborhood level can influence adolescent smoking and low receipt of tobacco prevention education in schools. The intersection of SES and race and ethnicity deserves further study in relation to other tobacco product use and other social determinants of health.

In another study conducted in Kentucky schools (Hahn et al. 2005), having a comprehensive tobacco-free campus and providing cessation resources in school were more common in schools in urban areas than in schools in nonurban areas. This finding suggests a potential need to increase tobacco prevention in schools located in rural communities.

The literature on the associations between school environment and tobacco use suggests that a lack of tobacco control policies in schools, or weak enforcement of such policies, is associated with tobacco use and worse SES-related disparities, although the evidence for policy comprehensiveness is mixed (Bonell et al. 2013). For instance, in Waves I–III of the Add Health cohort study, exposure to comprehensive school tobacco control policies affecting both students and staff was associated with lower odds of ever using tobacco among students, but exposure to policies that only addressed student smoking was not significantly associated with reduced odds of ever use in this age group (Jayawardhana et al. 2019). Adams and colleagues (2009) found that active enforcement of a school tobacco policy was associated with lower odds of tobacco use among students but no difference was seen based on the comprehensiveness of the policy. Boris and colleagues (2009) found no overall difference in current smoking among Louisiana ninth graders entering high schools with either a comprehensive smoking policy or a policy allowing for staff smoking in restricted areas. However, African American youth had higher odds of smoking if attending a school with a comprehensive tobacco-free policy compared to a school with a restricted smoking policy, and White youth showed no differences in prevalence of smoking based on policy type at school. The authors of this study speculated that the findings might represent a boomerang effect (i.e., increased smoking rates for African American students in schools with a comprehensive smokefree policy). Although the findings appear to be counterintuitive, it has been noted that Black youth tend to feel less connected to school than White youth (Yang and Anyon 2016). This may suggest that school-based tobacco policies could have less influence over tobacco use among the members of this racial and ethnic group compared to other social or environmental factors (i.e., tobacco use among peers who are Black, exposure to tobacco marketing).

In general, studies have rarely examined the effects of school-based tobacco control policies on tobacco use among students who are members of minoritized racial and ethnic groups relative to White students, students from sexual orientation and gender identity groups compared with heterosexual students, or lower versus higher SES students. Findings on the impact of perceived strictness of a policy appear mixed, potentially due to differences in study design. In a representative sample of 8th and 11th graders in Oregon, attending a school in which students perceived the smoking policy to be strictly enforced was associated with lower odds of any cigarette smoking, daily smoking, smoking on school property, and smoking if offered a cigarette by a best friend (Lipperman-Kreda et al. 2009). In contrast, a multilevel analysis of the impact of school-level tobacco policies on the prevalence of smoking among a representative sample of youth in Michigan found that the stringency of enforcement of a tobacco-free school policy was not significantly associated with current smoking after accounting for individual variables; however, all schools included in the study had a comprehensive tobacco-free school policy (Paek et al. 2013).

On the other hand, studies consistently demonstrate that the presence of health centers in schools that serve students of lower SES, students from sexual orientation and gender identity groups, and students from racial and ethnic groups, especially African American students, is a protective factor for multiple health problems, including tobacco use (Robinson et al. 2003; Knopf et al. 2016; Bersamin et al. 2017; Zhang et al. 2020). In 2015, the Community Preventive Services Task Force published a report based on a systematic review of 46 studies that evaluated onsite clinics serving urban, lower income, and high school students from racial and ethnic groups. The review found that having a school-based health center was associated with improved educational outcomes (e.g., higher grade point average, less suspensions) and health-related outcomes (e.g., lower substance use) in low-income communities (Knopf et al. 2016). However, the United States has a paucity of available school-based health centers. CDC estimated that, based on a representative sample of U.S. public and private school districts in 2016, the percentage of schools that had a school-based health center ranged from 6.0 to 52.0% across states (median: 21.5%) and from 5.6 to 56.6% across large urban school districts (median: 30.0%) (Brener et al. 2017). Nevertheless, the benefits of school-based health centers extend beyond reduced tobacco use among youth from racial and ethnic groups; their presence in schools serving youth from lower income, urban communities can be a conduit for improving health education, substance use prevention, and receipt of needed physical and mental health services, thus advancing health equity for students from racial and ethnic groups (Knopf et al. 2016).

E-cigarettes and emerging tobacco products have unveiled a fresh set of challenges for schools. Several studies have found that e-cigarette use is common on school grounds. For example, in the 2019 NYTS, 64% of U.S. youth reported noticing youth use of e-cigarettes at school (Dai 2021). Among Connecticut high school students, 45% of students who currently used e-cigarettes reported that they used their product in school with most use reported in school bathrooms (Jackson et al. 2020). In addition, studies have also found that it may be difficult for teachers and school administrators to distinguish some pod-based e-cigarette devices, such as JUUL e-cigarettes, from day-to-day electronic objects, such as flash drives (Schillo et al. 2020). These factors may complicate the enforcement of antitobacco policies in schools. Nonetheless, Nicksic and colleagues (2018) showed that having a school policy on e-cigarettes, such as comprehensive bans and restrictions on their use, is correlated with a lower likelihood of students using these devices. Notably, this research was based on a sample from Texas of which more than half were Hispanic youth. However, to date, little information is available that examines how school policies restricting e-cigarette use may or may not influence tobacco-related health disparities.

Multilevel study designs can elucidate the changing influence of schools over the course of the youth e-cigarette epidemic. Lippert and colleagues (2019) used multilevel modeling to find that school-level associations with student vaping decreased as e-cigarettes became more commonplace nationwide, even after controlling for student characteristics and exposure to tobacco use among friends and family members. Thus, although school contexts are still consequential, particularly during early stages of the youth e-cigarette epidemic, the influence of the school setting on student behaviors may shift in response to concurrent changes in broader health practices, culture, and policy in society. These findings have implications for diverse groups of youth, given that e-cigarettes were most commonly used initially by White male students but, as of 2021, were the most commonly used tobacco product among youth across genders and across all other racial and ethnic groups, as measured in the NYTS (Gentzke et al. 2022).

Although limited evidence exists regarding effective cessation interventions for youth in general (Fiore et al. 2008; U.S. Preventive Services Task Force 2020), researchers have been examining for decades the usefulness of giving youth access to smoking cessation services through school-based health centers (Kisker and Brown 1996; Price et al. 2003). However, little evidence is available on how such services are being made available to racially and ethnically diverse youth, students with lower SES, and students from sexual orientation and gender identity groups who use tobacco products. With the rise in the prevalence of e-cigarette use among adolescents, school-based health centers might play an important role in treating adolescents' addiction to nicotine through, for example, direct delivery of cessation services and connection to health system- or community-based cessation resources. Among schools in their sample of 168 public middle and high schools in Oregon, Paschall and Bersamin (2018) found that e-cigarette use increased sharply over time in schools without a health center compared to schools with a health center. Earlier, however, Price and colleagues (2003) noted that schools often struggle with establishing or maintaining health centers or smoking cessation treatment services within the schools themselves because of a lack of financial resources and personnel who are qualified to provide such services. Promoting the use of school-based health centers, especially in lower income schools and schools that serve students from racial and ethnic groups, may be an important strategy to reduce tobacco-related disparities (Darling-Hammond 2013). Beyond this approach, however, school-based tobacco prevention programs might benefit from a more person-centered—versus a demographic characteristic-centered—ecological approach and from addressing such issues as perceived discrimination (Unger 2015) and victimization, which influence school climate and school bonding.

The limited existing research suggests that comprehensive tobacco-free campus policies are especially important in socioeconomically disadvantaged communities, as such policies may protect youth at highest risk of smoking. Additionally, providing prevention education and cessation services through school-based health centers may serve as a protective factor against smoking among students who are members of diverse racial and ethnic groups and students from sexual orientation and gender identity groups. Still, longitudinal, cross-sectional, or experimental research rarely documents differences in exposure to such policies by race and ethnicity or SES. Additionally, whether the presence of such policies reduces noncigarette tobacco product use is unclear, as are the effects on reducing tobacco-related health disparities.

School Environment Summary

This section highlighted the importance of the school environment as a determinant of tobacco product use among youth from populations that are disproportionately affected by tobacco-related health disparities. Experiencing higher levels of school connectedness may be protective against tobacco product use among African American and Hispanic youth, but these students can experience lower levels of school bonding compared with students of other racial groups, such as Asian youth. Although the mechanisms explaining these relationships are not well understood, a few studies suggest that school engagement, such as participation in team sports or extracurricular activities, may reduce the likelihood of smoking among certain racial and ethnic groups of youth.

Evidence also suggests that youth from certain racial and ethnic groups are likely to show less engagement with school. Factors that may discourage these youth from forming better bonds with schools include social stigma and perceived discrimination. Data from the studies in this review suggest that adolescents from some racial and ethnic populations experience higher levels of discrimination and bullying than do White youth, which may ultimately impact disparities in tobacco product use.

Similarly, associations may exist between smoking and harassment and victimization experienced in schools on the basis of sexual orientation and gender identity and between smoking and e-cigarette use among adolescents who are LGBTQI+. Lower levels of school commitment and attachment might modify these relationships. Furthermore, school SES and individual race and ethnicity could impart multilevel interacting effects on smoking among adolescents. Given that many adolescents have intersectional identities and diverse experiences, future research could utilize additional multilevel studies to examine the interaction between school-, neighborhood-, and individual-level characteristics and tobacco product initiation and use.

Exposure to school-level tobacco control policies and programs constitutes another environmental factor that may influence differences in the use of tobacco products among youth. Having tobacco prevention programs and policies in schools is associated with a lower prevalence of smoking among adolescents. However, not all students have access to these policies and programs. In fact, there are disparities in the racial and ethnic, socioeconomic, and geographic characteristics of the schools that implement antitobacco policies and provide tobacco prevention and smoking cessation services. Because the prevalent use of e-cigarettes among youth can pose challenges for the enforcement of comprehensive tobacco-free policies in schools, it is important to examine how these policies are implemented in diverse school environments. Chapter 7 addresses approaches for designing effective school-based tobacco-free programs for youth from various racial and ethnic groups. However, additional research is needed to investigate how the unequal access to these policies, programs, and treatment services in schools can contribute to disparities in tobacco product initiation and use among youth.

Work Environment

The work environment influences health through physical, psychological, economic, and social mechanisms. These mechanisms include both positive aspects of the work environment, such as social support for wellness resources, and negative aspects, such as exposure to toxicants and psychosocial stress (Okechukwu et al. 2010). Positive working conditions contribute to improvements in multiple health outcomes (Schnall et al. 2009; Marmot and Bell 2010; Pfeffer 2018), including tobacco use patterns (Sorensen et al. 2004; Albertsen et al. 2006). A health-promoting workplace offers resources that support quitting, including rewards, control over decision making, and social support (NCI 2017a). However, as documented in NCI Tobacco Control Monograph 22 (NCI 2017a), working conditions may create stressors that contribute to increased tobacco use and barriers to quitting (Haenszel et al. 1956; Sterling and Weinkam 1976; Nelson et al. 1994; Leigh 1996; Giovino et al. 2000; Lee et al. 2007; Sorensen and Barbeau 2012). Studies consistently demonstrate that exposure to hazardous factors in the workplace occurs differentially across demographic subgroups, such as those defined by age, sex, race and ethnicity, educational attainment, or sexual orientation (Loomis and

Richardson 1998; Murray 2003; Berdahl 2008; Clougherty et al. 2010; Steege et al. 2014), and thus workplace factors have the potential to influence tobacco-related health disparities.

The 1985 Surgeon General's report, *The Health Consequences of Smoking: Cancer and Chronic Lung Disease in the Workplace*, examined the combined effects of occupational exposures and cigarette smoking on tobacco-related diseases (USDHHS 1985). The report identified disparities in cigarette smoking by race and ethnicity and sex, even after accounting for occupation or occupational classification.

Chapter 8 ("Occupation, the Work Environment, and Tobacco-Related Health Disparities") in NCI Tobacco Control Monograph 22 (NCI 2017b) contains information and conclusions that are highly relevant to this section:

> "More than 30 years after the [1985 Surgeon General] report's publication, significant disparities in tobacco use persist across the tobacco use continuum by occupation. Blue-collar and service workers are more likely to be ever-smokers, current daily smokers, and heavier smokers than white-collar workers, and are less likely to quit successfully, although intentions to quit and quit attempts do not differ by occupation. Tobacco use is especially prevalent in certain industries, notably construction and extraction, mining, and hospitality and food services—settings that offer few worksite cessation programs and often lack comprehensive smoke-free policies. The work environment influences patterns of tobacco use prevalence, intensity, and cessation by occupation. Plausible pathways mediating this relationship include work-related stress, work hours, racial discrimination, pro-tobacco social norms, and lack of social support for cessation. Workers' exposure to job-related hazards appears to be associated with lower interest in quitting and less likelihood of quitting" (NCI 2017b, p. 295).

This section includes studies focused on occupational factors as they relate to disparities in tobacco use and cessation, exposure to secondhand tobacco smoke, and social norms and builds on evidence from NCI Tobacco Control Monograph 22 (NCI 2017b) and the 1985 Surgeon General's report on workplace influences on tobacco-related health outcomes (USDHHS 1985).

Literature Review Methods

To identify the evidence presented in this chapter, the authors searched PubMed, the Social Sciences Citation Index, and Google Scholar for studies that focused on disparities in tobacco initiation, tobacco use, and cessation as they are affected by occupational factors. In particular, the search prioritized meta-analyses and prospective cohort studies, with a focus also on workplace tobacco-free policy implementation. The search, which was not restricted by date, yielded relevant articles published between January 1, 2008, and December 31, 2021, with selected earlier literature included to contextualize the field. Search terms are listed in Appendix 4.1.

The summary and conclusions related to this section were developed by combining the literature cited in previous Surgeon General's reports with new scientific evidence and by building on conclusions from the section in NCI Tobacco Control Monograph 22 (NCI 2017b) that focused on tobacco-related disparities in the workplace. In addition to adding newer studies, this synthesis includes broader discussions about noncigarette tobacco products, such as e-cigarettes, and also discusses populations, such as people from minoritized sexual orientation and gender identity groups, who were not included in prior reviews.

Working Conditions Associated with Tobacco Use

Positive working conditions contribute to improvements in multiple health outcomes (Schnall et al. 2009; Marmot and Bell 2010; Pfeffer 2018), including tobacco use patterns (Sorensen et al. 2004; Albertsen et al. 2006). As documented in NCI Tobacco Control Monograph 22 (NCI 2017b), working conditions may create stressors that contribute to increased tobacco use and barriers to quitting; a health-promoting workplace offers resources that support quitting, including rewards, decision latitude, and social support. Figure 4.3 presents an adapted model, drawing on NCI Tobacco Control Monograph 22 (NCI 2017b) and other sources (Punnett et al. 2009; Sorensen et al. 2016), to illustrate the potential roles of three influences on working conditions: psychosocial exposures, organizational factors, and physical hazards. Stress may serve as one mediator of these work-related exposures.

Psychosocial Exposures

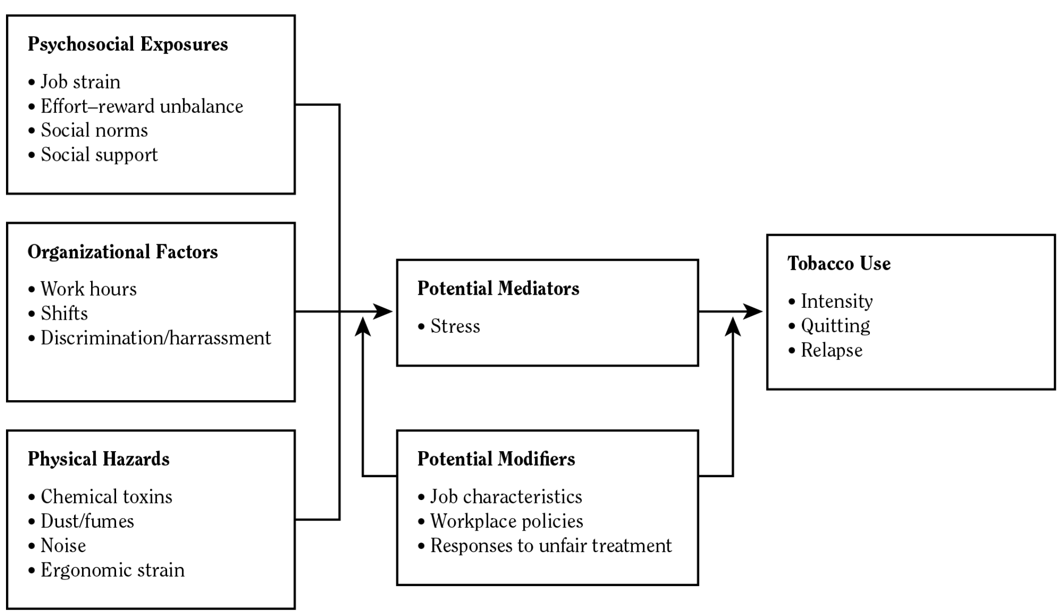
Disparities exist in the distribution of social hazards (e.g., violence, discrimination, or harassment that occurs in the workplace) by race and ethnicity, social class, sex, nativity, and sexual orientation and gender identity. According to data from the National Institute for Occupational Safety and Health, after adjusting for other work and demographic factors, being Black, American Indian and Alaska Native, Asian American, or Pacific Islander or being born outside of the United States all remained significant risk factors for being the victim of homicide at work (Steege et al. 2014). Black workers had almost three times the rate of workplace homicide as White workers, and American Indian and Alaska Native, Asian American, and Pacific Islander workers and workers born outside the United States had more than twice the occupational homicide rate of White workers and domestic-born workers, respectively. A study of Indiana nurses found an association between lateral violence in the workplace (i.e., covert or overt acts of aggression between coworkers) and greater risk of tobacco use (Foli et al. 2021).

In addition, researchers have examined the relationship between the experience of social hazards and tobacco use (Steege et al. 2014; Seelig et al. 2017; Chin et al. 2018). A longitudinal analysis of military personnel in the Millennium Cohort Study found that males who used to smoke and who experienced sexual assault had 6.62 times the risk of smoking relapse at follow-up as those who had not experienced such an assault during the time period (Seelig et al. 2017). Similarly, cross-sectional surveys of tobacco use on two military bases (one U.S. Army, the other U.S. Navy) found differential levels of tobacco product use by combat exposure among service members (Chin et al. 2018; Hall et al. 2018b). These studies, which were conducted between 2015 and 2016, found higher levels of tobacco use among service members who were the most likely to be exposed to combat, enlisted men or women (as opposed to officers), and service members who had been deployed a greater number of times.

Job strain has been conceptualized using the demand-control model (Karasek and Theorell 1990), which has shown that jobs characterized by high demand and low control are most detrimental to health. For example, according to cross-sectional surveys of nursing homes in Massachusetts between 2006 and 2007, job strain tends to occur differentially by race or ethnicity (Hurtado et al. 2012). Applying Karasek's job strain model (Karasek and Theorell 1990) (i.e., a combination of job-related activities of high psychological demand and minimal decision authority to manage demands at work), Hurtado and colleagues (2012) found that risk of job strain was higher among Black workers (relative risk = 2.9; 95% CI, 1.3–6.6) than it was among White workers in the same workplace.

A growing body of literature documents the effects of job strain on smoking, smoking intensity, and quitting (Heikkila et al. 2012; Schantz and Bruk-Lee 2016; NCI 2017a), although some of these findings are inconsistent (Allard et al. 2011; Griep et al. 2015; Rowe et al. 2015a). Some studies have found that job strain is associated with a higher prevalence of smoking (Green and Johnson 1990; Hellerstedt and Jeffery 1997; Lindstrom 2004), and other studies have yielded null findings (Greenlund et al. 1995; Niedhammer et al. 1998; Brisson et al. 2000; van Loon et al. 2000; Ota et al. 2010; Rowe et al. 2015b). A study using latent class modeling suggested that unobserved individual characteristics—such as self-control, stress-coping ability, personality traits, or health preferences—may help to account for these mixed findings and could be included in future studies of this topic (Azagba and Sharaf 2011).

Figure 4.3 Conceptual model of work-related pathways to tobacco use



Source: Model adapted from NCI Tobacco Control Monograph 22 (NCI 2017b) and other sources (Punnett et al. 2009; Sorensen et al. 2016).

In a systematic review of the effects of the work environment on smoking cessation, relapse, and amount smoked, Albertsen and colleagues (2006) found that high on-the-job demands increased the number of cigarettes smoked among people who smoke and were associated with fewer cessation attempts and an increased probability of relapse.

Work-related social norms and social support may also contribute to disparities in tobacco use. Social support in the workplace may contribute to increased cessation, a decrease in the likelihood of relapse, and a decrease in the number of cigarettes smoked (Griep et al. 2015; NCI 2017a). Other studies have found that smoking may cluster within work groups, potentially indicating the reinforcing role of social norms (Quist et al. 2014), and that quitting may be less likely among those working with other people who smoke (Yong et al. 2014).

Organizational Factors

Research on shift work, which is also a psychosocial occupational hazard, indicates that exposure to this stressor may occur differentially across population groups. In studies using nationally representative samples of U.S. workers, workers who were Black or Hispanic and had low levels of education and income were significantly less likely than their counterparts to have control over their work hours, schedules, and breaks and were more likely to work evening and night shifts (Deitch and Huffman 2001; Swanberg et al. 2005). Additionally, working long hours and having either variable shifts or shifts outside the usual workday have been associated with an increased likelihood of smoking (Bannai and Tamakoshi 2014; NCI 2017a). Furthermore, people who work long hours may be less interested in quitting (Yong et al. 2014), and prospective studies have provided evidence that shift work, including working evenings and nights, reduces the likelihood of successful smoking cessation (Eriksen 2005; Sanderson et al. 2005). Finally, working the night shift has been associated with an increased risk of relapse and reduced cessation rates (Nabe-Nielsen et al. 2011; Letri-Mann et al. 2016).

The organizational structure of the workplace may also produce other sources of workplace stress, including bullying, harassment, and discrimination. Exposure to workplace discrimination has been associated with smoking among Black workers (NCI 2017a). A study based on the BRFSS survey's Reactions to Race module found that workplace discrimination related to race and ethnicity was associated with current smoking in the total sample and with increased current and daily smoking among both Black people and White people (Chavez et al. 2015). Finally, some studies have related smoking status to job insecurity and job loss (NCI 2017a).

Physical Hazards

Research indicates that work environments often mirror broader societal imbalances in access to opportunities and resources (Steege et al. 2014). Hazards in the work environment often adhere to the inverse hazard law, which posits an inverse relationship between health hazards and the distribution of power and resources such that people with less power and resources have more hazards in their physical and social environments (Krieger et al. 2011). The inverse hazard law is particularly noteworthy in relation to commercial tobacco use because many of the most harmful chemicals in tobacco smoke—such as carbon monoxide, arsenic, benzene, ammonia, and formaldehyde—are well-documented occupational hazards (Anderson and Wu 2015). Further, diacetyl (2,3-butanedione), a flavoring additive used in some e-cigarette liquids, is the key causal factor in the development of bronchiolitis obliterans (otherwise known as *popcorn lung*, which is a severe lung disease) among workers in some flavoring and food production industrial settings (Barrington-Trimis et al. 2014; Whitsel et al. 2015; Fechter-Leggett et al. 2018). In addition, the workplace is a source of exposure to other harmful environmental toxicants, such as silica dust, a known cause of multiple diseases including lung cancer (U.S. Department of Labor n.d.).

Tobacco use may increase the risks associated with exposures to occupational hazards (Castellan et al. 2015). This increased risk may be additive (e.g., when workers are exposed to the same toxic chemicals at work and in tobacco products) or synergistic (e.g., when tobacco use increases the risks associated with an industrial hazard, such as asbestos). Tobacco products can become contaminated by workplace chemicals through contact of the products with unwashed hands, contaminated surfaces, or disposition of airborne contaminants. Additionally, the heat that is generated from combusted tobacco products can transform workplace chemicals (e.g., polytetrafluoroethylene, or Teflon, and other chlorinated hydrocarbons) into more toxic chemicals (Castellan et al. 2015). Combusted tobacco products can also pose fire risks for the workplace, especially in occupations involving volatile chemicals. In addition, smoking may contribute indirectly to increased health and safety risks. For example, reduced lung function resulting from smoking may increase workers' vulnerability to occupational exposures to dust, gases, and fumes and could increase risk of injury (National Institute for Occupational Safety and Health 1979).

Socially disadvantaged workers, including those with lower wages or lower levels of education, are more likely to use tobacco products and to be employed in jobs with exposures to physical hazards (Barbeau et al. 2004; Steege et al. 2014). Additionally, evidence indicates higher levels of exposure to occupational hazards among diverse minoritized racial and ethnic groups, people from sexual orientation and gender identity groups, immigrants and migrants, men (versus women), and people of lower SES (Loomis and Richardson 1998; Murray 2003; Clougherty et al. 2010; Steege et al. 2014).

Finally, exposure to job-related hazards has been associated with reduced interest in quitting smoking (NCI 2017a). Prospective cohort studies, especially studies of smoking cessation interventions, have provided strong evidence that the accumulation of occupational hazards reduces workers' intentions to engage in tobacco cessation and increases their risk of relapse (Sorensen et al. 1996, 2002; Albertsen et al. 2004). One mechanism that has been posited is that accumulated exposure to occupational hazards leads workers to perceive smoking cessation as futile, especially because occupational hazards and cigarettes often expose workers to the same hazardous chemicals (Sorensen et al. 1996). An alternate mechanism, represented in the CLD model (Figure 4.1), is that smoking serves as a coping response to accumulated exposure to occupational hazards. Such workplace stressors might be associated with lower wage work and financial strain, which may have reinforcing effects on stress and anxiety.

Influence of the Work Environment on Disparities in the Initiation and Use of Tobacco Products

Many Americans initiate smoking before their first job, but this is not always the case (Kandel et al. 2011). Compared to non-Hispanic White people, people from other racial and ethnic groups typically initiate smoking at later ages and, as a result, initiation among the members of these groups often coincides with their entry into the labor market (Moon-Howard 2003; Trinidad et al. 2004; Dutra et al. 2017; Cantrell et al. 2018). In addition, research suggests that the age of initiation is increasing overall in the United States (Barrington-Trimis et al. 2020).

Cigarettes

Data from studies of military personnel and transit workers indicate that there is a relationship between workplace factors and cigarette smoking initiation and/or subsequent smoking behaviors (Cunradi et al. 2007; Boyko et al. 2015; Brown et al. 2018). For example, in a study of 4,728 military personnel from 24 large U.S. military installations who smoke, increased smoking intensity and nicotine dependence were associated with smoking "to fit in with one's unit, being in the Army, smoking as a reaction to stress, and work-related stressors" (Brown et al. 2018, p. e231). Additionally, data from a multiethnic cohort of municipal transit operators in San Francisco followed over 10 years (1983–1985 and 1993–1995) found differences in smoking behaviors by race and ethnicity and by workplace factors (Cunradi et al. 2007). Specifically, after adjusting for sex, age, alcohol use, problems at work, work-related burnout, availability of time to unwind from work, and years driving, transit workers who were Black were found to be more likely than those who were Hispanic, Asian or Filipino, White, or classified as Other Race to have smoked over a 10-year period (OR = 1.55; 95% CI, 1.10–2.18; $p = 0.01$). The only other significant predictor of likelihood of smoking increase, initiation, or maintenance in covariate-adjusted analyses was frequency of job problems, such as accidents, overcrowding, problems with equipment, conflicts with management, crime, communication problems, access to restrooms, or pressure to maintain a schedule ($p = 0.004$).

The U.S. armed services is a unique federal workplace environment, with a command structure that allows for varied leadership approaches that can differ by branch of service, commander priorities, rank, and deployment status of armed services personnel. These factors combine to foster a complex policy landscape for tobacco prevention and control. The tobacco industry has a long history of targeting military personnel. For example, cigarettes were provided in basic field rations until 1975, when this practice was banned (Smith and Malone 2009). Additionally, cigarettes were sold at deeply discounted prices in commissaries located on military bases prior to the mid-1990s (Smith and Malone 2009). However, since the 1990s, the U.S. Department of Defense has attempted to require that cigarette prices on military bases be similar to those in the surrounding community, to restrict the places where smoking is allowed, and to increase the availability of cessation aids for military personnel who want to quit (Tate 1999; Smith and Malone 2009; USDHHS 2014). Efforts to continue promoting tobacco-free norms among members of the armed services and their families, including efforts to eliminate exposure to secondhand tobacco smoke in multi-unit military housing, deserve future research attention. Furthermore, given the targeted marketing of e-cigarettes and use of emerging tobacco products—such as nicotine pouches—which undermine tobacco-free norms and may impede cessation efforts, efforts are warranted to monitor and counter the availability, appeal, and use of such products by armed services personnel.

Smokeless Tobacco

Earlier, an analysis of military personnel using the longitudinal Millennium Cohort Study found an association between workplace environment and initiation of smokeless tobacco use and disparities in such initiation by education and race and ethnicity (Hermes et al.

2012). The authors found a greater likelihood of initiating smokeless tobacco use (between 2001–2003 and 2004–2006) among military personnel who had been deployed to Iraq or Afghanistan than among military personnel who were not deployed to those areas. The study also indicated that a higher risk of initiation was associated with multiple deployments (versus one) to those areas. Service members with less educational attainment, who identified as non-Hispanic White, or who were in the U.S. Air Force, U.S. Navy, or the U.S. Coast Guard were significantly more likely to initiate smokeless tobacco use while in the military than their counterparts who had more education, were from racial and ethnic groups, or were in the U.S. Army. There was no statistically significant difference in the initiation of smokeless tobacco between service members in the U.S. Marine Corps compared with those in the U.S. Army (Hermes et al. 2012). However, Lin and colleagues (2018) found that the prevalence of smokeless tobacco use was higher among service members in the U.S. Army (stationed at Fort Liberty, then Fort Bragg, Army Base in North Carolina) (32.6%) than it was among those in the U.S. Air Force (stationed at Lackland Air Force Base in Texas, which is part of Joint Base San Antonio) (11.6%). Compared with U.S. Air Force service members, U.S. Army service members who used smokeless tobacco products were heavier users with longer durations of use, were more likely to have started using smokeless tobacco after joining the military, and were less likely to make a quit attempt.

Firefighters are another population at risk for occupational disparities in the use of specific tobacco product types. Jitnarin and colleagues (2017) examined late initiation of smokeless tobacco use—that is, beginning use as an adult after joining the fire service—among male firefighters in the United States. They used age-standardized data on males from the U.S. Census and age distributions from the 2011 U.S. Department of Defense Health-Related Behaviors Survey (HRBS) of Active Duty Military Personnel as comparison groups to compute estimates of smokeless tobacco use among U.S. adult males in the general population and male military personnel. The study found a possible relationship between the fire service and the initiation of smokeless tobacco use. After age-standardizing results to men in the military who also have high rates of smokeless tobacco use, the study found that a statistically significant proportion of male firefighters, who never used smokeless tobacco before joining the fire service, initiated use after joining the fire service. Firefighters also initiated smokeless tobacco use at a later age than their counterparts in the military and general population. Although this analysis did not examine differences in the initiation of smokeless tobacco use by demographic characteristics, more than 80% of the sample of firefighters were White and male. The use of e-cigarettes or other noncigarette tobacco products was not assessed.

E-Cigarettes

Data from the 2014 NHIS showed differences in the use of e-cigarettes by occupation (Syamlal et al. 2016), with workers in the accommodation and food services industry and with occupations in food preparation and as food servers having the highest prevalence of e-cigarette use compared with people working in education services and in occupations in architecture, engineering, and computer and mathematical fields (who had the lowest prevalence of e-cigarette use) (also see Chapter 2 of the current report). In addition, several studies have found that many people who use e-cigarettes report using e-cigarettes in situations in which they cannot smoke cigarettes indoors, including in the workplace (Czoli et al. 2014; Li et al. 2014; Tucker et al. 2014; Ambrose et al. 2015; Kong et al. 2015; McDonald and Ling 2015; Suris et al. 2015). None of these studies, however, considered differences in the influence of workplace factors on e-cigarette use across demographic or racial and ethnic groups. Notably, much of the existing research on this topic was conducted before the proliferation of local laws mandating smokefree indoor air included e-cigarettes (Marynak et al. 2017). Additionally, these prior studies on the effects of the work environment on patterns in e-cigarette use may be less replicable given the rapidly changing landscape of noncigarette tobacco products, shifting patterns in use over time, and social norms about different types of tobacco products.

Multiple Product Use

In the 2008 HRBS among active duty military personnel, cigarette, smokeless tobacco, and cigar use was highest among young male (17–20 years of age and 20–25 years of age) U.S. Marine Corps and U.S. Army personnel, non-Hispanic White personnel, personnel with less than a college education, and personnel in lower pay grades (Olmsted et al. 2011). In adjusted analyses, compared with military personnel who identified as "Other race," non-Hispanic White service members were at higher risk of using cigarettes, smokeless tobacco, and cigars; cigarettes and smokeless tobacco in combination; and all three products together, and non-Hispanic Black and Hispanic service members were at lower risk of cigarette and smokeless tobacco use. This study also found an inverse relationship in the risk of using cigarettes, cigarettes and smokeless tobacco together, and all three products (cigarettes, smokeless tobacco, and cigars) together by level of educational attainment and pay grade. Risk of e-cigarette use was not assessed because they were not widely available when these data were collected in 2008.

However, additional studies have used more recent administrations of the HRBS to assess the dual use of e-cigarettes and other tobacco products. Keltner and colleagues (2021), using data from the 2015 HRBS in adjusted analyses, found that service members who were of rank enlisted (compared to rank of Officer), who lacked a bachelor's degree (compared to having a bachelor's degree or higher educational attainment), and who had a probable alcohol use disorder (compared to not having one) had significantly greater odds of dual use of e-cigarettes and cigarettes. Additionally, Smucker and colleagues (2021), using data from the 2018 HRBS, found that active service members who used both e-cigarettes and other tobacco products (including cigarettes, chewing tobacco or snuff, cigarillos or cigars, or pipes and hookahs) during the past 30 days were more likely than active service members who did not use tobacco products to report a physician-diagnosed medical condition and to have lower self-reported physical health, serious psychological distress, and insufficient sleep. Furthermore, service members who used both e-cigarettes and other tobacco products reported worse health outcomes than service members who had exclusively used e-cigarettes or exclusively used other tobacco products.

Influence of Work Environments on Disparities in Tobacco Cessation and Relapse

Notably, multiple studies have found an association between workplace factors and disparities in tobacco cessation and relapse by sex, age, race and ethnicity, rurality/urbanicity, and SES (Brissette et al. 2008; Steege et al. 2014; Tsai et al. 2018; Buettner-Schmidt et al. 2019; Park et al. 2019; Syamlal et al. 2019).

Coverage of Tobacco Cessation Treatment, Tobacco Surcharges, and Considerations

Having health insurance coverage for evidence-based tobacco cessation treatment increases the likelihood of successful long-term tobacco cessation (Kaper et al. 2005; Reda et al. 2009; van den Brand et al. 2017). Most of the U.S. population obtains health insurance through their workplaces (Boal et al. 2018; Berchick et al. 2019), but based on 2020 U.S. Census data from the Current Population Survey's Annual Social and Economic Supplement, 13.0% of full-time, year-round workers do not have private health insurance (Keisler-Starkey and Bunch 2021). In 2014, the estimated prevalence of being an uninsured worker in the United States was greatest for Hispanic people (33.3%), followed by non-Hispanic Black people (15.5%) and non-Hispanic White people (8.6%) (Boal et al. 2018).

The *Patient Protection and Affordable Care Act of 2010* requires most private health insurance plans to cover tobacco screening and cessation treatments, but it also allows certain health plans to implement surcharges for people who use tobacco (i.e., employers can require workers who smoke to pay higher insurance premiums than workers who do not smoke) (Friedman et al. 2016). The higher cost of health insurance for people who smoke may encourage some people to quit smoking, but the higher cost may also worsen financial insecurity and widen tobacco-related health disparities among people who have difficulty quitting. An analysis of 2011–2014 data from the BRFSS found that tobacco surcharges did not improve smoking cessation (Friedman et al. 2016). In 2016, a survey of a random sample of 300 public or private small employers in the United States revealed that only 16.2% of employers used tobacco surcharges to provide tobacco cessation resources for their employees (Pesko et al. 2018). The use of these surcharges for cessation resources occurred differentially based on the salary environment: 19.0% of higher paying employers used surcharges to provide these resources, and only 7.4% of lower paying employers did so.

Insurance coverage for smoking cessation differs by workplace characteristics (Kaper et al. 2005; Reda et al. 2009; van den Brand et al. 2017), and workplaces offer different cessation resources to employees. For example, Hughes and colleagues (2011) conducted a cross-sectional analysis of the 2008 Health Worksite Survey, which collected corporate health policy data from Washington state employers with 50 or more employees, finding that restaurants, bars, and lounges where less than 75% of workers had health insurance were less likely than other workplaces to offer cessation resources, such as referrals to state quitlines, to their employees. The demographic composition of the workplaces was not reported, but restaurants, bars, and lounges in the United States disproportionately employ people of lower SES as well as Black and Hispanic people (U.S. Bureau of Labor Statistics 2017, 2019).

The workplace environment is a setting that can encourage tobacco-free social norms, for example, by providing smoking cessation resources to employees and maintaining a smokefree environment. However, according to the 2014–2015 TUS-CPS, only 27.2% of working adults had a workplace that offered smoking cessation programs (Syamlal et al. 2019). Among indoor workers in that study, those who were White, had higher levels of income and educational attainment, worked in the Midwest, or were employed in workplaces with comprehensive smokefree policies had the highest access to workplace smoking cessation programs. The analysis from Syamlal and colleagues (2019) also showed that 80.3%

of people who worked indoors reported 100% smokefree policies at work (estimated to protect 84.0 million workers) and 27.2% of people who worked indoors and outdoors reported access to employer-sponsored cessation programs.

Exposure to Secondhand Tobacco Smoke in the Workplace

The 2006 Surgeon General's report, *The Health Consequences of Involuntary Exposure to Tobacco Smoke*, identified the workplace as a major source of secondhand tobacco smoke for adults (USDHHS 2006). Secondhand tobacco smoke has been causally linked to cardiac disease and lung cancer for people who do not smoke (Barnoya and Glantz 2005; USDHHS 2006; Kim et al. 2018). Notably, workplace smokefree policies have resulted in less smoking among workers covered by these policies (USDHHS 2006).

Differences exist in workplace exposure to secondhand tobacco smoke by sex, occupation, race and ethnicity, SES, and rurality (Gonzalez et al. 2013; Tsai et al. 2018; Buettner-Schmidt et al. 2019; Park et al. 2019). TUS-CPS data from 2003 and 2010–2011 indicated that female workers were more likely than male workers to work in a smokefree workplace in all occupational categories except for service (Babb et al. 2018).

A literature review by Angus and Semple (2019) found high levels of exposure to secondhand tobacco smoke among women in certain professions. The authors reviewed 17 studies (11 using U.S. samples) that primarily involved either cross-sectional questionnaires or qualitative studies (such as focus groups) and were published between 1993 and 2017. The authors concluded that home health workers, of whom 90% were female (Angus and Semple 2019), experienced high levels of exposure to secondhand tobacco smoke. The studies included in the literature review indicated that between 31% and 83% of home health workers had been exposed to secondhand tobacco smoke on the job (based on self-reports) (Stephany 1993; Markkanen et al. 2007; Keske et al. 2013).

Several studies have found differential exposure to secondhand tobacco smoke by worker characteristics other than sex (Harris et al. 2011; King et al. 2014). Per the 2009–2010 NATS, for example, 20.4% of nonsmoking employed adults had been exposed (per self-reports) to secondhand tobacco smoke in the workplace during the previous 7 days (King et al. 2014). The prevalence of exposure was higher among males compared with females; among Black, Hispanic, and American Indian and Alaska Native people compared with White people; and among those with less education and income compared to those with more education and higher income. Exposure did not differ significantly by LGBT status.

In their study of indoor workers (n = 23,820) in Missouri, Harris and colleagues (2011) found intersections in risk across disparity group status and exposure to secondhand tobacco smoke in rural workplace environments. Although the overall rate of workplace exposure to secondhand tobacco smoke statewide was estimated to be 11.5%, models showed that in lower SES rural areas across Missouri, at least 40% of nonsmoking young adult White males and 50% of nonsmoking young adult Black males were exposed to secondhand tobacco smoke in the workplace, suggesting disparities among workers, by geography and race, in exposure to secondhand tobacco smoke.

Workplace Social Norms and Social Support

The connection between smokefree environments, including smokefree worksites, and a reduction in tobacco use is well established (Rose et al. 2011; NCI and WHO 2016; Cheng et al. 2017). The impact of smokefree work environments extends well beyond worksites and workers. For example, research supports the existence of "norm spreading," in which policies prohibiting smoking in public places stimulate people to subsequently enact voluntary smoking restrictions in private spaces, such as in their homes and vehicles (Cheng et al. 2011, 2015).

Few studies have examined the relationship between having work breaks—one aspect of workplace social norms—and patterns of smoking cessation and relapse. In a qualitative study composed of 71 transit workers in California, 83% of whom were African American people who currently smoked or used to smoke, work breaks were reported as a key trigger for smoking relapse (Battle et al. 2015). In contrast, in a quantitative survey of 935 California transit workers of whom 60% were African American, perceived ease of taking a smoking break during a shift was not associated with smoking status, a finding that was contrary to the authors' hypothesis (Cunradi et al. 2017). One might logically assume that people who smoke have elevated attention to break times during the workday to smoke because of nicotine dependence compared to people who do not smoke; however, the relationship between taking breaks in the workplace and tobacco use merits further research, given that the available evidence on this relationship is unclear.

Both systematic reviews and the results of studies on cessation interventions have found a positive correlation between support for a nonsmoking work environment and successful smoking cessation (Albertsen et al. 2006; Sorensen et al. 2009). A supportive and trusting environment also appears to be associated with lower tobacco use. For instance, a prospective study of certified nursing assistants (CNAs), which is an occupational group that tends to receive much lower wages compared with other types of nurses, 90% of whom were female and 12.5% of whom were African American, assessed the impact of an intervention designed to create a supportive supervisory and organizational climate, but the intervention did not have a tobacco control component. The intervention reduced workers' weekly cigarette consumption on average by about seven cigarettes, with even stronger reductions in cigarette consumption found for U.S.-born, non-Hispanic White CNAs compared to CNAs from other racial and ethnic groups (Hurtado et al. 2016). It is important to note that this analytic sample lacked racial or ethnic diversity and that non-White people were combined in the analysis. Findings speak to the potential for a supportive work environment to promote less smoking among nurses with lower wages.

In contrast, a randomized controlled trial of a workplace wellness program conducted at small, lower wage worksites between 2014 and 2017 found that workplace cessation programs were not associated with smoking status, use of smokeless tobacco, or quit attempts (Kava et al. 2019). Even so, the presence of worksite cessation programs was associated with workers reporting that their workplace was invested in their cessation efforts.

Consistent with the conclusions of the 1985 Surgeon General's report, the existing literature indicates that, after statistical controls for age, sex, educational attainment, and race and ethnicity, occupational factors remain significant predictors of tobacco use behaviors, including age of initiation, quit attempts, engagement in cessation, and success in cessation attempts (Haenszel et al. 1956; Sterling and Weinkam 1976; Nelson et al. 1994; Leigh 1996; Giovino et al. 2000; Lee et al. 2007; Sorensen and Barbeau 2012).

Work Environment Summary

Cross-sectional and prospective cohort studies have provided consistently strong evidence that work-related stress and occupational hazards are associated with tobacco product use and initiation and inversely associated with smoking cessation. The existing literature focuses primarily on cigarette smoking and cessation, and research about the initiation of other tobacco products is limited. Despite evidence that the association between work-related stressors and smoking initiation varies by race and ethnicity, many of the studies in this review that examined the impact of workplace stressors and occupational exposures did not assess differences by race and ethnicity. Thus, one limitation of the studies in this review is that the contribution of the work environment to existing disparities in smoking initiation remains underexplored among people from certain racial and ethnic, SES, and sexual orientation and gender identity groups.

Within the existing research on occupational factors and tobacco, several studies have established a relationship between specific aspects of the work environment and tobacco use or cessation. Smokefree workplaces remain unevenly distributed across occupational groups, despite strong evidence of their effectiveness to reduce exposure to secondhand tobacco smoke, the consumption of cigarettes, and the prevalence of smoking. In fact, there are disparities by gender, type of occupation, race and ethnicity, SES, and rurality in exposure to secondhand tobacco smoke in the workplace. There may be interacting effects of multiple demographic characteristics with types of occupations on exposure to secondhand tobacco smoke. However, additional research is needed to understand these complex interactions, especially given the tobacco product-related disparities among people with intersectional identities. Further, the association between workplace social norms related to tobacco product use and smoking cessation may vary by race and ethnicity. Future research utilizing multilevel studies will be critical to understanding these relationships because the uneven distribution of state and local smokefree policies can contribute to diverging social norms related to tobacco products in the workplace.

Despite evidence of disparities—by race and ethnicity, sexual orientation and gender identity, immigration status, gender, and SES—in exposure to physical and social occupational hazards, research is limited on how the associations between these hazards in the workplace and tobacco product use and smoking cessation vary by these demographic characteristics. Additional stratified analyses are needed that can provide more information about these potential disparities. Future research could also consider latent class modeling because it can elucidate unobserved factors that are related to the workplace environment and tobacco use. The utilization of mediation analyses might also help to further understand the mechanisms that explain these relationships between work-related stressors and occupational hazards and tobacco product initiation, use, and cessation.

Studies on additional job characteristics that may impact disparities in smoking behaviors are also warranted. For example, employers are increasingly relying on nonstandard, less secure work arrangements (e.g., day laborers for temporary construction work), and Hispanic people and immigrants are disproportionately represented in these nonstandard work arrangements (Flynn et al. 2015). In addition, studies are needed to investigate tobacco product-related disparities using more recent data that reflect the evolving nature of employment (e.g., gig economy workers, such as ride app drivers or food delivery workers) and work environments in the United States (e.g., remote/teleworkers) and the emergence of e-cigarettes and other noncigarette tobacco products.

Healthcare Environment

Although the prevalence of smoking in the United States has declined steadily over the past several decades, the decline has not been distributed equally across SES levels or racial and ethnic groups (Cornelius et al. 2020). Such disparities are partially attributable to differential access to evidence-based tobacco cessation resources in the healthcare environment. The 2020 Surgeon General's report on smoking cessation reviewed the evidence on clinical tobacco cessation interventions, stating that "the prevalence of key indicators of smoking cessation—quit attempts, receiving advice to quit from a health professional, and using cessation therapies—also varies across the population, with lower prevalence among some subgroups" (USDHHS 2020, p. 6). This section takes a more in-depth view of the role of the healthcare environment in tobacco-related health disparities. Because people with limited economic resources often have less access to cessation resources, it is especially critical to improve the reach and impact of these resources for underserved populations (Browning et al. 2008; Cokkinides et al. 2008; Shiffman et al. 2008; Husten 2010; Trinidad et al. 2011; Jamal et al. 2012). This section details how differential access to care in the healthcare environment—including not having access to cessation resources and services, facing specific challenges to accessing cessation resources in mental healthcare and substance use treatment facilities, and lacking access to health insurance coverage of cessation treatments—may influence tobacco-related health disparities.

Literature Review Methods

This review is based on a thorough literature search conducted using the PubMed and PsycINFO databases. These databases were utilized because they include virtually all indexed journals that publish peer-reviewed research on tobacco assessment and intervention in the healthcare environment. Specific search terms are listed in Table A4.1. For inclusion in the review, studies had to meet all the following criteria: peer-reviewed, conducted in the United States, examined racial and ethnic and socioeconomic disparities in the assessment of tobacco use or delivery of tobacco treatment in healthcare and substance use and mental health treatment settings, and published between January 1, 2008, and December 31, 2021.

Disparities in Clinical Cessation Interventions

Findings from the 2000, 2005, 2010, and 2015 NHIS showed nationwide improvements in cessation-related indicators, including overall increases in the proportion of adults who smoke and who reported key milestones in the quitting process, such as (1) making a recent quit attempt, (2) having received advice to quit from a health professional, (3) using evidence-based treatment (behavioral counseling and/or cessation medication), and (4) achieving smoking cessation (Babb et al. 2017). Although each of these milestones is important, delivering cessation advice and promoting the use of evidence-based treatment are highlighted here because they reflect the direct involvement of the healthcare system.

Receiving cessation advice from a healthcare provider is effective for all people who smoke, including those who identify with minoritized racial and ethnic populations (Sanderson Cox et al. 2011), but disparities persist in having received such advice. A 2015 study showed that 57.2% of adults who currently or formerly smoked and who had seen a health professional in the preceding year reported having received advice to quit from a healthcare professional, the highest prevalence since 2005 (Babb et al. 2017). However, a lower percentage of non-Hispanic Asian adults (34.2%), American Indian and Alaska Native adults (38.1%), and Hispanic adults (42.4%) reported having received advice to quit from their providers compared with non-Hispanic White adults (60.2%); 55.7% of non-Hispanic Black adults reported having received advice to quit, but 95% confidence intervals overlapped with that of non-Hispanic White adults. Similarly, a lower percentage of people without health insurance (44.1%) reported having received advice to quit compared with those with any insurance (range: 56.8–69.2%) (Babb et al. 2017). Similar findings have been reported using 2018–2019 TUS-CPS data, with a lower percentage of Hispanic adults than White adults reporting having received advice to quit from a physician (NCI 2022a, b).

In a retrospective study of recent quitters responding to the TUS-CPS, receiving advice to quit smoking from a healthcare provider increased modestly over time, from 66% (standard error [SE] = 2%) in 2007 to 73% (SE = 4%) in 2015, mirroring the positive trend observed in other national surveys (Mai and Soulakova 2018). In the same study, the adjusted odds of having received advice to quit smoking from a healthcare provider were lower among Hispanic adults compared with non-Hispanic White adults (aOR = 0.66; 95% CI, 0.47–0.92) (Mai and Soulakova 2018). This trend of increased prevalence of having received advice to quit from a healthcare professional was also reflected in a study comparing 2010 to 2015 NHIS data, where Tan and colleagues (2018) noted the persistence of disparities in having received such advice, particularly among people with lower income, people who were uninsured, and members of specific racial and ethnic groups.

Additional studies have showed lower rates of having received advice to quit smoking from healthcare providers, along with other aspects of tobacco cessation treatment, for non-Hispanic Black and Hispanic people who smoke (Cokkinides et al. 2008; Bailey et al. 2018; Babb et al. 2020), although this varies by Hispanic population group (Babb et al. 2020). It is notable, however, that the disparity between non-Hispanic White and Hispanic adults who smoke in having received advice to quit from a healthcare provider has narrowed over time, from a peak difference of 13.3 percentage points (72.3% vs. 59.0%) in 2010–2012 to 7.0 percentage points (76.4% vs. 69.4%) in 2013–2015 (SEs <5.3%) (Mai and Soulakova 2018). This decrease potentially reflects the reduction in the uninsured proportion of Hispanic people over this period as a result of the *Patient Protection and Affordable Care Act* (Sommers et al. 2015).

The reasons underlying the observed disparities in having received advice to quit smoking from a healthcare provider remain unclear. A preliminary study by Landrine and colleagues (2018) examined predictors of receiving such advice. Consistent with other published findings, the odds of having received advice to quit from a healthcare provider were 2.39 times (95% CI, 1.38–4.14) higher among White people who smoked than they were among Black people who smoked. Among White people, no predictors of receiving advice emerged, but among Black people, both men and young people were less likely to have received advice (Landrine et al. 2018). Other studies have suggested that disparities in having received advice to quit smoking may be related, in part, to decreased access to healthcare among priority populations. Babb and colleagues (2020) found a higher proportion of Hispanic adults (vs. non-Hispanic White adults) who smoked had not visited a provider in the preceding year (27.7% vs. 14.7%). In another study of Medicaid-enrolled people in California who smoked, ethnic-related disparities in having received advice to quit were not significant when taking into account the number of clinical visits; those with greater numbers of clinical encounters were more likely to have received advice to quit (aOR = 1.99; 95% CI, 1.15–3.43) (Valencia et al. 2022). In a study of Asian American people in California who smoked, only half (50.8%) reported visiting a provider in the preceding year; factors associated with having received advice to quit included health insurance status and smoking intensity (Tong et al. 2011).

Evidence-based smoking cessation treatment, including behavioral counseling and pharmacotherapy, improves the likelihood of quit success (USDHHS 2020). However, utilization of these treatments is generally low, and disparities in utilization exist (USDHHS 2020). In a study of 2015 NHIS data, Babb and colleagues (2017) reported variations in the utilization of evidence-based treatment (counseling and/or medication): Hispanic and non-Hispanic Asian adults reported lower treatment use than non-Hispanic White adults (19.2% and 20.5% vs. 34.3%, respectively); adults without health insurance reported lower treatment use than privately insured adults (21.4% vs. 32.1%); and adults identifying as gay, lesbian, or bisexual reported lower treatment use than adults identifying as straight (14.5% vs. 31.7%). Other studies have had similar findings. For example, in an analysis of 2003 TUS-CPS data, Trinidad and colleagues (2011) found that, among people who smoked, people who identified as African American, Hispanic, Asian American, or Pacific Islander were less likely than White people to have used nicotine replacement therapy (NRT) during their last quit attempt. A study of U.S. Department of Veterans Affairs medical and ambulatory care centers, where access to services is available to all patients, found that only 36% of African American and 26% of Hispanic patients who smoked used NRT during a quit attempt compared with 50% of White patients who smoked, despite the fact that African American and Hispanic patients were more likely than White patients to make a quit attempt (Fu et al. 2005). In a more recent analysis of 2014–2016 data from 143 safety-net primary care clinics in 12 states, Bailey and colleagues (2018) found that patients who were uninsured and non-White were significantly less likely to have received both counseling and medication than were people who were insured and White.

Taken together, these findings suggest an urgent need, in particular for people from minoritized racial and ethnic groups and lower SES groups, to design health systems that (a) systematically screen all people for tobacco use and (b) effectively provide them with, or refer them to, evidence-based tobacco cessation treatment services (Husten 2010; USDHHS 2020).

Tobacco Cessation Resources in Mental Health and Substance Use Treatment Facilities

Although progress has been made in decreasing the prevalence of cigarette smoking among people with mental health conditions and/or substance use disorders, substantial disparities in tobacco use remain for this group (Prochaska et al. 2017; Han et al. 2022). Although motivation to quit smoking is generally high within these specific populations (Siru et al. 2009), intensive treatments may be required to successfully facilitate cessation (CDC 2013). Mental health and substance use treatment facilities are well-positioned to deliver high-quality, intensive tobacco cessation treatment to people with high levels of need. One key barrier to integrating treatment for tobacco cessation in these settings is the longstanding misconception among mental healthcare providers that smoking mitigates symptoms associated with mental illness or adaptively modifies neurobiological pathways for mental health patients, a belief perpetuated by industry-funded research that has contributed to a culture of acceptance of tobacco use on the grounds of mental health treatment facilities (Hall and Prochaska 2009; Schroeder and Morris 2010). In an effort to overcome this and other barriers, multiple national initiatives have been launched to facilitate the integration of treatment for tobacco use as part of mental health services (Christiansen et al. 2016). For example, in *Treating Tobacco Use and Dependence: Clinical Practice Guideline*, also known as the *Clinical Practice Guideline*, the U.S. Public Health Service called for the implementation of systems changes to facilitate the delivery of treatment services for tobacco cessation in mental health treatment facilities (Fiore et al. 2000). Similarly, the Substance Abuse and Mental Health Services Administration has supported both grants and state-level leadership academies to facilitate the integration of tobacco treatment in these facilities (Santhosh et al. 2014).

Integration of tobacco cessation services in treatment settings for mental health conditions and substance use disorders has not been optimal (Hunt et al. 2013). For example, Marynak and colleagues (2018) found that in 2016, fewer than half of these facilities offered evidence-based tobacco cessation treatment to their clients. An important caveat here, however, is that the provision of tobacco treatment in these facilities varies substantially across states. For example, in 2016, the provision of tobacco treatment in mental health treatment facilities ranged from a low of 20.5% in Idaho to a high of 68.8% in Oklahoma, and the provision of tobacco treatment in substance use treatment facilities ranged from a low of 26.9% in Kentucky to a high of 85.0% in New York (Marynak et al. 2018). Of note, Abraham and colleagues (2017) found that tobacco cessation services in facilities treating substance use were significantly more likely to be provided in states with higher cigarette excise taxes and higher levels of spending on tobacco prevention and control.

Access to Insurance and Resources for Tobacco Cessation

Tobacco-related health disparities are partially driven by the inability of lower income people to pay for the cost of tobacco cessation treatment. The prevalence of smoking in 2018 among adults enrolled in Medicaid is more than twice that of privately insured adults (23.9% vs. 10.5%, respectively) (Creamer et al. 2019). Accordingly, providing insurance coverage for cessation treatment is critical for improving access to care (Chen et al. 2016). The *Patient Protection and Affordable Care Act* requires coverage of all U.S. Preventive Services Task Force A and B graded services, including tobacco cessation treatment, for most private health insurance plans as well as for state Medicaid expansion plans. However, only 19 states had comprehensive coverage of cessation treatment for all enrollees in traditional Medicaid plans as of June 20, 2022 (CDC 2022), coverage barriers (e.g., copays, prior authorizations) remain (McMenamin et al. 2018; DiGiulio et al. 2020), and utilization of cessation treatment is low (Babb et al. 2017). Effectively engaging adults who smoke in evidence-based treatment is a critically important priority for public health policy (Ku et al. 2016).

The 2020 Surgeon General's report on smoking cessation concluded that, "with adequate promotion, comprehensive, barrier-free, evidence-based cessation insurance coverage increases the availability and utilization of treatment services for smoking cessation" (USDHHS 2020, p. 11). However, having health insurance is not sufficient in and of itself to support and increase tobacco cessation. For example, Brown and colleagues (2016), who examined associations between tobacco use and having health insurance in a large, nationally representative sample of women of reproductive age, found that pregnancy status significantly moderated the relationship between health insurance status and tobacco use. Specifically, among pregnant women, having health insurance was not associated with past-month tobacco use; in contrast, among nonpregnant women, having health insurance was significantly associated with a lower likelihood of using tobacco. The authors concluded that tobacco use persists during pregnancy despite the presence of insurance, suggesting that prenatal visits may miss opportunities to deliver cessation interventions.

Increasing access to cessation treatment among vulnerable and underserved populations will require commitments from both private and public health insurance companies and publicly funded healthcare programs. Specifically, insurers will need to (a) provide comprehensive coverage for evidence-based treatments and inform enrollees that such coverage and benefits are available; (b) remove barriers to accessing treatment, including deductibles, copays, and the need for prior authorizations; and (c) ensure that all enrollees who use tobacco have access to affordable, accessible, and evidence-based tobacco treatment to reduce tobacco-related health disparities. For instance, partnerships between healthcare organizations and quitlines, which are available in all 50 states, have been examined as an intervention strategy that can decrease barriers to accessing evidence-based smoking cessation services through the healthcare system (Vidrine et al. 2010). These partnerships are discussed further in Chapter 7.

Healthcare Environment Summary

Evidence reviewed in this section regarding disparities in access to, and utilization of, clinical cessation interventions reveals a persistent pattern of disparities, particularly among minoritized racial and ethnic groups and lower SES groups. Although the overall prevalence of having received advice to quit smoking from a health-care provider has increased over time, disparities persist. Disparities—including those by race and ethnicity, SES, sexual orientation, and health insurance status—also exist in the utilization of evidence-based cessation treatments.

Substantial disparities exist in the provision of tobacco cessation treatments in mental health and substance use treatment settings. In 2016, fewer than half of all such facilities in the United States offered evidence-based tobacco cessation treatments to their clients, with wide variation across states. Finally, a lack of adequate insurance coverage for evidence-based tobacco treatments has resulted in poorer treatment access among people with fewer economic resources. Taken together, these factors are important contributors to tobacco-related health disparities. Effectively mitigating these disparities will require barriers to be addressed at the patient, provider, and system levels.

Summary of the Evidence

The concluding remarks in this section highlight the strongest and most consistent relationships between social and environmental influences and tobacco-related health disparities. Studies reviewed in this chapter demonstrate that social influences from family members and peers are associated with tobacco product use among adolescents. Such characteristics as parental connectedness and peer smoking may also play a role in initiation and in transitioning to regular use of tobacco products. Further, the impact of these family and peer influences on smoking varies by race and ethnicity and gender. Specifically, studies show that peer smoking is associated with smoking among White, Black or African American, and Hispanic or Latino adolescents; further, greater exposure to peer smoking or smoking in the home among White youth might account for some of the racial and ethnic gaps observed in cigarette smoking rates among White youth compared to Black or African American and Hispanic or Latino youth. Exposure to parental smoking is also associated with adolescent smoking, and the relationship is similar across racial and ethnic groups.

Studies have found a strong and consistent positive association between discrimination and tobacco product use among Black and African American people but inconsistent effects among Hispanic or Latino and White people. Results from one study also suggest an association between structural stigma related to same-sex marriage and smoking among LGBT people. Further, important racial and ethnic and gender disparities are present in the role of acculturation in tobacco product use and cessation. Studies demonstrate that among Hispanic or Latino and Asian immigrants, interacting effects are evident between acculturation and gender on smoking. Among these two racial and ethnic groups, tobacco product use is higher among women who are acculturated compared to women living in their respective heritage countries. However, tobacco use is generally lower among men who are acculturated compared to men living in their respective heritage country.

The home environment also impacts tobacco-related outcomes within and across populations. Studies demonstrated significant disparities in exposure to secondhand tobacco smoke in the home by race and ethnicity, SES, home ownership, the presence of smokefree policies in multi-unit housing, and voluntary smokefree rules in a home. Unequal protections by smokefree policies among people living in multi-unit housing can contribute to disparities in exposure to secondhand tobacco smoke. Secondhand tobacco smoke can enter the homes of people who do not smoke and who live in multi-unit housing complexes that lack smokefree policies, including in public or government-subsidized multi-unit housing provided for lower income populations. Furthermore, existing evidence shows that Black or African American and Hispanic or Latino residents are more likely than White residents to be exposed to secondhand tobacco smoke in multi-unit homes even if they do not smoke or have smokefree rules that do not allow smoking in the home.

Most adolescents spend a majority of their time in schools, and certain aspects of the school environment can impact tobacco product use and initiation. The evidence demonstrates that Black or African American and Hispanic or Latino adolescents who are connected to school—either through relationships with educators or through participation in extracurricular activities—or who have an increased sense of belonging at school are less likely to initiate cigarette smoking than their counterparts who do not feel connected to school or who experience discrimination at school. Unfortunately, multiple studies suggest that Hispanic or Latino and Black or African American students generally feel less connected to the school environment than White and Asian American youth and are more likely to report discrimination at school, which is associated with a higher likelihood of cigarette smoking.

These differences in school bonding (i.e., school attachment, belongingness, and connectedness) and school climate and interactions can contribute to tobacco product-related disparities among the most disproportionately impacted adolescent populations. Further, having health centers and tobacco prevention policies and programs in schools appears to be associated with a lower prevalence of tobacco product use. However, studies have suggested that inequitable access to school health centers and the inequitable implementation of tobacco-free policies and tobacco prevention programs in schools may leave certain racial and ethnic and socioeconomic groups of adolescents unprotected.

The work environment can also impact tobacco product initiation, use, and cessation. Evidence from the studies reviewed shows that work-related stressors and occupational hazards are associated with smoking initiation, reduced motivation among workers to participate in smoking cessation programs, less success with cessation, and increased risk of relapse after successful cessation. Racial and ethnic disparities also exist in the associations between work-related stressors and occupational hazards and tobacco product-related outcomes. Additionally, due to variations in workplace social norms and the uneven distribution of state and local smokefree policies, disparities in exposure to secondhand tobacco smoke in the workplace exist by gender, occupation, race and ethnicity, SES, and geography. The impact of increases in remote working following the COVID-19 pandemic on tobacco product initiation, use, cessation, relapse, and related disparities is an important area for future research.

Although the prevalence of having received advice to quit smoking from a healthcare provider has increased over time for the overall population, evidence shows that disparities persist, particularly among minoritized racial and ethnic groups and lower SES groups, in having received such advice. Additionally, disparities are apparent in the utilization of evidence-based cessation treatments (i.e., counseling, pharmacotherapy), particularly among groups defined by race and ethnicity, SES, and health insurance status. Mental health and substance use treatment settings continue to broadly underutilize tobacco cessation treatment, despite the disproportionately high rate of smoking among people with mental health conditions and substance use disorders. Each clinical encounter is an opportunity to provide treatment and referral to more comprehensive cessation services for people who use tobacco. Delivery of evidence-based tobacco cessation treatment and barrier-free insurance coverage of these treatments should be a high priority for healthcare systems and insurance plans, with an emphasis on optimal application in mental healthcare settings.

Conclusions

1. Tobacco use among peer groups increases the likelihood of smoking initiation for White, Black, and Hispanic adolescents.

2. For adolescents, participating in extracurricular activities or feeling a sense of belonging at school can reduce the likelihood of cigarette smoking initiation. However, Black and Hispanic adolescents report lower school connectedness than White adolescents, which may increase the likelihood of smoking initiation.

3. As Asian American and Hispanic or Latino immigrants undergo acculturation to life in the United States, there is a greater risk of cigarette smoking among women and a reduced risk of smoking among men.

4. Inequitable smokefree protections for people living in multi-unit housing contribute to disparities in exposure to secondhand tobacco smoke.

5. Although smokefree policies in the workplace can reduce the use of tobacco products and encourage quitting, not everyone is evenly protected by these policies. Work-related stress and exposure to occupational hazards are linked to smoking initiation and difficulty quitting smoking.

6. Disparities in utilization of evidence-based cessation treatments exist, including by race and ethnicity, socioeconomic status, and health insurance status. Disparities persist in having received advice to quit smoking from a healthcare professional, particularly among minoritized racial and ethnic groups and lower socioeconomic status groups.

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Chapter 4 Appendix

Appendix 4.1: Search Terms Used for Chapter 4 *377*

Appendix 4.1: Search Terms Used for Chapter 4

Table 4A.1 Search terms used for Chapter 4

Topic	Search terms
Social influence	
Social influence (all topics) (Indexes: PubMed, ABI Inform, EBSCO, PsycINFO, and Web of Science)	(“social influences” OR sociocultural OR “socio-cultural” OR “social network” OR “social networks” OR “social support” OR “social supports” OR family influence* OR peer influence* OR racism OR discrimination OR accultura* OR “ethnic identity” OR “ethnic identities” OR trauma OR violence OR “adverse childhood” OR ses OR socioeconomic OR “socio-economic” OR poverty OR financial stress* OR unemploy* OR homeless* OR stigma OR stigmas OR stigmatiz* OR medicaid OR urban* OR rural OR “inner city” OR “inner cities” OR suburban OR “blue collar”) AND (tobacco OR smok* OR nicotine OR blunt* OR vap* OR “electronic cigarette” OR “e-cigarette” OR “electronic nicotine delivery system” OR hookah OR shisha OR waterpipe OR “water pipe” OR narghile OR cigar* OR snus OR “smokeless tobacco” OR “chewing tobacco” OR bidi OR menthol) AND (minority OR minorities OR disparity OR disparities OR LGB* OR transgender OR transgender* OR “sexual minority” OR “sexual minorities” OR “African American” OR “African Americans” OR africanamerican* OR American Indian* OR Native American* OR Alaska Villager* OR Alaskan Villager* OR Alaska Native* OR Alaskan Native* OR Pacific Islander* OR “First Nations” OR “First Nation” OR Maori OR Inuit OR Hispanic OR Hispanic* OR Latin* OR Mexican* OR central american* OR latin american* OR Asian OR Asians OR Chinese OR vietnamese OR korean OR koreans OR filipino* OR hawaiian OR hawaiian* OR salvadoran* OR Puerto Rican* OR cuban OR cubans OR honduran* OR multicultural OR “multi-cultural” OR multiracial OR “multi-racial” OR multiethnic OR “multi-ethnic” OR incarcerated OR disabled OR schizophrenic OR “mental health” OR “mentally ill” OR “mental illness” OR blind OR deaf) **Filters activated:** Publication date from 2008/01/01, English
Environmental influence	
Housing environment (Index: PubMed)	“smokefree homes” OR “multi-unit housing” OR “smoke-free homes,” AND/OR “household smoking bans,” AND/OR “home smoking bans,” AND/OR “home smoking restrictions,” AND/OR “household smoking restrictions” AND (minority OR minorities OR disparity OR disparities OR LGB* OR transgender OR transgender* OR “sexual minority” OR “sexual minorities” OR “African American” OR “African Americans” OR africanamerican* OR American Indian* OR Native American* OR Alaska Villager* OR Alaskan Villager* OR Alaska Native* OR Alaskan Native* OR Pacific Islander* OR “First Nations” OR “First Nation” OR Maori OR Inuit OR Hispanic OR Hispanic* OR Latin* OR Mexican* OR central american* OR latin american* OR Asian OR Asians OR Chinese OR vietnamese OR korean OR koreans OR filipino* OR hawaiian OR hawaiian* OR salvadoran* OR Puerto Rican* OR cuban OR cubans OR honduran* OR multicultural OR “multi-cultural” OR multiracial OR “multi-racial” OR multiethnic OR “multi-ethnic” OR incarcerated OR disabled OR schizophrenic OR “mental health” OR “mentally ill” OR “mental illness” OR blind OR deaf) OR (“LGBTQ”) OR (“gender and sexual minority”)
School environment (Indexes: PubMed, PsycINFO, and ERIC)	**Search #1:** (“minority” OR “African-American”) OR (“Black”) OR (“Hispanic”) OR (“Latino”) OR (“LGBTQ”) OR (“gender and sexual minority”) AND (“school environment”) AND (“tobacco” OR “smoking”)

Table 4A.1 Continued

Topic	Search terms
School environment *(continued)*	**Search #2:** (“school”) AND (“policies,” OR “tobacco,” OR “smoking,” OR “vaping,” OR “e-cigarette,” OR “Juul”)
Work environment (Index: PubMed)	**Search #1:** ((worker*[tiab] OR “work environment” [tiab] OR occupation*[tiab] OR business*[tiab] OR workplace*[tiab] OR job*[tiab] OR work*[tiab]) OR (“job strain”[tiab] OR “psychosocial work environment”[tiab] OR “workplace violence” [tiab] OR “work-family conflict”[tiab] OR “work hours”[tiab] OR “work schedule”* [tiab] OR “workplace abuse”*[tiab] OR “workplace discrimination”[tiab] OR “sexual harassment”[tiab] OR “occupational hazard”*[tiab])) AND (smoking[tiab] OR tobacco[tiab] OR “electronic cigarette”*[tiab] OR e-cigarette*[tiab] OR ecigarette*[tiab] OR “electronic nicotine delivery system”*[tiab] OR “electronic nicotine system”* [tiab] OR snuff[tiab] OR “smokeless tobacco”*[tiab] OR smoker*[tiab] OR “smoking initiation”[tiab] OR “tobacco initiation”[tiab] OR “smoking cessation”[tiab] OR “tobacco cessation”[tiab] OR “smoking relapse”[tiab] OR “tobacco relapse”[tiab]) (AND (race[tiab] OR ethnicity[tiab] OR LGBT[tiab] OR lesbian[tiab] OR gay[tiab] OR transgender[tiab] OR bisexual[tiab] OR gender[tiab])) **Search #2 (including MESH terms):** ((worker*[tiab] OR occupation*[tiab] OR business*[tiab] OR workplace*[tiab] OR job[tiab] OR job site*[tiab] OR jobsite*[tiab] OR work[tiab] OR worksite*[tiab] OR work site*[tiab] OR Work[mh] OR Occupational Groups[mh] OR Workplace[mh] OR Occupations[mh] OR Occupational Medicine[mh] OR Occupational Health[mh] OR Occupational Health Services[mh])) OR ((job strain[tiab] OR work environment*[tiab] OR psychosocial workplace*[tiab] OR social workplace*[tiab] OR workplace violence[tiab] OR occupational violence[tiab] OR work-family conflict*[tiab] OR work hours[tiab] OR work schedule*[tiab] OR shift work[tiab] OR night shift*[tiab] OR workplace abuse[tiab] OR abuse at work[tiab] OR work break[tiab] OR work breaks[tiab] OR workplace discrimination[tiab] OR discrimination at work[tiab] OR sexual harassment[tiab] OR work harassment[tiab] OR workplace harassment[tiab] OR occupational hazard*[tiab] OR work hazard*[tiab] OR workplace hazard*[tiab] OR occupational health hazard*[tiab] OR workplace health hazard*[tiab] OR occupational safety[tiab] OR workplace safety[tiab] OR work safety[tiab] OR workplace crime*[tiab] OR crime at work[tiab] OR violence at work[tiab] OR accidents at work[tiab] OR occupational accident*[tiab] OR work accident*[tiab] OR workplace accident*[tiab] OR workplace crowding[tiab] OR workplace stress[tiab] OR workplace stressor*[tiab] OR stress at work[tiab] OR occupational stress[tiab] OR occupational stressor*[tiab] OR work stress[tiab] OR work stressor*[tiab] OR workplace strain[tiab] OR occupational strain[tiab] OR strain at work[tiab] OR worksite wellness[tiab] OR work-site wellness[tiab] OR workplace wellness[tiab] OR worksite resource*[tiab] OR workplace resource*[tiab] OR occupational resource*[tiab] OR workplace policy[tiab] OR workplace policies[tiab] OR occupational noise[tiab] OR workplace noise[tiab] OR Workplace Violence[mh] OR Work-Life Balance[mh] OR Work Schedule Tolerance[mh] OR Shift Work Schedule[mh] OR Prejudice[mh] OR Social Discrimination[mh] OR Sexual Harassment[mh] OR Harassment, Non-Sexual[mh] OR Occupational Health[mh] OR Occupational Health Services[mh] OR Occupational Medicine[mh] OR Accidents, Occupational[mh] OR Occupational Injuries[mh] OR Asthma, Occupational[mh] OR Occupational Exposure[mh] OR Occupational Diseases[mh] OR Air Pollutants, Occupational[mh] OR Occupational Stress[mh] OR Noise, Occupational[mh]))

Table 4A.1 Continued

Topic	Search terms
Work environment *(continued)*	AND (tobacco[tiab] OR smok*[tiab] OR nicotine[tiab] OR blunt*[tiab] OR vap*[tiab] OR electronic cigarette*[tiab] OR e-cigarette*[tiab] OR ecigarette*[tiab] OR electronic nicotine delivery system*[tiab] OR vaping product*[tiab] OR hookah*[tiab] OR shisha[tiab] OR waterpipe*[tiab] OR water pipe*[tiab] OR narghile*[tiab] OR cigar*[tiab] OR snus[tiab] OR snuff[tiab] OR smokeless tobacco*[tiab] OR chewing tobacco*[tiab] OR bidi[tiab] OR bidis[tiab] OR smoking initiation[tiab] OR tobacco initiation[tiab] OR smoking cessation*[tiab] OR tobacco cessation*[tiab] OR smoking relapse*[tiab] OR tobacco relapse*[tiab] OR quit attempt*[tiab] OR Nicotine[mh] OR Tobacco[mh] OR Tobacco Use[mh] OR Tobacco Smoking[mh] OR Tobacco Products[mh] OR Smoking[mh] OR Smokers[mh] OR Tobacco Use Disorder[mh] OR Tobacco Smoke Pollution[mh] OR Smoking Devices[mh] OR Smoking Water Pipes[mh] OR Electronic Nicotine Delivery Systems[mh] OR Vaping[mh] OR Smoking Reduction[mh] OR Smoking Cessation[mh] OR Tobacco Use Cessation[mh] OR Smoking Cessation Agents[mh] OR Tobacco Use Cessation Devices[mh] OR Smoking Prevention[mh] OR Ex-Smokers[mh] OR Smoke-Free Policy[mh]) **Search # 3 (based on terms found in initial searches):** (secondhand smoke at work[tiab] OR environmental smoke at work[tiab] OR workplace secondhand smoke[tiab] OR workplace environmental smoke[tiab] OR smokefree worksite*[tiab] OR smoke-free worksite*[tiab] OR smokefree workplace*[tiab] OR smoke-free workplace*[tiab] OR tobacco-free worksite*[tiab] OR tobacco-free workplace*[tiab])
Healthcare environment (Indexes: PubMed and PsycINFO)	“tobacco” and “treatment access” “discrimination” and “healthcare” and “tobacco” “tobacco” and “insurance” and “access” “tobacco use” and “race” and “treatment” “tobacco” and “primary care” “tobacco” and “mental health treatment” “tobacco” and “substance abuse treatment” **Timespan:** 2008–2020

Chapter 5
Tobacco Industry Influences on Tobacco-Related Health Disparities

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Introduction

The tobacco industry strongly influences the promotion and use of tobacco products. Tobacco Control Monograph 19, which was released by the National Cancer Institute (NCI) in 2008, concluded that "[t]he total weight of evidence—from multiple types of studies, conducted by investigators from different disciplines, and using data from many countries—demonstrates a causal relationship between tobacco advertising and promotion and increased tobacco use" (NCI 2008, p. 11). The subsequent 2014 Surgeon General's report, titled *The Health Consequences of Smoking—50 Years of Progress*, also concluded that there is a causal relationship between tobacco marketing and tobacco use among youth and young adults: "The evidence is sufficient to conclude that advertising and promotional activities by the tobacco companies cause the onset and continuation of smoking among adolescents and young adults" (U.S. Department of Health and Human Services [USDHHS] 2014, p. 12).

As shown in Figures 1.1 (in Chapter 1) and 4.1 (in Chapter 4), this report conceptualizes the influence of the tobacco industry as separate from, but intersecting with, social and environmental influences that affect individual tobacco use and tobacco-related health disparities. This chapter also draws on the Host-Agent-Vector-Environment (HAVE) model to examine influences on tobacco use, with a particular focus on influences from the tobacco industry—or the "vector" (Figure 5.1) (Giovino et al. 2009; Samet and Wipfli 2013; Hyland et al. 2017; McKee and Stuckler 2018; Garcia-Cazarin et al. 2020). The HAVE model, which is based on an epidemiological infectious disease perspective, situates individuals as the "host;" tobacco products as the "agent;" the tobacco industry as the "vector;" and the broader context, including policies, as the "environment." As the vector, the tobacco industry influences individual (or host) tobacco use behaviors through the development and marketing of tobacco products (agent) and by taking actions—including social, community, legal, and political tactics (e.g., counteracting tobacco control policy or programmatic efforts)—that may influence the broader environment (Cruz 2009; Farrelly 2009; Giovino et al. 2009; Garcia-Cazarin et al. 2020).

Disparities are explored in this chapter through the lens of tobacco retailing and the marketing and promotion of tobacco products through new and traditional media. The studies included in this section focus on differences in (a) *exposure* to tobacco industry influences across population groups and disparities in *outcomes* between groups and (b) the *strength of the association* between particular tobacco industry influences and tobacco product use across demographic groups (i.e., interaction effects) (Ward et al. 2019).

Influences of the Tobacco Retail Environment

This section reviews evidence on the influence of tobacco marketing in the retail environment on tobacco-related health disparities in the United States as it relates to the community environment (i.e., the density or proximity of tobacco retailers) and the consumer or store environment (advertising, promotion, and price).

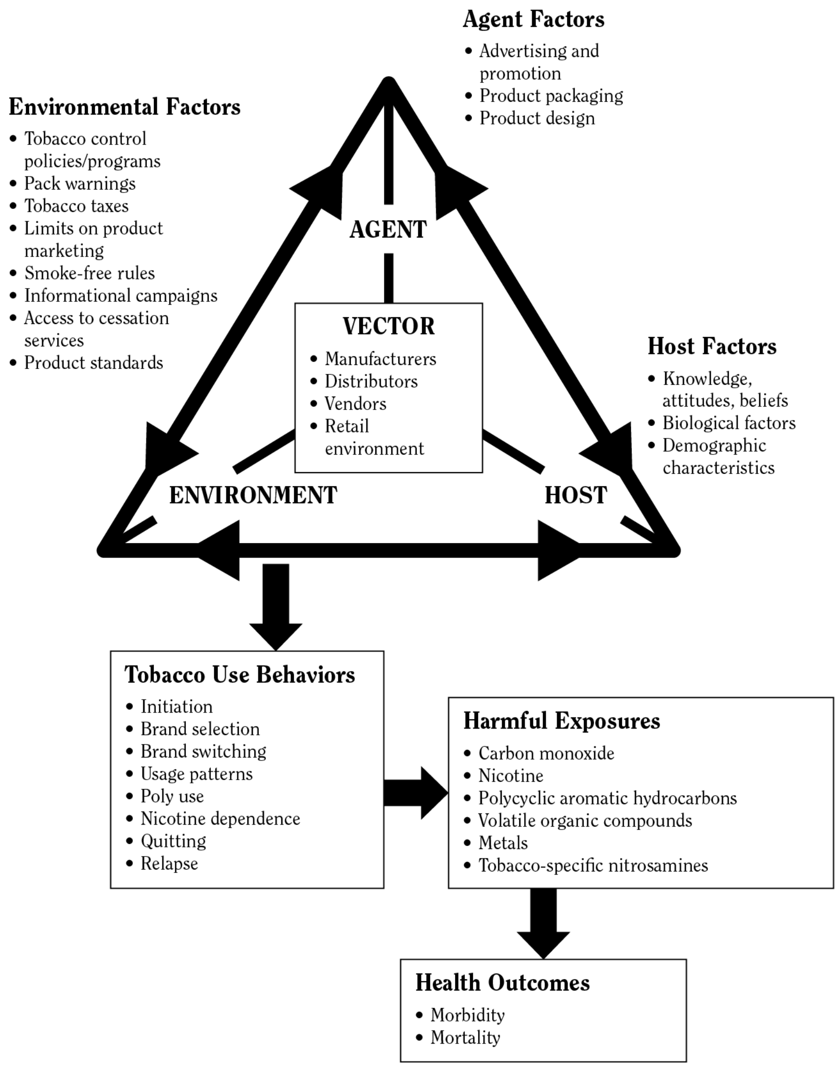
Literature Review Methods

A literature search was conducted in PubMed and the Web of Science electronic databases. The literature searches related to the density of tobacco retail outlets focused on studies published between 2008 and 2021 to avoid duplication of the literature reviewed in NCI Tobacco Control Monograph 19. Studies in which data collection occurred before 2000 were excluded. Specific search terms are listed in Table 5A.1 in Appendix 5.1. Other potentially relevant articles were identified from the references listed in the articles that met the inclusion criteria. The search was also supplemented with literature nominated by colleagues and reviewers with relevant expertise.

Community Environment

An estimated 380,000 retailers sell tobacco in the United States (Center for Public Health Systems Science 2014; *Federal Register* 2016), resulting in the potential for frequent exposure to commercial tobacco products in the retail environment. Although tobacco retailers in the United States are numerous, their geographic distribution

Figure 5.1 Host-Agent-Vector-Environment model for commercial tobacco use



Source: Hyland and colleagues (2017), adapted with permission.

is not uniform, resulting in more ubiquity of commercial tobacco in some places than in others (Lee et al. 2017). Differences in access to and availability of tobacco products may be a social justice issue because such differences may contribute to disparities in tobacco use and tobacco-related disease (Lee et al. 2017).

In 2010–2011, almost half of U.S. adolescents (13–16 years of age), who were surveyed using an internet panel, reported that they had visited convenience stores, the most common type of tobacco retailer, weekly (Sanders-Jackson et al. 2015). Frequent exposure to tobacco retailers among youth is a concern because studies show that living in an area with a high density of such retailers may be associated with trying smoking (Pokorny et al. 2003; McCarthy et al. 2009). Greater density of tobacco retailers around schools has also been found to be associated with smoking experimentation among high school students in urban settings but not among high school students or middle school students in rural settings (McCarthy et al. 2009).

Some studies of youth also suggest that those living in neighborhoods with the highest retailer density have a higher prevalence of smoking than youth living in neighborhoods with lower retailer density (Novak et al. 2006; Henriksen et al. 2008). For example, the prevalence of smoking was 3.2 percentage points higher at schools in neighborhoods with the highest tobacco outlet density than it was at schools in neighborhoods without outlets, but presence of an outlet within 1,000 feet of a school and the distance to an outlet from school were not associated with the prevalence of smoking (Henriksen et al. 2008). Additionally, another study found that the more tobacco retailers surrounding a school, the more likely school-aged youth were to purchase their own cigarettes (Leatherdale and Strath 2007). Although another study found no association between retail density and student reports of buying cigarettes from a store, it found a significant linear trend between decreases in retailer density and increases in borrowing cigarettes among students who smoked experimentally (McCarthy et al. 2009). Furthermore, a study of 6th-, 7th-, and 8th-grade students found no association between higher levels of retail tobacco availability and continued smoking, defined as smoking on one or more days in the past 30 days among those who had ever tried smoking (compared with those who had ever tried smoking and did not continue to smoke) (Pokorny et al. 2003).

Studies have also explored these relationships among adults. A study of adults reported an association between retailer density and current smoking and between retailer density and daily smoking (versus smoking some days) among people living in metropolitan locations (Golden et al. 2019). However, another study from Northern California suggests that the effect is limited to neighborhoods with higher socioeconomic status (SES) households (Chuang et al. 2005), potentially because the concentration of convenience stores may not be a sufficient indicator of tobacco availability in lower SES neighborhoods. The residential proximity of tobacco retailers (e.g., living within 500 meters of a tobacco retailer) is associated with reduced smoking cessation (Reitzel et al. 2011; Cantrell et al. 2015a) and with increased risk of relapse (Chaiton et al. 2018). Additionally, in a study of 475 adult residents of Washington, D.C., who were attempting to quit smoking, participants had 1.0 (median) and 2.7 (mean) contacts with a tobacco retailer per day (Kirchner et al. 2013). Contrary to expectations, daily exposure to tobacco retailers was significantly associated with lapsing when cravings to smoke were absent or low, which may indicate that such exposures can influence lapses when other temptations to smoke are relatively low (Kirchner et al. 2013). However, increased risk of relapse or reduced cessation in areas with high retailer density has not been found for all populations.

In addition, Henriksen and colleagues (2004; 2010) found that frequency of visits to tobacco retailers is a risk factor for young people's experimenting with and initiation of smoking. Surveys of more than 2,125 students in 6th, 7th, and 8th grades found that weekly or more frequent visits to tobacco retailers was associated with 50% higher odds of ever smoking (Henriksen et al. 2004). Later, a longitudinal research study of 1,681 adolescents (11–14 years of age) who had never smoked found that students who visited the types of stores containing the most cigarette advertising (convenience, liquor, and small grocery stores) at moderate frequencies (between twice a month and twice a week) at baseline were 64% more likely to have initiated smoking 12 months later than their peers who reported low visit frequency (less than twice a month) to such stores at baseline (Henriksen et al. 2010). Students who reported high frequency (more than twice a week) of visiting stores containing the most cigarette advertising at baseline were 158% more likely than students who reported low visit frequency to have initiated smoking 12 months later. Greater frequency of store visits, as reported at baseline, remained significantly associated with higher likelihoods of smoking initiation 30 months later (Henriksen et al. 2010).

Relationships Between the Density of Tobacco Retailers, Race and Ethnicity, and Income

Several studies have examined the relationship between the density of tobacco retailers and such neighborhood demographic characteristics as racial and ethnic composition and level of income at the state or city level. Studies have consistently found a greater density of these retailers in neighborhoods with higher percentages of Black residents (Schneider et al. 2005; Fakunle et al. 2010, 2019a; Yu et al. 2010; Loomis et al. 2013; Tucker-Seeley et al. 2016; Ribisl et al. 2017b; Mills et al. 2022) and Hispanic residents (Schneider et al. 2005; Fakunle et al. 2010; Siahpush et al. 2010a; Yu et al. 2010; Loomis et al. 2013; Reid et al. 2013; Duncan et al. 2014; Tucker-Seeley et al. 2016; Ribisl et al. 2017b; Mills et al. 2022). Higher densities of tobacco retailers have also been found in lower income neighborhoods (Schneider et al. 2005; Fakunle et al. 2010, 2016, 2019a; Siahpush et al. 2010a; Yu et al. 2010; Mayers et al. 2012; Loomis et al. 2013; Reid et al. 2013; Tucker-Seeley et al. 2016; Galiatsatos et al. 2018; Glasser et al. 2022).

However, findings from studies examining tobacco retailer density as it relates to racial and ethnic neighborhood composition and neighborhood SES have not always been consistent across states and cities or in their approaches to measurement (Siahpush et al. 2010a; Mayers et al. 2012; Duncan et al. 2014; Fakunle et al. 2016). For example, in a random sample of 94 census tracts in Omaha, Nebraska, Siahpush and colleagues (2010a) found, based on a simple regression, that the percentage of stores that sell tobacco was positively associated with the percentage of non-Hispanic Black residents and the percentage of Hispanic residents in neighborhoods. However, when using geographically weighted regression (i.e., allowing for local parameters to be estimated rather than assuming a constant relationship between variables across a study area) in 80 census tracts in Polk County, Iowa, Mayers and colleagues (2012) found no association between the density of tobacco retailers and the percentage of Hispanic residents, and a negative association between the density of tobacco retailers and the percentage of African American residents (i.e., lower outlet density in tracts with higher proportions of African American residents). Duncan and colleagues (2014) also found no significant association in multivariate spatial regression analyses between the density of tobacco retailers and neighborhood demographic characteristics in 167 census tracts in Boston. However, the authors attributed this finding to the potential differential siting of tobacco retailers near large populations of college students given the large number of college and university campuses in Boston, most of which are located outside neighborhoods with more non-White residents than White residents and with more lower income residents than higher income residents.

Schwartz and colleagues (2021) found that, across 3,846 subregions in 13 cities in Ohio, the subregions with a higher prevalence of African American and Hispanic people and people with incomes below the poverty level had higher densities of tobacco retailers. These researchers also found an association between historical redlining and tobacco retailer density. Established by the federal government in the 1920s and 1930s, redlining was a discriminatory housing policy that discouraged banks from offering mortgages in neighborhoods that had a high percentage of residents from certain racial and ethnic groups (U.S. Department of Justice 2021; Legal Information Institute n.d.). Schwartz and colleagues (2021) found that historical redlining grades (e.g., "best," "still desirable," "definitely declining," and "hazardous") were associated with the modern-day density of tobacco retailers in these Ohio cities. Thus, inconsistencies across state- or city-level studies may be related to the unique demographic composition of particular communities, the different covariates used, and the lack of a standardized measurement for the density of tobacco retailers, which may limit the generalizability of findings.

Five studies examined disparities in the density of tobacco retailers in national samples of such retailers. Using a single sample of tobacco retailers from 2007 and U.S. census tract data, Rodriguez and colleagues (2013, 2014) considered the role of urban and rural geography in two national studies. The density of tobacco retailers was positively associated with the proportion of families experiencing poverty, the proportion of women older than 25 years of age without a high school diploma or equivalent, and the proportion of Hispanic and Black residents in a U.S. census tract and in urban areas compared to non-urban areas (Rodriguez et al. 2013). This study also found that the density of tobacco retailers was negatively, or inversely, associated with average household size (i.e., larger average household size was associated with lower tobacco retailer density); this inverse association between household size and tobacco retailer density was stronger in urban areas than in non-urban areas. Many studies of density use census tracts, which are relatively stable subdivisions of counties that have a population size between 1,200 and 8,000 people (United States Census Bureau n.d.), as a unit of analysis for a neighborhood, and classify each census tract's density as a function of its population and size. In the study by Rodriguez and colleagues (2013), urbanicity was derived from the rural–urban commuting area classification system, which uses commuter patterns to classify census tracts. Urban census tracts were associated with a 32% increase in the density of tobacco retailers compared with nonurban census tracts (Rodriguez et al. 2013). The relationship between all neighborhood sociodemographic characteristics, except poverty, and the density of tobacco retailers varied by urban and rural geography. For example, the relationship between the density of tobacco retailers and a larger proportion of Hispanic residents was stronger in urban areas than in rural areas (Rodriguez et al. 2013).

In a subsequent study, Rodriguez and colleagues (2014) used mixture regression analysis to determine the optimal number of latent disparity classes among all U.S. census tracts by modeling the relations of the proportion of Black people, Hispanic people, and families living in poverty with tobacco outlet density while controlling for urban or rural status. The authors identified additional heterogeneity in the relationship between the density of tobacco retailers and sociodemographic characteristics in urban and rural census tracts according to level of disparity class, resulting in six latent disparity classes (low, moderate, and high disparity classes in both rural and urban areas). In rural areas, there was a positive relationship between density of tobacco retailers and the composition of Hispanic census tracts in high-disparity class tracts, but a negative relationship was found in rural areas with low- and moderate-disparity classes; an increase in the proportion of Hispanic people in low- and moderate-disparity class census tracts was associated with a decrease in tobacco outlet density. In urban census tracts, there was a positive relationship between tobacco outlet density and composition of Hispanic neighborhoods in both high- and moderate-disparity class tracts, but no statistically significant relationship was observed in low-disparity class tracts. Because the analysis focused on the proportion of non-Hispanic Black populations, there were few differences in tobacco outlet density across levels of disparity classes in rural census tracts. However, for urban areas, each quartile increase in the proportion of Black people was associated with a 5.7%, 2.2%, and 1.4% increase in tobacco outlet density in high-, moderate-, and low-disparity class census tracts, respectively. With respect to poverty level in both rural and urban areas, a strong positive relationship was found between an increasing proportion of families living in poverty and tobacco outlet density for the high- and moderate-disparity class census tracts; the positive relationship between poverty and tobacco outlet density was stronger in urban areas than in rural areas and across all levels of disparity classes (Rodriguez et al. 2014).

Studies using national samples of tobacco retailers must be interpreted with consideration of regional residential patterns of segregation and migration. For example, in 2012–2015, among rural Hispanic residents, 38.5% lived in the West South-Central U.S. census division, compared with only 0.6% in New England (James et al. 2017). Thus, national-level studies examining the intersection of ethnicity and rurality should also account for regional, state, and local differences.

Using a national sample of tobacco retailers in 2012, Lee and colleagues (2017) found in unadjusted models that the density of tobacco retailers was highest in neighborhoods with proportionately more Black residents and lowest in neighborhoods with proportionately more White residents or more Asian and Pacific Islander residents; no such relationship was found with respect to the proportion of Hispanic residents. However, the proportion of both Black and Hispanic residents was negatively associated with the density of tobacco retailers when controlling for income, race and ethnicity, and the proportions of vacant housing and renter-occupied units. Instead, both vacant housing and renter-occupied units, serving as proxy variables for neighborhood stability, were positively correlated with tobacco retailer density, even after controlling for income and race and ethnicity (Lee et al. 2017). However, in another study that used national tobacco retailer data at four timepoints (2000, 2007, 2012, and 2017), Mills and colleagues (2022) found significant, positive relationships between tobacco retailer density and the percentage of Black residents, Hispanic residents, and vacant housing units in a census tract; and lower income was associated with lower retailer density. Between 2000 and 2017, Mills and colleagues (2022) found that the income–retailer density and vacant housing–retailer density relationships weakened.

D'Angelo and colleagues (2016) examined disparities in the proximity of tobacco and fast-food retailers to public schools using a national sample of schools in 2011. Schools comprising the top quartiles of Hispanic students, Black students, and students receiving free or reduced-price lunch had an average of 9.2, 9.6, and 10.9 tobacco outlets near schools, respectively, compared to an average of 2.8 tobacco outlets near schools with the highest quartile of White students. In adjusted models, the number of tobacco retailers near schools was 4% greater for each 10% increase in the proportion of enrollment of Black students and students from lower income families but 8% greater for each 10% increase in the proportion of enrollment of Hispanic students.

Elsewhere, Giovenco and colleagues (2019a) examined the impact of New York City's tobacco-free pharmacy law, which was implemented in 2018, on the density of tobacco retailers. Density reduction was greatest in neighborhoods with higher median household incomes and a greater proportion of non-Hispanic White residents. Farley and colleagues (2020) examined the impact of the 2009 federal prohibition of flavored cigarettes (excluding menthol) and New York City's additional prohibition of the sale of other non-menthol flavored tobacco products (excluding e-cigarettes), which was implemented in 2010. Despite local legislation restricting these sales, among 1,557 New York City tobacco retailers in the 2017 New York Retailer Advertising of Tobacco Survey, the availability of any explicit-flavored noncigarette tobacco product (i.e., noncigarette tobacco products that use descriptions or pictures to evoke a specific smell or taste) and the availability of any concept flavor-named noncigarette tobacco product (i.e., tobacco products that use more ambiguous descriptors) were each positively associated with the proportion of Black residents in a neighborhood. Additionally, in multivariate analysis, the availability of explicit-flavored and concept flavor-named large cigars or cigarillos was positively associated with the proportion of Black residents in a neighborhood and the presence of a high school in the neighborhood.

Other Neighborhood Sociodemographic Characteristics

Research examining disparities in the density of tobacco retailers for other neighborhood sociodemographic characteristics has been limited. In one such study that used spatial modeling in a 2012 sample of tobacco retailers, Lee and colleagues (2016) found that having higher proportions of female same-sex couples and male same-sex couples in a U.S. census tract was associated with a higher density of tobacco retailers. In models that adjusted for other neighborhood demographic (race and ethnicity and income) and place-based (rurality and the presence of an interstate highway) characteristics, the relationship persisted for male same-sex couples but not for female same-sex couples.

Two studies conducted in California examined the roles of nativity and geography on the density of tobacco retailers in this state. Bostean and colleagues (2022) found that neighborhoods in California with higher concentrations of Latino residents who are foreign-born have higher densities of tobacco retailers but lower densities of alcohol retailers, but there was no statistically significant association between neighborhood composition of foreign-born Asian residents and density of tobacco and alcohol retailers. Henriksen and colleagues (2020) found that, among licensed tobacco retailers in California, there were geographic disparities in product availability and prices in rural versus nonrural counties, with retailers in rural counties being more likely to sell chewing tobacco, to sell larger packs of cigarillos for less than $1, and to charge less for the cheapest pack of cigarettes. For smokeless tobacco products, the price of the leading brand of chewing tobacco, Copenhagen—a brand of Altria, the parent company of Philip Morris USA—was higher in rural stores than in nonrural stores, and the price of Grizzly—a discount brand of chewing tobacco made by American Snuff Company, which is a subsidiary of Reynolds American, Inc., which also owns R.J. Reynolds Tobacco—did not differ between stores in rural and nonrural counties.

Elsewhere, Young-Wolff and colleagues (2014) determined that people with serious mental illness who smoked lived in San Francisco Bay-area neighborhoods with a mean tobacco retailer density that was 2.2 times higher (median 1.13 times higher) than that of the average San Francisco area resident. In univariate analyses, older age, non-White race, neighborhood poverty, and unstable living situations were all associated with living closer to a tobacco retailer among people who smoked and had serious mental illness. For New York City in October 2016, Rogers and Vargas (2018) found that 82% of supportive housing facilities for people with mental illness had at least one tobacco retailer within 500 feet; comparatively, 56% of other residential properties that did not provide supportive housing for people with mental illness had at least one tobacco retailer within 500 feet.

In another study, Hall and colleagues (2019) examined the impact of corporate changes in the sale of tobacco products on the density of three tobacco retailers in 12 southeastern states. Specifically, CVS, a large pharmacy chain, had discontinued the sale of tobacco products in 2014, but two large discount chains offering very low prices, Family Dollar and Dollar General, had started selling tobacco products in 2012 and 2013, respectively. From 2012 to 2014, the decision by CVS decision to stop selling tobacco reduced the density of tobacco retailers in the Southeast by 0.45 stores per 10,000 adults. However, decisions by Family Dollar and Dollar General to sell tobacco led to an overall increase in the density of tobacco retailers by 1.17 stores per 10,000 adults, and increases in density were even larger in rural counties.

Density of Vape Shops and Hookah Establishments

Seven studies examined the relationship between the density of vape shops and neighborhood-level demographic characteristics. In the U.S. sample of the 2016 International Tobacco Control Four Country Vaping and Smoking Survey, vape shops were the most common place for adults who use e-cigarettes daily or weekly to purchase their products (43.3% compared with 26.8% who purchased online and with 29.9% who purchased at other tobacco retailers) (Braak et al. 2019). According to data from the 2021 National Youth Tobacco Survey (NYTS), vape or tobacco shops (20.2%) were the second most common sources of tobacco products among middle and high school students who currently used tobacco products, behind social sources (22.5%) (Gentzke et al. 2022). Vape shops differ from conventional tobacco retailers (e.g., convenience stores) because they may sell only tobacco products, including e-cigarettes; they may focus on selling e-cigarettes but not conventional tobacco products; and/or they may be “head shops” or smoke shops (Kong et al. 2017a; Lee et al. 2018). Using a national sample, Dai and colleagues (2017) found that the density of vape shops was higher in urban neighborhoods than in nonurban neighborhoods. In urban areas, the density of vape shops was higher in neighborhoods with greater proportions of young adults, adults 30–44 years of age, and Hispanic or Asian residents. In nonurban areas, the density of vape shops was higher in neighborhoods with greater proportions of African American or Hispanic residents. The density of vape shops in urban areas was also lower in areas with a greater proportion of residents with a college degree, but the density of vape shops did not differ by level of educational attainment in nonurban areas. In a different study, which compared the density of vape shops located near a college campus by urban or rural location, Dai and Hao (2017) found a higher density of vape shops near college campuses that were located in cities compared with college campuses that were located in rural areas. Bostean and colleagues (2018), studying Orange County, California, and Wheeler and colleagues (2020), studying Virginia, found a greater density of vape shops in neighborhoods with a larger proportion of Hispanic residents; in the California study, the density of vape shops was also greater in neighborhoods with a larger proportion of Asian residents. In contrast to these studies, Giovenco and colleagues (2016) used data from New Jersey and found that the odds of a census tract having at least one vape shop were greater in neighborhoods with lower percentages of Hispanic and Black residents and with middle-income tracts (as opposed to higher income). Lee and colleagues (2018), however, noted that discrepancies in findings across studies may be related to the different ways in which vape shops were defined. Giovenco (2018) posited that findings among vape shops that sell only e-cigarettes may diverge from vape shops that sell e-cigarettes and other tobacco products, where vape shop density patterns are more like those seen for cigarettes. Chido-Amajuoyi and colleagues (2020) found that neighborhoods with a higher proportion of non-Hispanic Black residents in Austin, Texas, had lower odds of having vape shops, and neighborhoods with a higher percentage of residents with incomes below the federal poverty level had higher odds of having vape shops. Further, 40% of vape shops were located within a half mile of a middle or high school. Similarly, Wheeler and colleagues (2020) found that neighborhoods in Virginia with higher levels of socioeconomic disadvantage had a greater density of vape shop outlets. Finally, Venugopal and colleagues (2022), examining the incidence of vape shops in U.S. census tracts, found no disparity by race or ethnicity of youth, but the incidence of vape shops in the two lowest SES quintiles was nearly double that of vape shops in the highest SES quintile. Further, authors found increasing incidence of vape shops in neighborhoods with poor air quality, measured as nitrogen dioxide levels in 2018.

Very few studies published during the relevant search timeframe examined the density of hookah establishments by neighborhood demographic characteristics. One study (Kates et al. 2016) examined the proximity of hookah establishments to colleges and universities nationwide and found that public universities were less likely than private institutions to have a hookah establishment within 3 miles. Another study found that the density of hookah establishments in North Carolina and Virginia was greater in areas with more male residents and more Hispanic residents but not more Black residents (King et al. 2020). This study also found a bimodal pattern for the density of hookah establishments by SES, with higher density in areas where more residents held bachelor's degrees or higher and in areas with more households living below the federal poverty level (King et al. 2020). Additional research is needed to better understand the relationship between the distribution and proximity of hookah establishments and hookah-related health disparities.

Consumer or Store Environment

The content of tobacco marketing in retail spaces differs across demographic groups when such marketing is defined as advertising, promotions, and price. This section focuses on the availability and placement of tobacco advertising in retail stores, and later sections address targeted advertisements in mass media and other media channels.

Influence of Marketing and Advertising on Tobacco-Related Health Disparities

In 2022, the tobacco industry spent $8.05 billion to market cigarettes and $572.7 million to market smokeless tobacco products (Federal Trade Commission 2023a,b). In 2019, major e-cigarette manufacturers spent $1.033 billion on the advertising and promotion of e-cigarettes; this number declined to $719.9 million in 2020 (Federal Trade Commission 2022). Retail marketing includes store advertising, such as company-branded posters on the exteriors of tobacco retailer locations, and price promotions, such as offering coupons for discounts off the price of a pack of cigarettes (NCI 2008). Qualitative research among tobacco retailers in the United States—including 29 retailers in 21 states (Feighery et al. 2003) and 63 owners and managers of small food stores in lower income neighborhoods in 4 cities (D'Angelo et al. 2020a)—suggests that manufacturers of tobacco products often establish contracts directly with the owners of retail stores to have their branded advertisements and promotions placed on store exteriors and interiors and to have their products priced cheaply. In a field study that included direct observations of 2,230 tobacco retailers from 97 counties in the contiguous United States, 95% of stores had at least one marketing material that advertised tobacco products at the point of sale, with an average of 29.5 total tobacco marketing materials per store (Ribisl et al. 2017a). Importantly, the risk of future smoking has been shown to increase with exposure to tobacco marketing (Shadel et al. 2012; USDHHS 2012a). Additionally, based on a 2015 systematic review, studies across different designs, settings, and measures document an association between exposure to tobacco marketing in retail stores and smoking (Robertson et al. 2015). In brief, advertisements attract new consumers and act as cues to people who currently smoke or formerly smoked. In addition, exposure to tobacco marketing is strongly associated with a greater likelihood of tobacco use initiation and progression toward regular use (NCI 2008).

Race and Ethnicity, Income, and Education

Disproportionate exposure to tobacco marketing among people from disparate racial and ethnic groups and people living in communities with lower incomes may contribute to higher tobacco use among these groups. Importantly, prior to the 1998 Master Settlement Agreement—which banned cigarette advertising on outdoor billboards—tobacco companies engaged in prominent billboard marketing of cigarettes that reached large numbers of youth and were disproportionately concentrated in neighborhoods with greater proportions of lower income residents and of African American residents (Luke et al. 2000; NCI 2008). Although cigarette billboards are no longer permitted, several studies have reported that tobacco advertising is more prevalent in neighborhoods with greater percentages of residents from minoritized racial and ethnic groups (Luke et al. 2000; Seidenberg et al. 2010; Widome et al. 2013; Hillier et al. 2015; Kirchner et al. 2015), with lower incomes (Barbeau et al. 2005; Seidenberg et al. 2010; Siahpush et al. 2010b;

Hillier et al. 2015), or with lower socioeconomic status (Barbeau et al. 2005). However, research examining differences in tobacco marketing by the racial and ethnic composition of neighborhoods has been limited to Black or African American, Asian, and Hispanic or Latino groups, with little examination of disaggregated ethnic groups.

Studies have also investigated the intensity of advertising in specific communities. For example, Seidenberg and colleagues (2010) found that storefront cigarette advertisements were larger in communities with greater proportions of African American residents and residents with lower incomes. Additionally, Widome and colleagues (2013) used data collectors to assess intensity of store advertising in St. Paul, Minnesota, according to four categories: none, discreet, moderate, or "in your face," which were based on the estimated percentage (0%, <10%, 10–25%, and >25%, respectively) of the property that was covered by tobacco advertising. Authors reported greater likelihood of having "in your face" or "moderate" levels of exterior advertisements in neighborhoods with greater proportions of Asian residents, Black or African American residents, residents receiving public assistance, and residents younger than 18 years of age. Neighborhoods with greater proportions of White residents had lower likelihoods of "in your face" and "moderate" levels of exterior advertising. No such relationships were detected for interior advertising (Widome et al. 2013).

However, studies have not found significant relationships between tobacco advertising and neighborhoods with greater proportions of Hispanic residents (Feighery et al. 2008; Siahpush et al. 2010b; Widome et al. 2013). Feighery and colleagues (2008), who examined changes in the number of tobacco advertisements in retail stores from 2002 to 2005 in California, found that advertising increased more rapidly in neighborhoods with an above-average proportion of African American residents. Finally, Hillier and colleagues (2015) found that in Philadelphia, Pennsylvania, tobacco advertising was more common in retail stores that accepted funds from one or both of two federal food assistance programs: the Supplemental Nutrition Acceptance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Having more tobacco advertising in stores that accept SNAP and WIC may increase tobacco-related marketing disparities for families with lower incomes and those with young children, potentially increasing tobacco-related health disparities.

The tobacco industry has a long history of engaging in targeted marketing. NCI Tobacco Control Monograph 19 concluded that "Targeting various population groups—including men, women, youth and young adults, specific racial and ethnic populations, religious groups, the working class, and gay and lesbian populations—has been strategically important to the tobacco industry" (NCI 2008, p. 11). Studies reviewed for this Surgeon General's report document tobacco industry targeting of specific racial and ethnic populations of youth. For example, Widome and colleagues (2013) found that tobacco advertisements placed at less than 3 feet from the ground, which is eye level for young children, were more common in neighborhoods with relatively more Black or African American people than people of other races and ethnicities. Mills and colleagues (2018) found menthol advertising was more prevalent in neighborhoods in the third and lowest income quartiles than in neighborhoods in the highest income quartile. Seidenberg and colleagues (2010) found that overall, the proportion of detached advertisements (i.e., advertisements separated from the storefront) and advertisements located within 1,000 feet of schools did not differ significantly in the community of Dorchester in Boston, Massachusetts, which is a predominantly lower income, non-White community, compared with Brookline, a suburb of Boston that is a predominantly White, higher income community. Comparatively, however, Dorchester had a greater proportion of large and medium-sized advertisements, and when the advertisements were weighted by size, advertisements within 1,000 feet of schools were nearly twice as likely to be found in Dorchester as in Brookline.

Menthol Cigarettes, Cigars, and Smokeless Tobacco

Studies in various states or cities have examined disparities in tobacco advertising among retailers and the comparative availability of multiple tobacco products, including menthol cigarettes, cigars, and smokeless tobacco. Retail advertising for menthol cigarettes is more common in neighborhoods with greater percentages of African American people, youth, and residents with lower incomes (Seidenberg et al. 2010; Henriksen et al. 2012; Widome et al. 2013; Roberts et al. 2015).

In Ohio, Roberts and colleagues (2015) found that retail marketing for cigars and cigarillos was most common in neighborhoods with higher percentages of African American residents, and advertising for cigarillos was also most common in economically disadvantaged neighborhoods. In addition, the variety of tobacco products advertised outside retail stores (e.g., on windows, doors, sidewalks) was greater in urban, economically disadvantaged African American communities than in urban, economically disadvantaged White communities and rural White communities, regardless of economic position (Roberts et al. 2015). Cantrell and colleagues (2013) found that in Washington, D.C., availability of little cigars and cigarillos was more common in neighborhoods with greater proportions of African American people than in neighborhoods with lower proportions of African American people, and exterior advertising of little cigars and cigarillos was greatest in neighborhoods with higher proportions of youth and of African American people. In New Jersey, Giovenco and colleagues (2018) found greater availability of cigars and cigarillos in retailers near high schools that had a greater percentage of students receiving free or reduced-price lunches and near schools with predominantly non-White students. In New York City, Giovenco and colleagues (2019b) found that the availability of 99-cent cigarillos was higher in neighborhoods with larger proportions of Black and Hispanic residents and with more lower income residents than in neighborhoods with smaller proportions of Black and Hispanic residents and with more higher income residents.

For smokeless tobacco, availability and promotion were lower in retailers near high schools with a greater percentage of students receiving free or reduced-price lunches and near schools with predominantly non-White students (Giovenco et al. 2018). Similarly, in two counties in Minnesota, Widome and colleagues (2012) found a greater number of advertisements for smokeless tobacco in neighborhoods with fewer youth, fewer Black or African American and Asian residents, and fewer people receiving public assistance.

At least some of the findings from these studies likely represent an interaction effect of racially and ethnically segregated communities and poverty on exposure to retail tobacco marketing (Sheehan 2014). For example, communities with high proportions of African American and Hispanic residents are disproportionately of lower SES (Quillian 2012). Thus, studies that examine the relationship between racial and ethnic composition of neighborhoods and retail marketing of tobacco products could consider controlling for neighborhood SES (Sheehan 2014). However, the high collinearity that can exist between neighborhood SES and racial composition does not aways allow for differentiation between effects of SES and racial composition in neighborhoods (Cantrell et al. 2014). For a review summarizing disparities in the retail marketing of tobacco products, see Lee and colleagues (2015c).

E-Cigarettes

Disparities in the advertising of e-cigarettes are important because exposure to advertising for e-cigarettes is associated with use of these products among youth (USDHHS 2016), and e-cigarettes are the most commonly used tobacco product among youth across all measured racial and ethnic groups (Gentzke et al. 2022). To date, some studies suggest that e-cigarette advertising and availability were most prominent, at least initially, in neighborhoods with a greater proportion of non-Hispanic, White residents—suggesting that advertising and marketing patterns for e-cigarettes did not mirror the patterns found for most other types of tobacco products when they are introduced to the tobacco marketplace (Rose et al. 2014; Wan et al. 2017; Giovenco et al. 2018, 2019b).

Focusing on the Omaha, Nebraska, metropolitan area, Wan and colleagues (2018) found that after adjusting for covariates, the density of retail advertising for e-cigarettes was greatest in neighborhoods with lower median household incomes. In an earlier study by Wan and colleagues (2017), stores in Omaha were most likely to have advertisements for e-cigarettes if they were located in neighborhoods with relatively greater percentages of non-Hispanic White residents, higher per capita income, and higher percentages of people with at least a high school education.

However, D'Angelo and colleagues (2020b), in a study with later data, found indicators of more widespread distribution of e-cigarette advertising and availability in stores that sell cigarettes. In New York City, Giovenco and colleagues (2018) found that e-cigarettes were more likely to be sold near schools in which most students were White and least likely to be sold near schools in which the majority of students was non-White. Similarly, retailers were least likely to display advertisements for e-cigarettes in neighborhoods with the highest quartiles of Black and Hispanic residents (Giovenco et al. 2019b). In Los Angeles County, Escobedo and colleagues (2020a) found that e-cigarettes, flavored e-cigarettes, and self-service displays of e-cigarettes were less available in communities with a greater proportion of African American, Hispanic or Latino, American Indian, and Korean American residents with lower income levels than in communities with a greater proportion of non-Hispanic White residents with lower income levels. However, no significant differences were found in the availability of price promotions for e-cigarettes. In Baltimore, Fakunle and colleagues (2018) found greater availability of e-cigarettes in alcohol retailers located in neighborhoods (census tracts) in which (a) the percentage of non-White people was higher than the citywide average for this population and (b) the median household incomes were below the citywide median. Elsewhere, in a study involving seven counties in Ohio, Roberts and colleagues (2015) found that external promotions for e-cigarettes were most common in neighborhoods with greater percentages of African American residents. Finally, using national samples of tobacco retailers in 2012, Rose and colleagues (2014) found greater availability of e-cigarettes in neighborhoods with higher median household incomes and lower percentages of African American or Hispanic residents. However, by 2015, a follow-up to this study found that e-cigarette retailers had expanded into neighborhoods with more Black residents and almost 80% of tobacco retailers sold e-cigarettes (D'Angelo et al. 2020b). In addition, this study found that, among new e-cigarette retailers that had not sold these products in 2012, the prevalence of e-cigarette price promotions was highest in neighborhoods with greater proportions of Hispanic residents. Further, stores in neighborhoods with the highest proportions of Black residents had more exterior e-cigarette advertisements. Whether retail patterns of e-cigarette marketing will begin to mirror overall patterns of tobacco retail marketing is an empirical question that requires market surveillance over time.

Another marketing strategy unique to vape shops and hookah establishments is promoting the social appeal of these tobacco products—that is, to encourage tobacco use as a pleasurable way to spend time. In such marketing, information is provided on how to use tobacco or vaping products as a hobby, including (a) advertising the places to go (e.g., vape shops, hookah establishments, cigar bars); (b) adding events or features (such as alcohol) in these establishments to encourage consumers to spend time there; and (c) promoting a variety of social ways to use the products, such as producing vape clouds or sharing a hookah device. For example, an analysis of websites about establishments that offered hookah tobacco smoking suggested that 79% of these establishments served food and 41% served alcohol (Primack et al. 2012), providing a gathering place for young adults. Similarly, content analysis of online reviews on Yelp indicated that vape shops that were reported as "bar type" were relatively more likely to be in business than those that were not reported as "bar type," suggesting an attractive social option for consumers (Kong et al. 2017b). A content analysis of interviews with vape shop retailers found that they were interested in promoting their stores as recreational spaces that include such social aspects as art galleries, music, or a bar (Tsai et al. 2016). One qualitative study of eight leaders of organizations serving people in the lesbian, gay, bisexual, transgender, and queer or questioning (LGBTQ) community in New York City described how hookah establishments may serve as a medium for socialization for people who identify as LGBTQ and how smoking can bond people who share a sexual orientation (Jannat-Khah et al. 2018). In general, little research was found regarding the availability of social settings for tobacco use for different demographic groups.

Individual Sociodemographic Characteristics

Studies on disparities in the retail marketing of tobacco products are typically ecological or describe relationships with groups of people in specified geographic areas (Siahpush et al. 2016). Studies have consistently shown that exposure to tobacco marketing in retail stores is associated with current use of conventional tobacco products and e-cigarettes among youth and increased susceptibility to tobacco use among youth who have never smoked (Agaku and Ayo-Yusuf 2014; Mantey et al. 2016; Singh et al. 2016a). Youth exposure to tobacco marketing is higher in retail stores than through other marketing channels (e.g., Internet, newspaper/magazine, TV/movies) (Dube et al. 2013; Agaku et al. 2014; Singh et al. 2016a; Papaleontiou et al. 2020). According to the 2019 NYTS, 79.4% of youth reported exposure to tobacco marketing at retail stores; the prevalence of self-reported exposure was highest among non-Hispanic White (83.1%) youth, followed by Black, non-Hispanic (76.4%), Hispanic (76.2%), and other race, non-Hispanic (68.0%) youth (Wang et al. 2019).

Few studies have examined the relationship between the community-level retail marketing of tobacco products and individual-level sociodemographic characteristics. Consistent with the ecological literature, in adjusted analyses, Siahpush and colleagues (2016) found statistically significantly greater exposure to retail marketing of cigarettes in the Omaha, Nebraska, metropolitan area among study participants who were non-Hispanic Black, had lower incomes, were male, and were younger in age and who reported more frequent visits to stores. In Florida, Bernat and Choi (2018) found that, compared with adolescents living in metropolitan areas, adolescents living in nonmetropolitan areas of the state were more likely to report seeing tobacco advertisements at convenience stores, gas stations, grocery stores, and big-box stores (e.g., Walmart, Kmart) and were less likely to report seeing tobacco advertisements in pharmacies or drug stores. In an analysis of data from Wave 1 of the 2013–2014 Population Assessment of Tobacco and Health (PATH) Study, which focused on associations between race and ethnicity and exposure to tobacco industry marketing, Carroll and colleagues (2020) found greater exposure to tobacco retail advertisements and/or marketing materials among non-Hispanic Black respondents than among non-Hispanic White respondents; such exposure was even lower among non-Hispanic Asian respondents than among non-Hispanic White respondents for a majority of measures of tobacco marketing exposure. In Ohio, Burgoon and colleagues (2019) found that adolescent boys who identified as non-Hispanic Black or another racial and ethnic group reported greater exposure to tobacco retailers than did adolescent boys who identified as non-Hispanic White. In addition, while self-reported marketing exposure was greater among boys from rural areas than among boys from urban areas, potential exposure to tobacco marketing between home and school was greater among boys living in urban areas than among boys living in rural areas. Liu and colleagues (2019), who examined data from the 2016–2018 NYTS, found that in 2018 middle and high school students under 18 years of age who used e-cigarettes in the past 30 days primarily obtained their products from social sources (72.6%), followed by vape shops or other stores that sold only e-cigarettes (16.5%), gas stations and convenience stores (9.8%), the Internet (5.7%), and other locations (e.g., grocery stores, drug stores, kiosks; <2% each). This pattern of access was similar by sex and by race and ethnicity.

Using a national sample of adolescents from Wave 1 of the PATH Study, Moran and colleagues (2019b) found that among adolescents who had never used tobacco products (n = 9,716), those who were African American and those with lower SES (as indicated by the level of education of a participant's parent) were relatively more likely to report seeing advertisements for cigarettes and non-large cigars than were non-Hispanic White and higher SES respondents. Among adolescents who had ever used tobacco products, this relationship was significant only for ads for non-large cigars. Compared with Hispanic and non-Hispanic White youth, African American youth were also more likely to use e-cigarettes (based on self-reports) because of appealing advertising. Youth in the lowest education group were most likely to self-report that they used e-cigarettes because people in the media or other public figures use them.

According to a national study by Singh and colleagues (2016b) that relied on self-reports in the NYTS, U.S. middle and high school students in 2015 and 2016 saw advertisements for e-cigarettes most frequently in retail stores; exposure in these stores was higher among non-Hispanic White students than among non-Hispanic Black and Hispanic students and students of other non-Hispanic races or ethnicities.

Influence of Tobacco Product Promotions and Price Reductions on Tobacco-Related Health Disparities

One of the most effective ways to prevent and reduce smoking is to increase the price of cigarettes (Levy et al. 2004; Chaloupka et al. 2011). In fact, NCI Tobacco Control Monograph 21, developed in collaboration with the World Health Organization, concluded that "[a] substantial body of research, which has accumulated over many decades and from many countries, shows that significantly increasing the excise tax and price of tobacco products is the single most consistently effective tool for reducing tobacco use" (NCI and WHO 2016, p. 151). The 2000 Surgeon General's Report, *Reducing Tobacco Use*, further noted that "raising tobacco excise taxes is widely regarded as one of the most effective tobacco prevention and control strategies" (USDHHS 2000, p. 19). The vast majority of tobacco marketing expenditures are for promotions that reduce the price of cigarettes (Federal Trade Commission 2023a). Similar to the case with advertising, research indicates that promotions of tobacco products and the prices to be paid for them vary by neighborhood sociodemographic characteristics.

Studies in single states or cities have found that price promotions for Newport brand menthol cigarettes are most common in neighborhoods with relatively greater percentages of youth and Black students (Henriksen et al. 2012; Waddell et al. 2016) and Black residents (Kephart et al. 2019). Results are mixed for Hispanic youth, with one study finding more price promotions in neighborhoods with greater percentages of Hispanic youth (Waddell et al. 2016) and another finding no significant association (Henriksen et al. 2012). However, previous studies have found no significant relationship between promotions and neighborhood sociodemographic characteristics for such other brands as Marlboro (Henriksen et al. 2012; Waddell et al. 2016; Kephart et al. 2019) and Doral (Waddell et al. 2016).

A variety of studies have reported that cigarettes are cheaper in neighborhoods with greater percentages of certain racial and ethnic groups (Cantrell et al. 2015b; Henriksen et al. 2017), youth (Toomey et al. 2009; Henriksen et al. 2016, 2017; Epperson et al. 2019), and lower income residents (Seidenberg et al. 2010; Henriksen et al. 2017)—a phenomenon known as *price discrimination*. For example, Seidenberg and colleagues (2010) reported that the mean advertised price for a pack of cigarettes was $0.39 lower in the lower income, predominantly non-White neighborhood of Dorchester (in Boston) than in Brookline (a suburb of Boston), which is a predominantly higher income, White neighborhood. Furthermore, Henriksen and colleagues (2017) found that Swisher Sweets brand cigarillos cost less in California neighborhoods with a greater percentage of school-aged youth and in neighborhoods with lower median household incomes compared with neighborhoods with a lower percentage of school-aged youth and higher median household incomes, respectively.

Several studies have examined Newport brand menthol cigarettes specifically, the most popular menthol brand in the United States (Henriksen et al. 2012, 2016; Epperson et al. 2019; Miller Lo et al. 2022). In California and the United States overall, prices of Newport menthol cigarettes were lower in neighborhoods with a higher proportion of African American residents and of Asian American and Pacific Islander residents, but this relationship did not reach statistical significance with respect to the proportion of Hispanic residents (Henriksen et al. 2016). Additionally, in California, Newport prices were lower in neighborhoods with a higher proportion of youth (5–17 years of age) (Epperson et al. 2019) and Black students (Henriksen et al. 2012, 2016). In contrast, race and ethnicity, age, and income of residents did not predict variation in bottled water prices in California or the U.S. overall (Henriksen et al. 2016).

Similarly, in Washington, D.C., prices for Newport menthol cigarettes were lower in neighborhoods with relatively more African American people and at retailers near public schools compared with neighborhoods with fewer African American residents and retailers near private schools (Cantrell et al. 2015b). Prices for Newport menthol cigarettes were also higher in neighborhoods with higher median family incomes (Cantrell et al. 2015b). In Massachusetts, prices for Newport menthol cigarettes were lower in neighborhoods with a greater percentage of Black residents (Kephart et al. 2019). In addition, more retailers illegally sold Newport menthol cigarettes at $0.25 or more below Massachusetts' established minimum price in neighborhoods with a greater percentage of Black and Latino residents (Kephart et al. 2019).

A study by Poston and colleagues (2012) using data collected in 2011 suggested that consumer prices after tax for Newport menthol cigarettes were lower at military exchanges, which are not open to the civilian population. People who smoke were able to pay between 18.1% and 26.7% less by purchasing Newport menthol cigarettes at U.S.-based Army, Air Force, Navy, and Marine Corps exchanges rather than at the nearest Walmart. Similarly, using data collected in 2016, Kong and colleagues (2019) found that packs of cigarettes and smokeless tobacco were cheaper at retail stores located on Air Force bases than they were at nearby off-base retailers. As noted in Air Force Instruction 48-104, the U.S. Department of Defense issued a policy stating, "prices of tobacco products shall match the prevailing local price in the community, including the effect of all applicable taxes" (Secretary of the Air Force 2019, p. 10). However, despite this policy, which supersedes similar previous policies by the Air Force, at least one study conducted in 2019 found that some tobacco products continued to be cheaper at retailers on Air Force bases than they were at nearby off-base retailers (Kong et al. 2022a). Similar price-matching policies have been enacted in other branches of the military, such as the Navy (Department of the Navy 2020) and the Marine Corps (McDonald 2017).

Few national studies have examined disparities in the retail marketing of tobacco products. Using a national sample of tobacco retailers audited in 2012, Ribisl and colleagues (2017a) found that 95% of the retailers displayed tobacco marketing and 75% of the stores displayed at least one price promotion. On average, stores in neighborhoods with a higher percentage of non-Hispanic Black residents displayed more marketing materials than stores in neighborhoods with a lower percentage of non-Hispanic Black residents. Any price promotions were most common in neighborhoods with greater percentages of African American people in general and of youth overall. Earlier, drawing on a 2012 sample of national retailers in public school enrollment zones (the area from which schools draw their student population), Henriksen and colleagues (2016) found that the cheapest packs of cigarettes in retailers were sold in stores in neighborhoods with lower median household incomes. Similarly, using a 2015 national sample, Mills and colleagues (2019) found that the cheapest cigarettes were sold in mass merchandiser stores (compared to convenience stores), stores in neighborhoods with lower median household incomes compared with higher median household incomes and in neighborhoods with greater percentages of school-aged youth.

Two national studies have examined disparities in retail marketing for menthol cigarettes, and one national study has examined disparities in the retail marketing of little cigars and cigarillos. Based on data collected in 2015, Mills and colleagues (2018) found that advertising for menthol cigarettes and promotions for Newport brand menthol cigarettes were most common in neighborhoods with more African American residents compared with neighborhoods with fewer African American residents. In another study, Kong and colleagues (2020) found greater availability and a higher frequency of retail advertising and marketing materials for flavored little cigars and cigarillos in neighborhoods with a higher proportion of Black residents and in neighborhoods with lower income residents.

Using a 2012 sample of national retailers, Lee and colleagues (2015b) found that retail marketing of tobacco products did not differ substantially according to the same-sex couple rate (the number of same-sex couples per 1,000 coupled households in a census tract) in ways that would promote health disparities. Later, relying on a 2015 sample of national tobacco retailers, Rust and colleagues (2019) found that interior tobacco price promotions were more common in retailers that accepted payments from the federal food assistance programs, WIC and SNAP, compared with stores without authorization to accept WIC or SNAP. SNAP-authorized retailers were more likely to display interior tobacco advertisements in stores, with no significant difference in exterior advertising; WIC-authorized stores were less likely to display exterior tobacco advertisements, with no significant difference in interior advertising (Rust et al. 2019). Finally, Osman and colleagues (2019) found that, among adults who smoked, the receipt and redemption of coupons were higher among those who (a) were White than among those who were Black or other race, non-Hispanic than among those who were Hispanic, female than among those who were male, and people from minoritized sexual orientation groups than among those who were heterosexual; (b) had difficulties paying bills than among those with no such difficulties; and (c) had attained middle-level education (defined in the study as having attained a GED certificate up to an associate degree) than among those with a college degree or higher.

Only one study examined the prevalence of price promotions in vape shops and differences by community demographics, suggesting that this is an area that needs further attention. Garcia and colleagues (2017) explored marketing in vape shops and found that, of 77 shops in Southern California, 84% offered discounts for e-cigarette products. The study also found that vape shops in predominantly Hispanic communities were the most likely to have discounts and were more likely to have marketing materials tailored for Hispanic consumers than were shops in other communities.

Disparities in Violations of Retail Tobacco Regulations

FDA regulates the manufacturing, marketing, and distribution of tobacco products in the United States. Research on disparities in retailer compliance with FDA regulations is limited. Frick and colleagues (2012) found no differences in researcher-observed violations of FDA regulations between higher income and lower income neighborhoods in Columbus, Ohio, but in three counties in North Carolina, Rose and colleagues (2013) found higher odds of nonadherence to provisions in the *Family Smoking Prevention and Tobacco Control Act* (*Tobacco Control Act*) (2009a) (e.g., continued sales of “light” labeled cigarettes) in neighborhoods with higher percentages of families living below the poverty level, but lower odds of nonadherence in neighborhoods with greater percentages of Black residents overall. In one national study, Lee and colleagues (2015a) found that in 2014, violations of FDA advertising and labeling regulations—as identified by FDA in formal determinations of and inspections for marketing, advertising, and labeling violations—varied by neighborhood sociodemographic characteristics. For example, in adjusted analyses, single cigarettes (which cannot be sold legally under the *Tobacco Control Act* [2009]) were most often available for purchase in neighborhoods with greater percentages of Black or Latino residents. In contrast, self-service displays where customers could physically access tobacco products for purchase were less likely to be found in neighborhoods with greater percentages of Black or Latino residents. Although rarely found by 2014, false or mislabeled products (typically vending machines with “light” or “mild” labels) were less likely to be found in stores in neighborhoods with greater percentages of residents under the age of 18.

Tobacco Retail Summary

Regarding the community environment (e.g., retail density and proximity of retailers), most studies, but not all studies reviewed in this section, have found a greater density of tobacco retailers in neighborhoods with higher percentages of Black or African American residents (Schneider et al. 2005; Fakunle et al. 2010, 2019a; Yu et al. 2010; Mayers et al. 2012; Loomis et al. 2013; Tucker-Seeley et al. 2016; Ribisl et al. 2017b), Hispanic residents (Schneider et al. 2005; Fakunle et al. 2010; Siahpush et al. 2010a; Yu et al. 2010; Reid et al. 2013; Duncan et al. 2014; Tucker-Seeley et al. 2016), and residents with lower income levels (Schneider et al. 2005; Fakunle et al. 2010, 2016, 2019; Siahpush et al. 2010a; Yu et al. 2010; Mayers et al. 2012; Loomis et al. 2013; Reid et al. 2013; Tucker-Seeley et al. 2016; Galiatsatos et al. 2018). Data were less consistent for Hispanic residents than for Black or African American residents. In the studies that used national-level data, the associations between neighborhood sociodemographic characteristics and density of tobacco retailers and vape shops varied by urbanicity, suggesting potential interaction effects. One study found that (a) more than 77% of 18,379 schools across 97 U.S. counties had at least one tobacco outlet within 800 meters (about 0.5 miles) and (b) tobacco outlets were more common near schools with greater proportions of Black, Hispanic, and lower income students and less common near schools with greater proportions of White and higher income students (D’Angelo et al. 2016). Another study found that about 40% of vape shops were located within a 0.5-mile radius of a middle or high school in Austin, Texas (Chido-Amajuoyi et al. 2020). Taken together, these studies suggest the importance of investigating tobacco retailer–school proximity in future disparities research. However, there is a gap in the literature focusing on other disparities in addition to race and ethnicity and income. More research is also needed to investigate potential disparities in the density of tobacco retailers among other populations, such as American Indian and Alaska Native people, Pacific Islander people, people of different ethnicities subsumed under aggregated population groups, and people who identify as LGBTQI+. Furthermore, additional research is needed to examine whether disparities in tobacco retailer density, including density of vape shops and other e-cigarette retailers, have changed over time and across space (i.e., across various neighborhoods).

Regarding the consumer and store environment (e.g., advertising, promotions, and pricing), evidence suggests that the tobacco industry strategically uses targeted marketing and advertising of tobacco products in neighborhoods with certain characteristics. Similar to the findings related to disparities in tobacco retailer density, some studies have found that tobacco advertising is more prevalent in neighborhoods with greater percentages of African American residents or residents with lower incomes compared with neighborhoods with lower percentages of African American residents or residents with higher incomes (Barbeau et al. 2005; Seidenberg et al. 2010; Siahpush et al. 2010b; Widome et al. 2013; Hillier et al. 2015; Kirchner et al. 2015). Some brands and varieties of cigarettes are also cheaper in neighborhoods with greater percentages of minoritized racial and ethnic groups, youth, or lower income residents (Toomey et al. 2009; Seidenberg et al. 2010; Henriksen et al. 2012, 2016, 2017; Cantrell et al. 2015b; Epperson et al. 2019; Kephart et al. 2019), which could encourage experimentation and regular use of tobacco products among community members. Additionally, the prices of cigarettes may be lower in neighborhoods with higher proportions of youth, which could increase smoking initiation among youth in these neighborhoods (Toomey et al. 2009; Henriksen et al. 2016, 2017; Epperson et al. 2019). Retail advertising for menthol cigarettes, the only remaining characterizing flavor in cigarettes other than tobacco flavor, is more common in neighborhoods with greater percentages of African American people, youth, and lower income residents (Seidenberg et al. 2010; Henriksen et al. 2012; Widome et al. 2013; Roberts et al. 2015; Mills et al. 2018). Menthol cigarettes also tend to be cheaper in these neighborhoods (Henriksen et al. 2012, 2016; Mills et al. 2018; Kephart et al. 2019). Because menthol cigarettes are associated with increased tobacco initiation and more difficulty quitting, especially among African American people who smoke menthol cigarettes (see Chapter 3) (FDA n.d.), the disproportionate distribution of menthol product-related advertising can further contribute to persistent racial and ethnic disparities in the use of such products.

More studies are needed to examine relationships between the availability of noncigarette tobacco products (e.g., cigars, e-cigarettes, nicotine oral pouches), advertising for these products, and the demographic characteristics of neighborhoods. Studies suggest both greater availability and higher levels of advertising for cigars in neighborhoods with greater percentages of African American and lower income residents (Cantrell et al. 2013; Roberts et al. 2015; Giovenco et al. 2019b; Kong et al. 2020). Among youth, there are also racial and ethnic differences in exposure to advertising for certain tobacco products, such as cigars and cigarettes. On the other hand, advertising patterns for e-cigarettes and smokeless tobacco products appear to differ from patterns for other tobacco products. Specifically, studies suggest that the advertising of e-cigarettes and smokeless tobacco products is relatively more prominent in neighborhoods with higher proportions of non-Hispanic White residents (Widome et al. 2012; Giovenco et al. 2019b). However, in the years since e-cigarettes have been on the market, the targeted advertising of these products may have begun to shift into neighborhoods with greater proportions of members of minoritized racial and ethnic groups (Grilo et al. 2021). Future research should monitor these trends in advertising at the neighborhood level and how they might impact tobacco product use disparities.

Marketing and Media

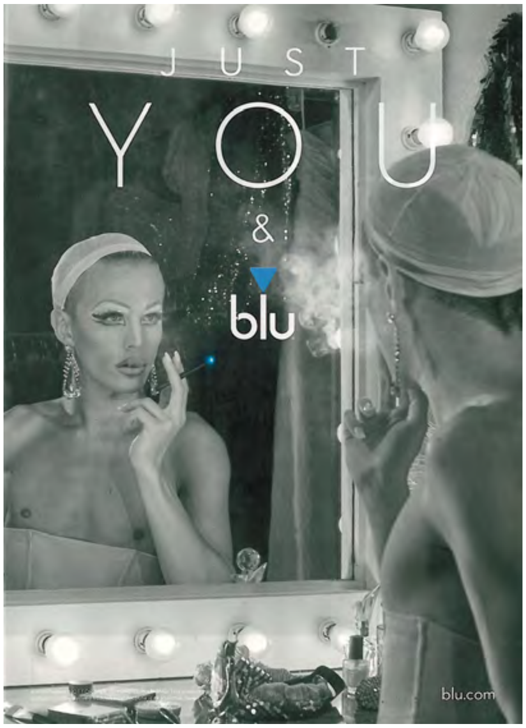
The tobacco industry uses an array of communication and promotional tools to market its products to consumers, including social and digital media, traditional or mass media advertising, sponsorships (for noncigarette products), and price promotions. Prior Surgeon General's reports and NCI Tobacco Control Monograph 19 have already causally linked tobacco marketing to tobacco use (NCI 2008; USDHHS 2012a, 2014), but several developments in the interim have necessitated new examinations of this linkage, including the expansion of tobacco marketing through social media and digital marketing, the expanded landscape of tobacco products, the adoption of different restrictions pertaining to allowable marketing strategies for noncigarette tobacco products compared with cigarettes, and the potential for different levels of exposure to and impact of marketing on tobacco use across populations. This section examines several domains of tobacco control research on channels for tobacco marketing and the relationship between tobacco marketing communications and tobacco use and related disparities. Finally, this chapter includes examples of tobacco product advertising to specific groups in a variety of media (Figure 5.2). Chapter 1 includes a brief history of targeted menthol cigarette marketing, and Chapter 8 includes additional details about current activities of the commercial tobacco industry.

Literature Review Methods

For this section of the chapter, PubMed, Google Scholar, Ovid, and PsycInfo were searched for articles published between 2008 and December 31, 2021. Specific keyword terms and the search strategy are presented in Appendix 5.1. The articles were reviewed, organized chronologically and thematically, and then the findings

Figure 5.2 Examples of promotional content for tobacco products aimed at specific population groups through various marketing channels

A. LGBTQI+ populations



Source: Ad for ITG Brands' blu brand e-cigarettes that appeared in, for example, *Playboy* and *US Weekly* magazines in 2016 (Trinkets & Trash 2016c).

Source: Instagram post in 2021 by Optimo Cigars, a subsidiary of Swisher International (Trinkets & Trash 2021c).

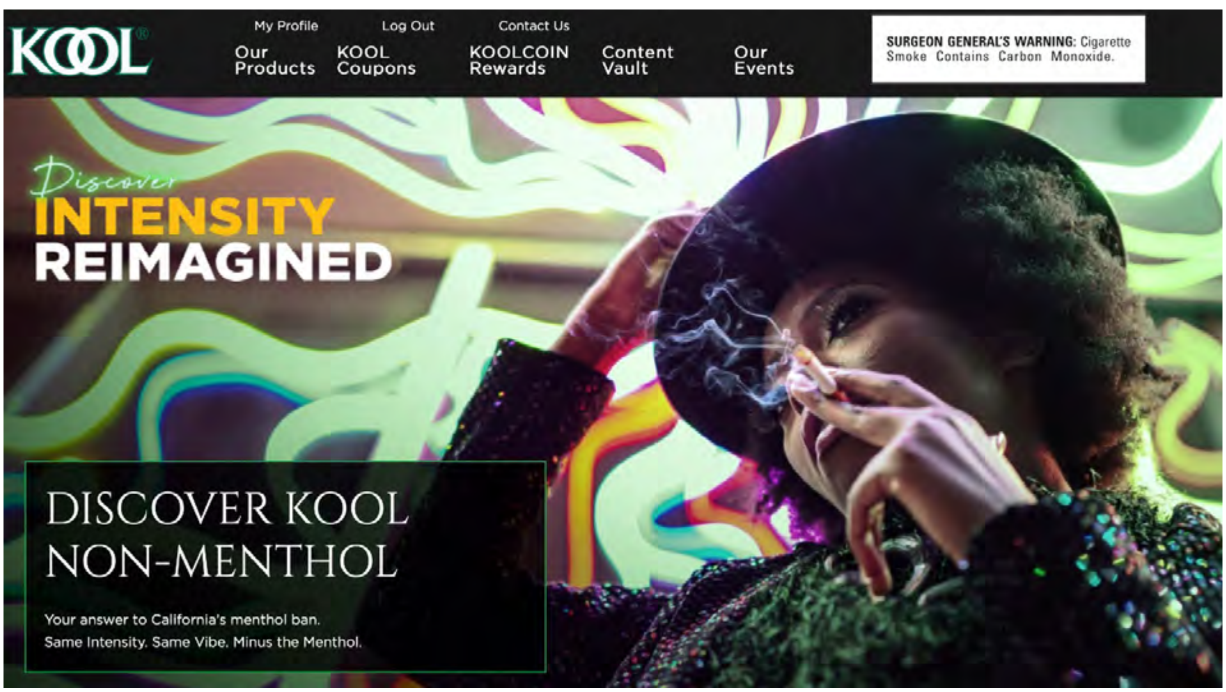
B. Black or African American populations

Source: Instagram post by Puff Bar in 2020 (Stanford Research into the Impact of Tobacco Advertising 2020).

Source: Ad for Altria's Black & Mild brand cigars that appeared in, for example, *Entertainment Weekly*, *Men's Journal*, *Popular Mechanics*, and *Rolling Stone* magazines in 2019 (Trinkets & Trash 2019c).

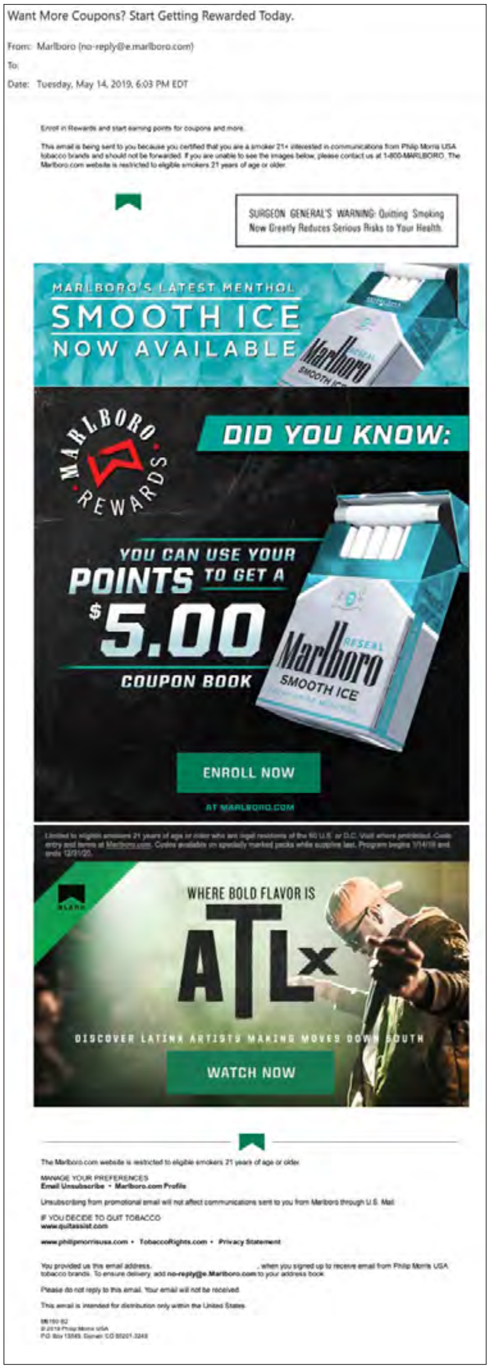
B. Continued

Source: Instagram post by Swisher Sweets brand cigars in 2018 (Stanford Research into the Impact of Tobacco Advertising 2018).



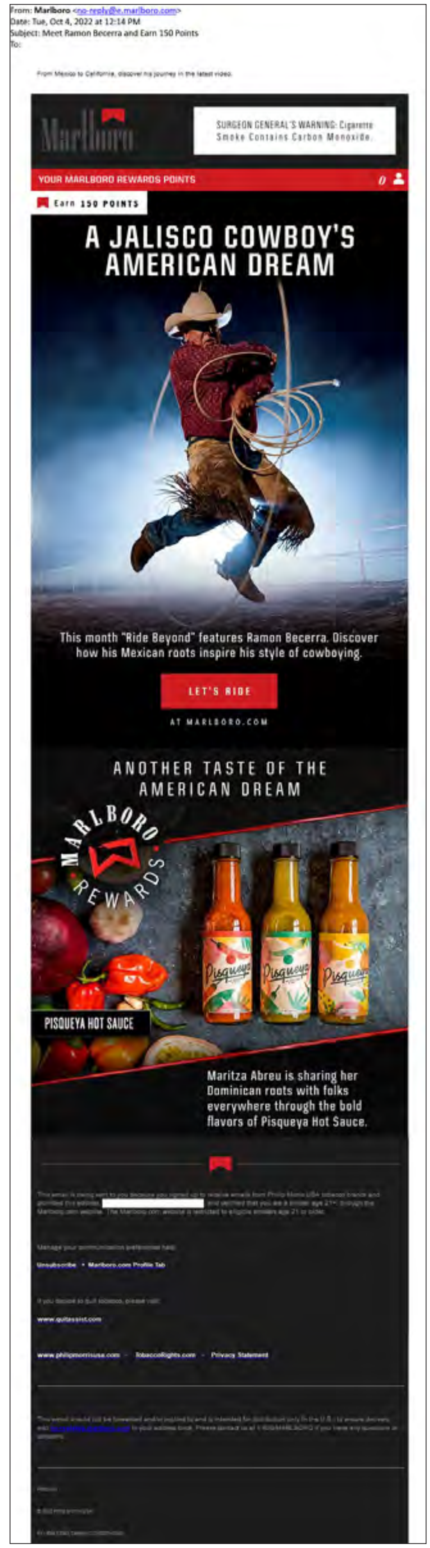
Source: Website image from Kool brand cigarettes in 2022 (Stanford Research into the Impact of Tobacco Advertising 2022).

C. Hispanic or Latino populations



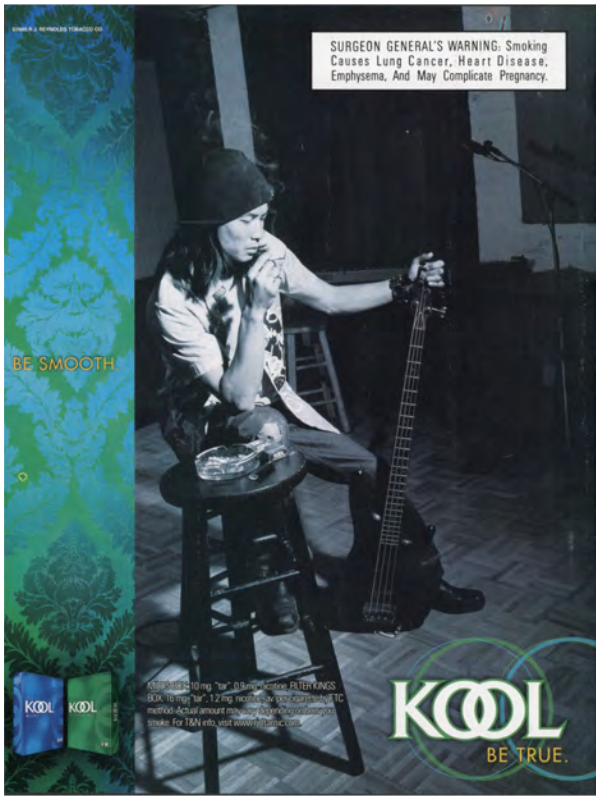
Source: Email that promotes rewards points that consumers can earn from purchasing the Smooth Ice product from Marlboro brand cigarettes and ATLx, a Marlboro Black feature on Latinx artists (Trinkets & Trash 2019d).

Source: Ad for Camel Crush brand cigarettes from 2013 that targeted Spanish-language consumers: "Los dos—tu cigarillo a tu manera" ("Both—your cigarette, your way") (Trinkets & Trash 2013a).



Source: Email from Marlboro in October 2022 that promotes its rewards program by celebrating Hispanic heritage (Trinkets & Trash 2022d).

D. Asian and Pacific Islander populations



Source: Ad for ITG Brands' Kool brand cigarettes in 2005 (Stanford Research into the Impact of Tobacco Advertising n.d.a).

E. American Indian and Alaska Native populations

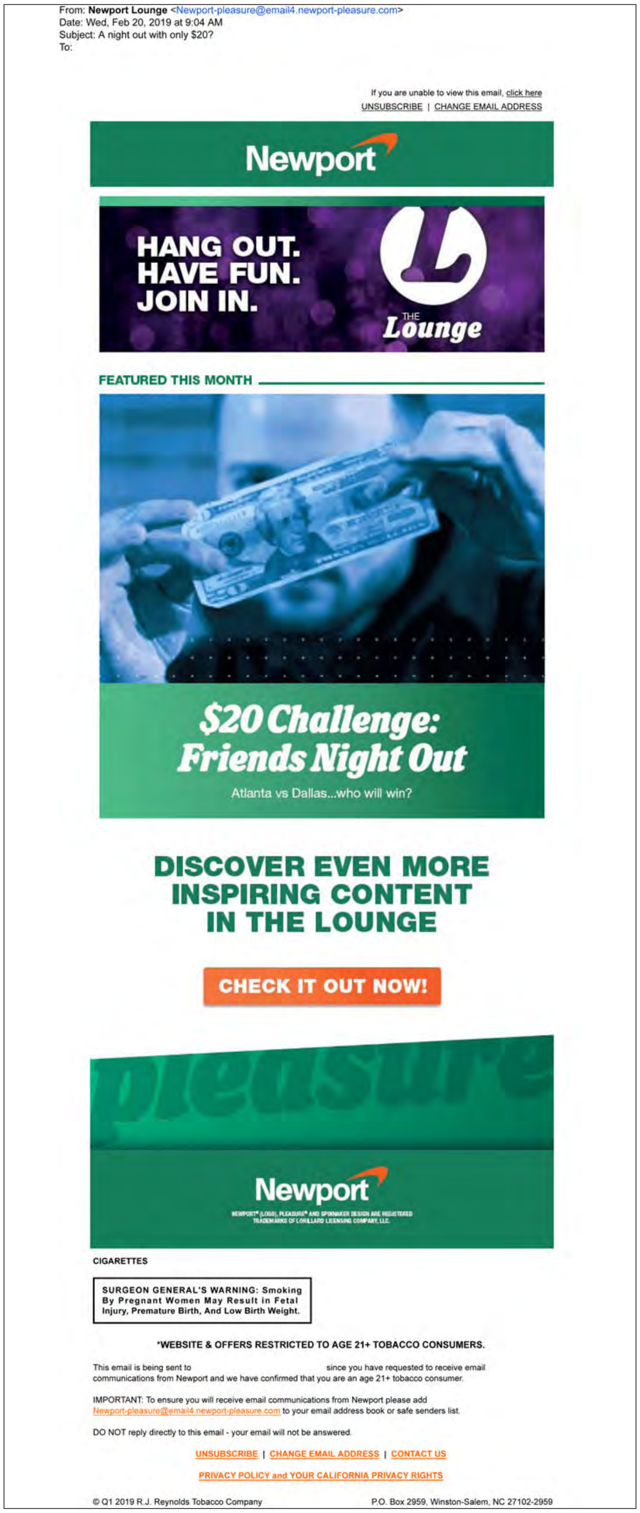
Source: Branding logo for nicotine-free IndianHead real Indian tobacco e-liquid; (Stanford Research into the Impact of Tobacco Advertising 2021).

Source: Promotional signage for Seneca Country tobacco products (Countertobacco.org n.d.).

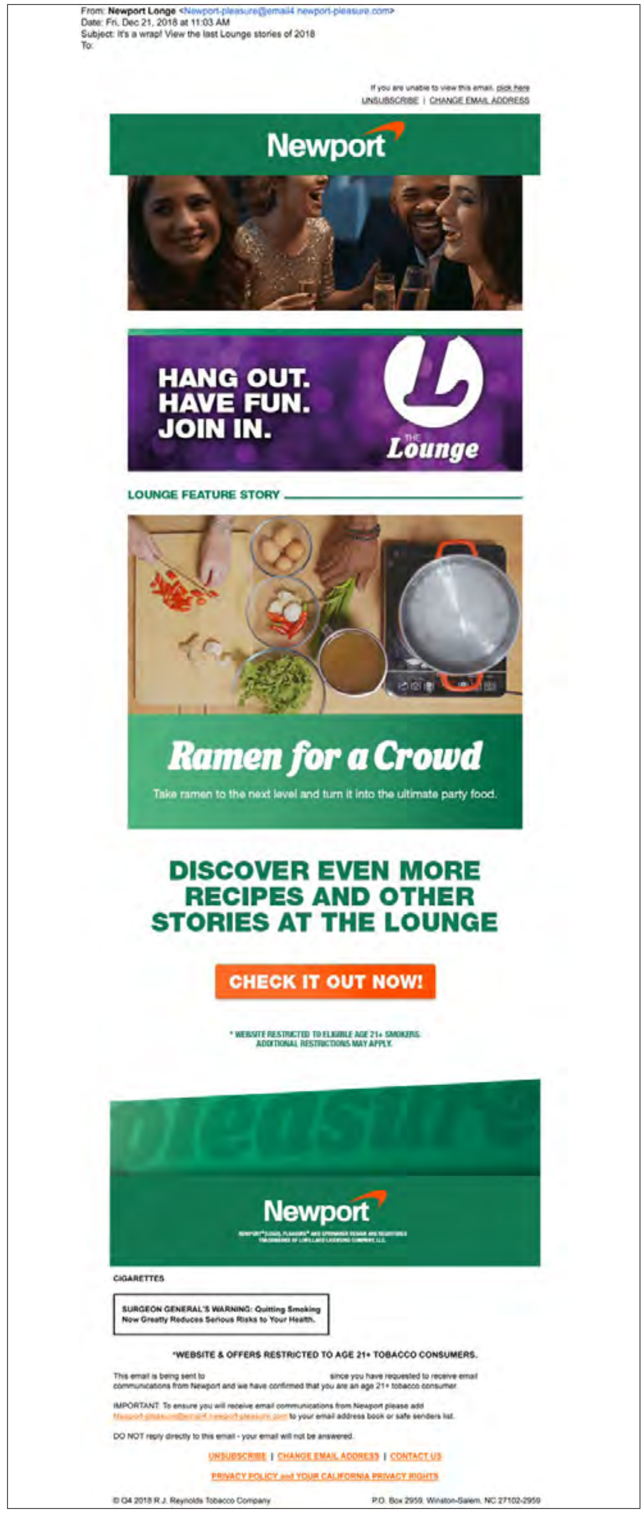
Source: Facebook advertisement from Kiyou Smoke Shop (n.d.) that promotes Signal brand tobacco products.

Source: Promotional web advertisement to attract online membership in Signal brand tobacco products (Signal n.d.).

F. Lower socioeconomic populations



Source: Email from February 2019 promoting The Lounge section of Newport brand's website, specifically a $20 friends-night-out challenge (Trinkets & Trash 2019a).

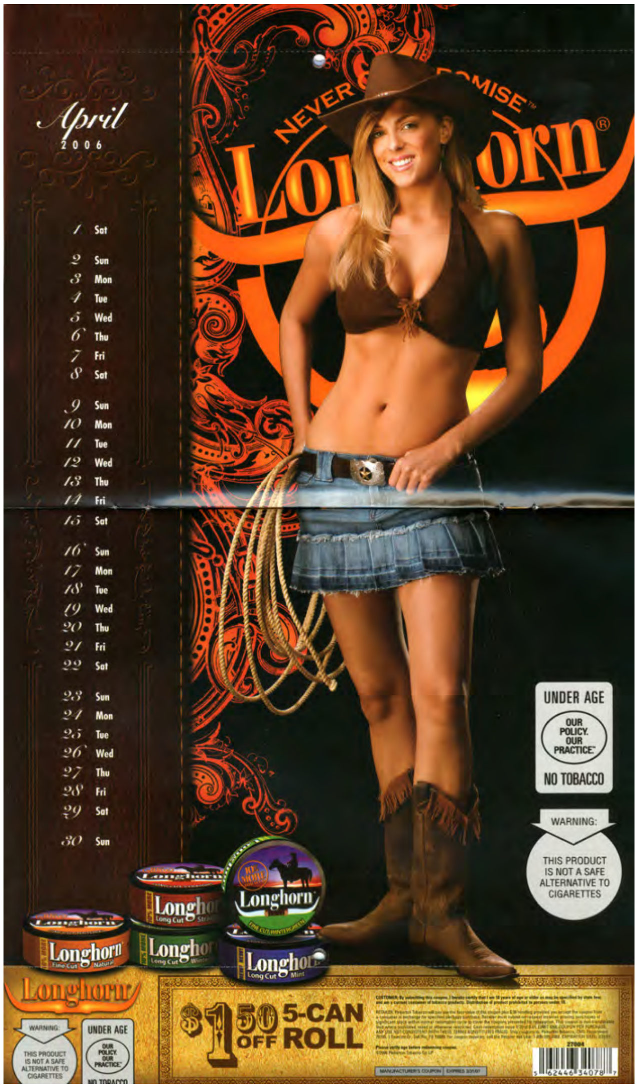


Source: Email from December 2018 holiday season promoting The Lounge, an online feature from Newport brand cigarettes in which consumers can get recipes and read about other stories (Trinkets & Trash 2018b).

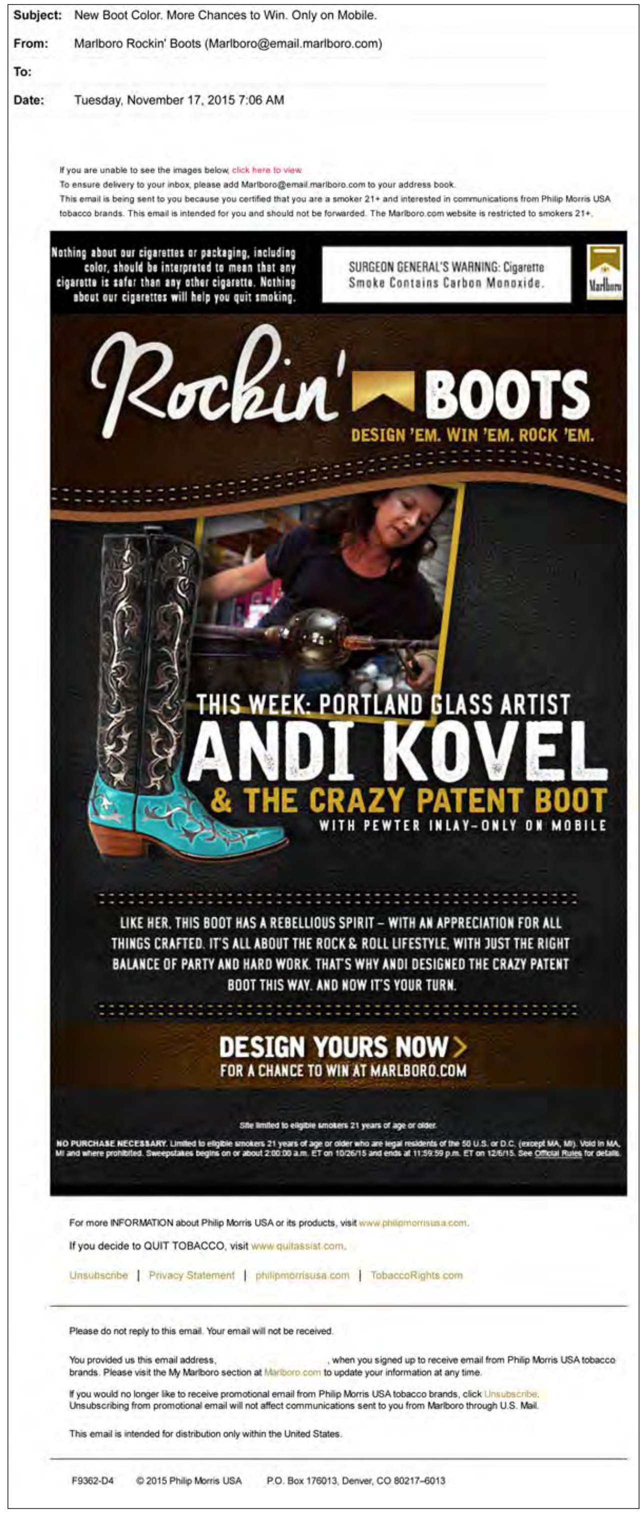
F. Continued

Source: Ad for blu brand e-cigarettes that included a parody of a warning label: "Important: Less harmful to your wallet." The ad ran in, for example, *ESPN Magazine* and *Rolling Stone* in 2017 as part of blu brand's Something Better series (Trinkets & Trash 2018a).

G. Rural populations

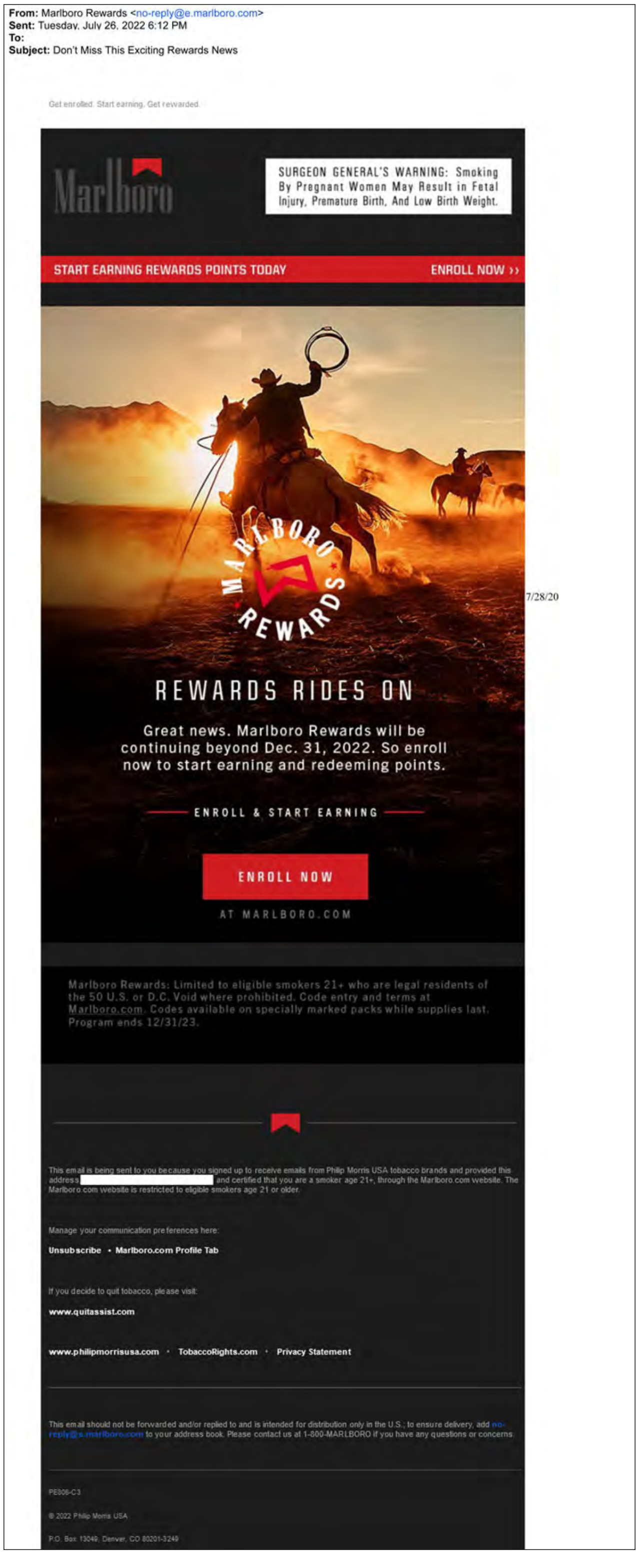


Source: Ad from 2006 that promotes Longhorn brand smokeless tobacco and doubles as a calendar for the month of April (Stanford Research into the Impact of Tobacco Advertising 2006).

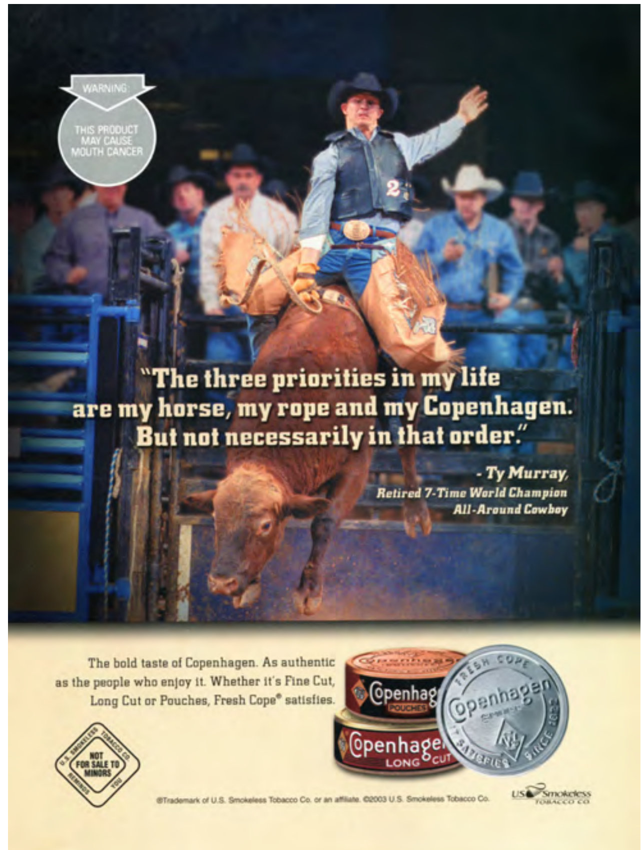


Source: Email from November 2015 that highlights Marlboro brand's Rockin' Boots contest for mobile phone users (Trinkets & Trash 2015).

G. Continued



Source: Email from 2022 about the continuation of reward points for consumers of Marlboro brand cigarettes (Trinkets & Trash 2022e).



Source: Ad from 2003 that contains a quotation from a rodeo star indicating that using Copenhagen brand smokeless tobacco is one of his three priorities in life (Stanford Research into the Impact of Tobacco Advertising 2003).

G. Continued

Source: Social media post from 2019 that promotes Swedish Match's ZYN brand nicotine pouches and an upcoming country music festival (Stanford Research into the Impact of Tobacco Advertising 2019).

Source: Direct mail from September 2018 about weekly mobile coupons for Red Seal brand smokeless tobacco, which is made by U.S. Smokeless Tobacco Company, a subsidiary of Altria. Text on the mailing celebrates American farmers: "We're proud to call the heartland home" (Trinkets & Trash 2018c).

H. Youth and young adult populations

Source: September 2019 cover of *Cigar Aficionado* magazine that shows a photo of celebrity actor and musician Nick Jonas. The issue also includes a feature story about Nick Jonas (Savona 2019; Storey 2019).

Source: Online advertisement from 2016 for college night at the Starbuzz Hookah Lounge in Riverside, California (Stanford Research into the Impact of Tobacco Advertising 2016b).

Source: Promotional signage at a vape shop in Lincoln, Nebraska, in 2022 announcing a double discount for students who bring friends to the store (Countertobacco.org 2022a).

I. Military and veterans and other occupational groups

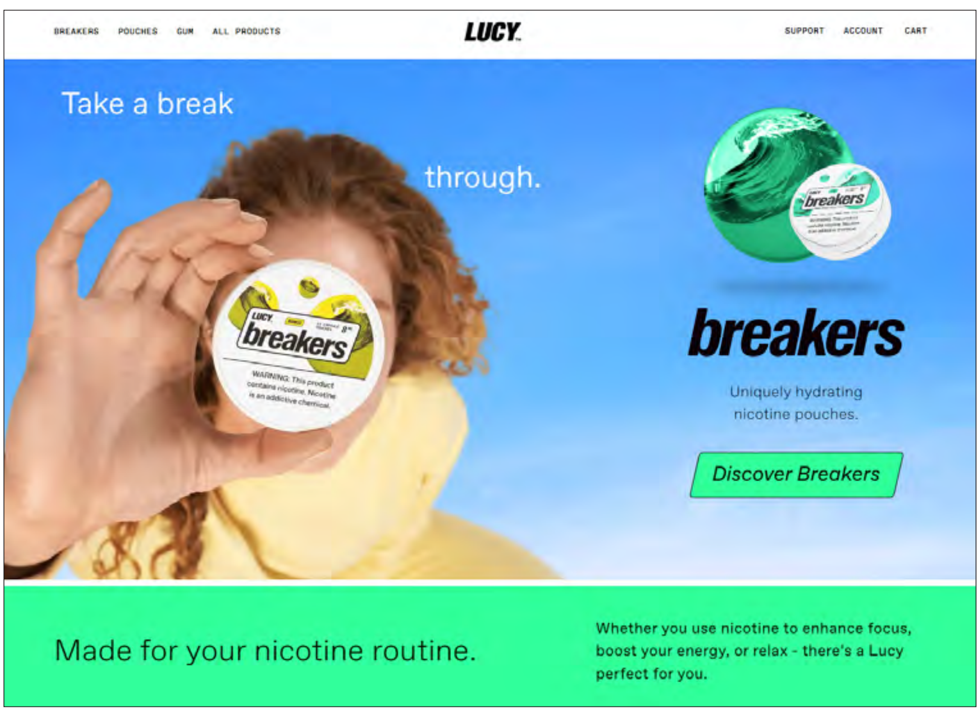
Source: Ad for Copenhagen brand smokeless tobacco from 2008 that shows two firefighters in action (Stanford Research into the Impact of Tobacco Advertising 2008).

Source: Ad—which appeared in, for example, *Car and Driver*, *Men's Journal*, and *Popular Mechanics* magazines in 2021—that announces Copenhagen brand smokeless tobacco's pledge to make donations to charity organizations that support veterans (Trinkets & Trash 2021a).

Source: Screenshot from 2021 about VUSE brand e-cigarette's initiative to donate $100,000 to disabled American veterans (Trinkets & Trash 2021b).

J. Behavioral health

Source: Pole signage outside a cigar retail store in Sarasota, Florida, in 2022 asking consumers to make a decision about spending $200 on therapy or $20 on "a good cigar" (Countertobacco.org 2022b).



Source: Online promotional content about Breakers brand nicotine pouches. The content suggests that by using Breakers, consumers can enhance their focus, boost their energy, and feel relaxed (Lucy n.d.).

were synthesized. Information from research articles was triangulated with data from outside sources exemplifying marketing practices (e.g., websites of nongovernmental organizations, published reports of industry practices and social media use, and news articles).

Influences of Tobacco Marketing on Tobacco-Related Health Disparities

The purpose of advertising is to increase the value of a brand. Previous reports have established a causal link between exposure to tobacco marketing and use of tobacco products (NCI 2008; Lovato et al. 2011; USDHHS 2012a, 2014). The 2012 Surgeon General's report concluded "that there is a causal relationship between advertising and promotional efforts of the tobacco companies and the initiation and progression of tobacco use among young people" (USDHHS 2012, p. 10). Advertising and health communication theories, as well as decades of tobacco control research, provide a strong rationale to expect that exposure to tobacco-related messages on social media will similarly influence tobacco-related attitudes, beliefs, and behaviors.

Theories of advertising are grounded in the premise that promotional messages will generate cognitive and affective responses in people before they buy a product (Lavidge and Steiner 1961; Fishbein and Ajzen 1975; Batra and Ray 1986; MacKenzie et al. 1986; Muehling 1987; Kempf and Smith 1998; Vakratsas and Ambler 1999). The premise underlying health communication theories is that changes in health behaviors can be achieved by providing people with information that shapes their beliefs and attitudes about those behaviors (Fishbein and Ajzen 1975; Ajzen and Fishbein 1980; Bandura 1986; Noar 2005). Characteristics of the message, the source of the message, the person exposed to the message, and the environment in which the exposure occurs can all affect its salience, the cognitive and affective response, and the subsequent behavior (Emery et al. 2012; Albarracin et al. 2014; Tannenbaum et al. 2015; Pierce et al. 2017). Protobacco advertising and promotion is associated with more positive tobacco-related attitudes and beliefs and higher rates of tobacco use, and antitobacco advertising and advertising bans are associated with denormalization of tobacco use and reductions in that behavior (Hamilton 1972; Warner 1977; Hu et al. 1995; Kozlowski et al. 2000; Saffer and Chaloupka 2000; NCI and WHO 2016).

Targeted marketing contributes to tobacco use disparities among disparate populations (Yerger and Malone 2002; Gardiner 2004; Sutton and Robinson 2004; Yerger et al. 2007; USDHHS 2012b, 2014). Targeted promotion may make messages more effective by enhancing their cultural appropriateness, relevance, and reach. For example, menthol cigarette brands have targeted African American people by featuring hip-hop culture, music, and movies in their marketing materials (Hafez and Ling 2006). Liking hip-hop music and self-identifying as a peer among the hip-hop generation have been associated with risk of tobacco use among youth (Mulder et al. 2009, 2010; Lisha et al. 2016; Harakeh and Bogt 2018; Walker et al. 2018). Hip-hop has cultural roots in both Black or African American and Hispanic or Latino communities (Chang 2005). Although the full extent of the tobacco industry's sponsorship of hip-hop music and support of its subculture is not completely clear, the tobacco industry is known to sponsor a variety of cultural events using a hip-hop theme, such as the *Kool Mixx* promotional campaign launched by Brown & Williamson in 2004 (Pickett 1998; U.S. Marketing & Promotions 1998; Hafez and Ling 2006).

By race, among adults who currently smoke, menthol cigarette use is more prevalent among African American people than among people in other groups (Villanti et al. 2016). Additionally, among adults who smoke, Newport is the most popular brand of menthol cigarettes, and more than half of people who smoke Newport menthol cigarettes are African American (Cohn et al. 2019). In a study of a California city, African American adolescents were found to be more likely than youth from other racial and ethnic groups to recognize Newport, and recognition of the Newport brand has been associated with increased smoking initiation (Dauphinee et al. 2013). The 1998 Master Settlement Agreement restricts the use of such targeted promotions for cigarettes but not for other products in some media channels for marketing, including brand name sponsorship of events such as music concerts. Brand-sponsored events continue to be used to promote other tobacco products, including cigars (Ganz et al. 2018).

In this vein, the marketing of noncigarette tobacco products—such as cigars, cigarillos, and/or smokeless tobacco—is designed to appeal to specific groups, including youth (Kostygina et al. 2016a), people who identify as LGBTQ+, and Hispanic and African American people (Hendlin et al. 2023). Notably, the strategies used to promote these products parallel those used in the past to promote conventional cigarettes.

According to communication inequality theory, population-level disparities in health outcomes may be caused, in part, by inequalities in communication, which result, for example, from such technologies as the Internet being used relatively more often by people with higher incomes and higher levels of educational attainment, by youth and young adults, and by people who are employed than by their respective counterparts (Viswanath and

Kreuter 2007; Pew Research Center 2021a). Although this technology gap has declined, with 93% of U.S. adults reporting Internet use in 2021, disparities persist based on age, income, and education. For example, almost all (>99%) young adults, college graduates, and people with incomes over $75,000 use the Internet; however, this figure drops to 75% for people 65 years of age and older and to 86% for people with high school or less education or those with incomes of less than $30,000 (Pew Research Center 2021a). "Communication inequality is defined as the differences among social groups in their ability to generate, disseminate, and use information at the macro level and to access, process, and act on information at the individual level" (Viswanath 2006, p. 222). People living in resource-poor areas, geographically remote areas, or areas with little or no Internet access could be underexposed to positive health messages, such as digital tobacco countermarketing campaigns, and overexposed to negative health messages, such as tobacco marketing, in nondigital media channels. Negative health messages may have a direct effect on health behavior by encouraging tobacco product use, and they may also overwhelm any positive health messages. Messages from tobacco prevention and control programs must compete with a myriad of tobacco marketing materials that a person encounters over the life course.

Disparities in the quantity and quality of health communication experienced by people in certain socioeconomic and racial and ethnic groups may be partially responsible for some tobacco-related health disparities seen in these groups. Research has documented inequalities in health communication and illustrated the contributions of these inequalities to health disparities. For example, Ishikawa and colleagues (2016) conducted a path analysis of data from the nationally representative Annenberg National Health Communication Survey to assess the direct and indirect effects of the relationship between SES indicators (measured by education attainment and household income) and an index of four health behaviors, including tobacco smoking. Results showed evidence of mediation via indirect effects by inequalities in use of health media (e.g., frequency of viewing or reading health sections on TV, in print, and on the Internet) and disparities in social participation (that do and do not lead to differential media use), suggesting that socioeconomic disparities in the use of health media partially explain disparities in health behaviors (Ishikawa et al. 2016).

In the context of tobacco marketing, several well-documented disparities in exposure are consistent with the broader literature on inequalities in communication. For example, an analysis of PATH Study data by Moran and colleagues (2019b) found that among youth who never used tobacco, African American youth and youth of lower SES (defined as youth whose parents have less than a college degree) were more likely to recall having seen ads for cigarettes and non-large cigars and to report being exposed to tobacco-related coupons than their non-Hispanic White and Hispanic counterparts and youth whose parents had a college degree or higher, which was used in the study as a proxy for higher SES. In addition, African American youth were more likely than non-Hispanic White and Hispanic youth to indicate that they "used [e-cigarettes] because the advertising appeals to me" (Moran et al. 2019b, p. 286). Students of lower SES were more likely than students of higher SES to report using e-cigarettes and non-large cigars "because people in the media or other public figures use them" (Moran et al. 2019b, p. 286). A national study found, in unadjusted analyses, that non-Hispanic Black adults were more likely than non-Hispanic White adults and non-Hispanic adults of other races (American Indian, Alaska Native, and multiple races) to trust information about the health effects of using tobacco from tobacco companies; however, this finding was no longer statistically significant in adjusted analyses (Nguyen et al. 2017). Soneji and colleagues (2014) examined a national sample of youth and young adults (15–23 years of age) and found that nonsmoking Hispanic and non-Hispanic Black respondents were more likely to report exposure to tobacco company websites than were non-Hispanic White respondents and that exposure to such marketing was associated with smoking during the past 30 days and with established smoking. However, the study did not find an interaction between marketing exposure and tobacco use by race and ethnicity. Among young adults, Lienemann and colleagues (2019) also found that the relationship between liking a tobacco advertisement and using cigarettes and cigars was stronger among those with lower levels of educational attainment than among those with higher levels of educational attainment, and the relationship between liking ads and using e-cigarettes and smokeless tobacco was stronger among those living below the federal poverty limit compared with those living above poverty. Tan and colleagues (2021) further found that bisexual young adult women had greater aided recall of e-cigarette, cigarette, and cigar ads compared with heterosexual or lesbian/gay young adult women. Ad recall was even greater for bisexual Hispanic women. Heterosexual and bisexual Black women and heterosexual Black men also had higher aided recall of certain types of tobacco product ads compared with their White heterosexual counterparts. Such analyses are becoming more common and have the benefit of teasing apart the differential effects of exposure to tobacco marketing by disparity categories and the potential differential impact of exposure to marketing on tobacco use outcomes.

Marketing Tobacco Products on Social and Digital Media

The media environment is rapidly changing. Using social and digital online media to market their products has become a prominent marketing strategy for tobacco companies. Such marketing is not subject to the same restrictions that curbed marketing on traditional media, such as (a) the so-called "Broadcast Ban," which was enacted in the *Public Health Cigarette Smoking Act* of 1969 (1970) and banned cigarette advertising on television and radio; and (b) the *Comprehensive Smokeless Tobacco Health Education Act of 1986* (1986), which banned advertising for cigarettes and smokeless tobacco on "any medium of electronic communication subject to the jurisdiction of the Federal Communications Commission" (Ernster 1989; Centers for Disease Control and Prevention [CDC] n.d.a).

In addition, the Master Settlement Agreement banned cigarette advertising on billboards and also restricted other cigarette marketing, such as using brand names to sponsor events (Public Health Law Center n.d.b). However, the Federal Communications Commission has not sought to regulate the Internet (Campaign for Tobacco-Free Kids 2021). Additionally, advertising for tobacco products on social and digital media is subject to the same mandatory health warnings as it is in other media channels, but such advertising has not been subjected to the Broadcast Ban that prohibits cigarette and smokeless tobacco advertisements on radio and television (Campaign for Tobacco-Free Kids 2021).

Digital and social media marketing strategies may have an additional impact because they are interactive in ways that traditional media are not. The following sections review the literature on trends in social and digital online media marketing overall and potential differences in marketing that may influence tobacco-related health disparities. This section extends the discussion of social media and digital media strategies beyond what was in the 2016 Surgeon General's report on e-cigarette use among youth and young adults (USDHHS 2016).

Although the prevalence of smoking and sales of cigarettes in the United States have declined since the 1998 Surgeon General's Report focused on disparities, decreases in the sale of cigarettes have been partially offset by increases in the sale of other tobacco products, including e-cigarettes and cigarillos (Ali et al. 2020, 2022; Wang et al. 2022). In addition, there are now substantial disparities in the use of other types of tobacco products by race, ethnicity, sex, sexual orientation, and gender identity (Emory et al. 2019; Gentzke et al. 2022). In fact, the prevalence of e-cigarette use among youth and young adults exceeds use of combustible cigarettes (see Chapter 2). Youth are exposed to e-cigarette advertising across diverse channels, including social and digital media, and this exposure is associated with lower harm perceptions of e-cigarettes, greater intention to use e-cigarettes, and experimentation with e-cigarettes (Collins et al. 2019).

Social Media Marketing

Extensive literature supports the idea that a person's social interactions and media environment exert significant influences on their tobacco use behaviors (see Chapter 4) (NCI 2008; USDHHS 2012b). However, the ways in which a person interacts socially and the media landscape itself have changed during the past decade. Indeed, digital and social media have become part of everyday life, especially for teenagers: 95% of teenagers reported using at least one social media platform in 2022, most commonly YouTube (95%) followed by TikTok (67%) (Vogels et al. 2022). By 2016, 98%, or almost all, young adults reported regular use of at least one social media site (Villanti et al. 2017). African American and Hispanic adults also use certain social media platforms—such as YouTube, Facebook, Instagram, TikTok, and WhatsApp—at rates higher than such use by White adults (Auxier and Anderson 2021). The nearly ubiquitous use of social media among adolescents (Anderson and Jiang 2018; Vogels et al. 2022) plays a significant role in their daily lives, development, and identity formation (Hur and Gupta 2013; Michikyan and Suárez-Orozco 2016). However, as described in the 2023 Surgeon General's Advisory, *Social Media and Youth Mental Health,* inappropriate or harmful content is widely available to youth on social media, and youth who spend more time on social media increase their risk of experiencing poor mental health, including symptoms of depression and anxiety (USDHHS 2023).

In this new media environment, people are targeted by customized information algorithms, and they also curate their own media content. The combined effect of targeted promotions and curated content can create "echo chambers" in which youth and adults consume only the information that supports their worldviews (Slater 2007; Bessi et al. 2015). In this scenario, antitobacco public health media campaigns compete with promotional product marketing campaigns in the social media environment, potentially resulting in confusion and misinformation for the audience.

Additionally, use of social media by youth may differ by sociodemographic factors. Although social media use is fairly ubiquitous across racial and ethnic groups, some differences have emerged in the prevalence of use and in the frequency with which diverse groups access the Internet, which may contribute to disparities in access to digital content. For example, in 2022, Black (56%) and Hispanic (55%) teens were more likely than White (37%) teens to say they are online "almost constantly" (Vogels et al. 2022). Additionally, although access to smartphones is universally high, only 79% of teens who live in households making less than $30,000 say that they have access to a desktop or laptop computer compared with 94% of teens who live in households with income levels of $75,000 or more (Vogels et al. 2022).

Social media use differs substantially by SES. For example, social media use increases with years of education; in 2021, 77% of college graduates used social media but only 64% of people with a high school education or less used it (Pew Research Center 2021b). Additionally, promotional content and marketing are tailored to different populations, an approach known as narrowcasting (Cappella et al. 2015). Although trailing urban and suburban populations, populations in rural areas are increasingly online and on social media, increasing from about 40% in 2010 to 66% in 2021 (Pew Research Center 2021b). Digital and social media channels allow advertisers to quickly access hard-to-reach communities and share targeted messages and promotions with them, creating an environment in which information often extends beyond the reach of traditional media sources.

The tobacco industry has adapted its marketing to the shifting media landscape and is leveraging the new media environment to promote newer tobacco products (CDC 2016; O'Brien et al. 2020; American Lung Association n.d.) while also making combustible tobacco products more appealing, such as by using social media influencers from the United States and other countries to glamorize smoking (Kaplan 2018). Because of limited regulatory oversight, tobacco manufacturers and vendors are able to promote their products through increasingly diverse media channels, including social media (Freeman 2012; Liang et al. 2015). Social media provides an important platform to market tobacco products and engage consumers. Tobacco brands and retail outlets use social media to advertise a broad range of products and devices; update marketing strategies used in previous decades (USDHHS 2016); and recruit celebrities, musicians, and models to endorse their products (Kostygina et al. 2016b; USDHHS 2016).

Early research suggests that content on social media about e-cigarettes, menthol cigarettes, little cigars, and cigarillos is highly prevalent (Huang et al. 2014, 2016; Kostygina et al. 2016b; Rose et al. 2017). For example, estimates of the number of views of e-cigarette-related videos on YouTube exceeded 100 million by June 2013 (Huang et al. 2016). The types of e-cigarette-related social media messages have since grown (Huang et al. 2019; Xie et al. 2021; Sun et al. 2023). In addition to widespread promotion of e-cigarette-related content on YouTube (Huang et al. 2016, 2019; Xie et al. 2021), Twitter (Huang et al. 2014, 2019), Instagram (Czaplicki et al. 2019; Huang et al. 2019; Chu et al. 2021), and TikTok (Tan and Weinreich 2021; Marynak et al. 2022; Sun et al. 2023), Barker and Rohde (2019) found that e-cigarette-related content on Reddit consists primarily of messages about methods of buying and selling e-cigarette products.

From 2014 to 2015, the number of tweets about little cigars and cigarillos exceeded that of e-cigarettes. Using keyword filters, Kostygina and colleagues (2016b) captured over 4.3 million tweets related to little cigars and cigarillos, of which approximately 83% contained references to cannabis (e.g., for blunt use). This is more than twice as many tweets related to little cigars and cigarillos over a 3-month period than the number of posts about e-cigarettes captured over a 5-year time frame (1.7 million, 2008–2013) found by Kim and colleagues (2015).

Additionally, Kim and colleagues (2021) reported that the total amount of tweets about JUUL increased 67 times, from nearly 19,000 in the first quarter of 2017 to more than 1.2 million in the last quarter of 2018. During this period, JUUL became the most popular brand of e-cigarettes in the United States (Kim et al. 2021). In a different study, the most common type (20%) of Twitter post abouts JUUL used person tagging (@username), suggesting that Twitter users were sharing information about specific products (Allem et al. 2018). Similarly, posts related to the use of hookah are prominent on social media and largely reflect positive (60%) sentiment (Allem et al. 2017b).

A modest but growing body of literature suggests that teenagers frequently observe tobacco-related messages on social media. By 2015, 40% of youth (13–17 years of age) and 57% of young adults (18–21 years of age) in the United States indicated they saw e-cigarette advertising online always, most, or some of the time (Truth Initiative 2015). In a study of college students in Hawaiʻi conducted between November 2016 and January 2017, exposure on social media to content about e-cigarettes was associated with current e-cigarette use (Pokhrel et al. 2018). Additionally, a study of middle and high school students in rural Tennessee found that e-cigarette use was associated with exposure to tobacco marketing on social media and overall high exposure to tobacco marketing (Peiper et al. 2020). Another study showed that greater social media use and heavier exposure to advertisements of e-cigarette content in social media posts were associated with a greater risk for e-cigarette use among adolescents 13–18 years of age (Vogel et al. 2021).

Coreas and colleagues (2021) found that, among adolescents 12–17 years of age in the PATH Study, those who reported having seen tobacco product-related content posted on social media at any wave of the study (2013–2018) were more likely to experimentally smoke by Wave 4 (2018) compared with those who did not report having seen any tobacco product-related content posted on social media. Furthermore, Shan and Azagba (2022) found that, among adolescents in the PATH Study, the odds of cigarette and e-cigarette initiation among those who follow or like tobacco brands on social media was more than two times the odds of initiation for those who do not follow or like tobacco brands on social media. No studies were identified that examined whether the relationship between social media marketing exposures and tobacco use outcomes varied by race and ethnicity.

Research indicates that populations experiencing tobacco-related health disparities continue to be disproportionately targeted by marketing from the tobacco industry (Primack et al. 2007; Dilley et al. 2008; Cantrell et al. 2013; Brown-Johnson et al. 2014; Lee et al. 2015c; Cruz et al. 2019b; Lempert and Glantz 2019). Since some disparate groups may also use specific social media platforms at relatively higher rates than their counterparts (Auxier and Anderson 2021), the effects of targeted marketing through social media may be even more potent. For example, Emery and colleagues (2014) analyzed data from a nationally representative, cross-sectional online survey of U.S. adults to assess the media diet of lesbian, gay, and bisexual (LGB) and non-LGB people. The analysis showed that LGB people had higher odds of sharing content related to e-cigarettes through social media than non-LGB people ($p < 0.05$). In another study, LGBT adults were exposed more often to tobacco-related media than were non-LGBT adults, and the effect was strongest among people who smoke and are LGBT (Emory et al. 2019). Similarly, African American adults may be more likely than non-Hispanic White people to observe links to social media sites that offer content about tobacco products (e.g., product characteristics and branding information) (Escobedo et al. 2020b). Additionally, in a study of adolescents from Connecticut who were followed from 2013 to 2014, exposure to e-cigarette marketing through Facebook—but not other social media platforms (Twitter, YouTube, Pinterest, or GooglePlus)—was associated with subsequent e-cigarette use after adjusting for age, race, gender, and cigarette smoking status at baseline (Camenga et al. 2018).

In summary, the limited evidence on relationships between social media use, exposure to tobacco-related content on social media, and tobacco product use by demographic characteristics is only beginning to be investigated. Although use of social media and exposure to tobacco marketing through such online media may differ between disparate groups, more work is needed to identify whether such exposures contribute differently to disparities in various tobacco use outcomes by race and ethnicity, sexual orientation and gender identity, or other sociodemographic factors. Additionally, more studies should examine intersectional identities (e.g., race and ethnicity and SES) using interaction terms or stratified models to examine how targeted tobacco marketing may influence tobacco-related disparities among populations with multiple marginalized identities.

Influencer Marketing and Sponsored Marketing

The changing media environment has resulted in seismic shifts in advertising strategies. The proliferation of ad blockers on computers and mobile devices has reduced website click rates to only 6% for display ads (Knowledge@Wharton 2017). As a result, a phenomenon called *influencer marketing* is increasingly common (Knowledge@Wharton 2017). Influencers are celebrities or “micro-celebrities” who use and have a high number of followers on social media—either in general or among a targeted population group (Carter 2016). The ubiquity of mobile devices has turned influencers into constant companions of the target audience; in 2022, 83% of more than 3,500 marketing and communications professionals viewed influencer marketing as effective (Geyser 2023). Marketers use Instagram, TikTok, Facebook, and other social media platforms to foster product engagement and to acquire brand ambassadors (i.e., influencers who are paid to endorse brands or promote products). According to the aforementioned survey of marketers, nearly 75% of brands track sales from influencer campaigns, with 55.5% of brands using TikTok, 50.8% using Instagram, 42.1% using Facebook, and 38.3% using YouTube as their network of choice for influencer marketing campaigns globally. Instagram’s engagement rates range from 0.95% per follower for macro-influencer or celebrity accounts with over 100,000 followers to 4.2% for micro-influencer accounts with fewer than 5,000 followers. TikTok’s largest macro-influencer accounts with over 1 million followers average 10.3% engagement, and small accounts with 1,000–5,000 followers garner 15.0% engagement (Geyser 2023).

“Brand communities” (i.e., online social groups that are engaged in a product beyond just use) established on social media enhance customer–product and customer–brand engagement, as well as customer–company and customer–customer relationships (Laroche et al. 2013). The plethora of influencer marketplaces (e.g., Famebit.com) enables marketers to find social media celebrities and influencers whose followers are the target population for the brand (Knowledge@Wharton 2017).

In brief, influencer marketing offers tailored or targeted exposure to potential consumers who are susceptible to or already interested in the product category in which the brand operates, and as a result, consumers will likely pay attention (Brown and Hayes 2008). Additionally, influencer marketing can be used to target specific communities, including the Black or African American community, with tobacco messages. For instance, in a study examining tweets about little cigars and cigarillos from October 2014 to April 2015, Kostygina and colleagues (2016b) found that 17% of account users (representing 318,893 accounts) posting about little cigars and cigarillos were influencers. Influencers were often hip-hop artists or those with Twitter accounts that were tied to the rap music community.

In addition to influencer marketing, sponsored content and native advertising have emerged as new ways to reach targeted audiences to generate interest in products (Wojdynski and Evans 2015; Escobedo et al. 2020b). Wojdynski and Evans (2015, p. 157) use the terms *sponsored content* and *native advertising* interchangeably to describe "any paid advertising that takes the specific form and appearance of editorial content from the publisher itself." This includes advertorials (paid advertising content in the format of an editorial or objective news article), editorial content, brand journalism and blogs, and incentivized user- or consumer-generated product reviews and social media posts or location check-ins. Another example of sponsored content is the posting of selfies featuring a product or using a backdrop with product branding, often without explicit acknowledgment of the presence of the promotional content or disclosure of brand sponsorship. For example, an analysis of smoking imagery from Instagram, a photo-sharing social media platform, used tobacco- and e-cigarette-related text tags to identify more than 2 million relevant image posts. Content analysis of a sample of 8,000 of these image posts found that "smoking selfies" were the dominant image type. Such user-generated content was most often created by college-aged individuals and women, with most appearing to depict individuals of White race (Cortese et al. 2018). Although these posts were not explicitly tagged as advertising content, 40% of the posts included brand names or logos. Another study of Instagram posts with the hashtag vaping (#vaping) collected more than 500,000 images in a 5-month period in 2019 and found that images portraying people had the most engagement in the form of likes and comments and were more commonly posted by personal rather than business users (Ketonen and Malik 2020). Because new and emerging marketing strategies aim to leverage consumer-generated content, it has been challenging for researchers to clearly differentiate enthusiastic consumer-generated messages or opinions from sponsored content. As a result, few studies to date have measured the amount or impact of tobacco advertising and marketing content versus content posted from individual accounts (Huang et al. 2014). Thus, sponsored content and native advertising raise novel regulatory concerns and surveillance challenges for tobacco control researchers and programs that monitor tobacco industry practices concerning the marketing and promotion of cigarette and noncigarette tobacco products.

Digital Marketing

Beyond social media platforms, digital marketing has also been found to be widespread and associated with youth tobacco use. The 2021 NYTS documented that 43.9% of youth overall reported exposure to tobacco marketing through the Internet, with non-Hispanic Black youth reporting higher average levels (49.2%) of exposure to such marketing (Gentzke et al. 2022). In the 2014 NYTS, in adjusted analyses, exposure to e-cigarette ads at high or medium levels over the Internet showed a dose-response relationship with higher odds of current e-cigarette use (Dai and Hao 2016). Several studies using data from the PATH Study have found that engagement of youth with online tobacco marketing (e.g., watching videos about tobacco products online, signing up for e-mail alerts, playing online games) is associated with a higher incidence of initiating tobacco use (Soneji et al. 2017, 2018; Choi et al. 2020), increased frequency of tobacco use (Soneji et al. 2018), progression to using multiple tobacco products (Soneji et al. 2018), and a lower incidence of tobacco cessation (Soneji et al. 2018). Online engagement with tobacco marketing at baseline was also associated with higher odds of past-30-day use of cigarettes, e-cigarettes, cigars, smokeless tobacco, and hookah 1 year later (Choi et al. 2020). In another analysis of 2013–2014 (Wave 1) and 2014–2015 (Wave 2) data from the PATH Study, Soneji and colleagues (2019b) found that the percentage of youth who had engaged in at least one form of online tobacco marketing had increased from 8.7% to 20.9%. Notably, engagement with online tobacco marketing has been associated with increased (a) susceptibility to smoking (a measure of the likelihood of initiating smoking) (Pierce et al. 1995) and experimentation (Pierce et al. 1998; Soneji et al. 2017) among people who had never used tobacco and (b) probability of established smoking (Choi et al. 2001) or e-cigarette use (Clendennen et al. 2020) in the future.

Online banner and video ads have emerged as a digital alternative to print ads, usually appearing in news and entertainment publications. In an analysis of all online banner and video advertisements in the United States and Canada for tobacco products during a 1-year period in 2012–2013, two studies found that online banner and video advertising was a tactic used mainly to advertise e-cigarettes and cigars rather than conventional cigarettes, with some of this advertising offering unproven claims about benefits to health (Richardson and Vallone 2014; Richardson et al. 2015b). Later, Padon and colleagues (2017) analyzed a sample of video ads for e-cigarettes that were available as of August 2016. All of the ads in this study contained some content that was appealing to youth, with frequent emotional messages, including associating vaping with happiness, sex, and success. More than half of the video ads featured animation. Most of the ads (88%) appealed to the value of e-cigarettes over cigarettes, and 44% of the ads mentioned health (Padon et al. 2017).

In August 2016, the deeming rule effectively prohibited marketing of e-cigarettes with unsubstantiated modified risk claims (*Federal Register* 2016). In a content analysis of retail websites for e-cigarettes conducted in 2011–2012 (before the adoption of the deeming rule in 2016), Grana and Ling (2014) revealed that health claims and messages about smoking cessation that were unsupported by scientific evidence were frequently used to promote and sell e-cigarettes. A longitudinal study examining 288 websites for retailers of e-cigarettes before (2013–2014) and after (2016–2017) finalization of the deeming rule found that, although the marketing of products with claims such as "healthier than smoking" significantly declined during this period, more than half (52.4%) of e-cigarette retailer websites contained a health claim in the later period (Hsu et al. 2018). Additionally, no reduction was seen in the use of direct cessation claims (i.e., that e-cigarettes can help people quit smoking); these claims were present on 10.1% of websites in 2013–2014 and on 11.1% of websites in 2016–2017 (Hsu et al. 2018). Additionally, in a systematic review of literature about e-cigarette marketing communication messages by channel published between 2003 and 2019, cessation and health-related benefits were the most commonly reported marketing communication messages (each cited in 31 out of 41 studies included in the review; 75.6%) (Lyu et al. 2022). During summer 2020, Swisher International and John Middleton, a subsidiary of Altria, which makes Swisher Sweets and Black & Mild cigarillos, deployed the "#blacklivesmatter" hashtag and other racial-equity messaging in social media marketing (Heley et al. 2023).

Product price promotions are also prevalent on websites of retailers. For example, one study of online e-cigarette retailers found that more than half of the websites offered promotions or discount coupon codes at checkout, 23% offered loyalty or reward programs, and 11% offered discounts for new customer referrals (Mackey et al. 2015).

The relationships between e-cigarette advertising and e-cigarette use and cigarette advertising and cigarette use in both the online and traditional advertising environments are similar for both U.S. adults and adolescents. Agaku and colleagues (2017), who conducted a longitudinal study of the relationship between receptivity to e-cigarette advertisements and e-cigarette use among a sample of U.S. adults who did not use cigarettes or e-cigarettes at baseline, found that receptivity to e-cigarette advertisements at baseline was associated with greater odds of e-cigarette use at follow-up. Among U.S. middle and high school students participating in the 2014 NYTS, exposure to e-cigarette marketing on the Internet, in print, at retail stores, in movies, or on TV increased the likelihood of ever use of e-cigarettes, current use of e-cigarettes, and susceptibility to use e-cigarettes (Mantey et al. 2016). Further, as the number of channels of exposure to e-cigarette marketing increased, the likelihood of use and susceptibility also increased (Mantey et al. 2016). Another study of the 2014 NYTS also found that exposure to e-cigarette marketing via the Internet was associated with increased odds of perceiving e-cigarettes to be less harmful and less addictive than cigarettes, perceived likelihood of trying an e-cigarette soon, and e-cigarette use (Pu and Zhang 2017). Cruz and colleagues (2019a) found that California adolescents who never smoked but were exposed frequently to cigarette ads through the Internet or in stores were more likely to initiate cigarette smoking 16 months later, and those who had never smoked hookah but were exposed to hookah marketing in stores were more likely to initiate hookah use. Similarly, adolescents who never used e-cigarettes but were exposed to e-cigarette ads on the Internet, outdoors, or through stores were more likely to initiate e-cigarette use (Cruz et al. 2019a). Importantly, researchers have argued that marketing materials for e-cigarettes should not include implied and overt health claims, the presence of doctors on websites, celebrity endorsements, or the use of characterizing flavors (Grana and Ling 2014). However, this study predated the deeming rule in 2016,[1] which extended FDA's authority to all categories of products that met the statutory definition of a tobacco product, meaning "any product made or derived from tobacco that is intended for human consumption, including any component, part, or accessory of a tobacco product . . ." (*Federal Register* 2016, p. 28976). Importantly, marketing such tobacco products with unsubstantiated health claims is prohibited by federal law and may be subject to FDA enforcement under the *Federal Food, Drug & Cosmetic Act* (*Federal Register* 2016).

Beyond these overall associations between advertising and tobacco use, researchers are beginning to examine how differences in exposure to online tobacco advertising may contribute to tobacco-related health disparities. Among adolescents 14–17 years of age in the 2014–2015 PATH Study, engagement with online tobacco marketing in the past year was higher for female LGB youth (37.2%), male LGB youth (30.5%), and transgender youth (35.1%) compared with straight female (22.9%)

[1]The *Consolidated Appropriations Act of 2022* (2022), enacted on March 15, 2022, amended the definition of the term tobacco product in section 201(rr) of the *Federal Food, Drug & Cosmetic Act* to include products that contain nicotine from any source.

or straight male (21.3%) youth (Soneji et al. 2019a). Additionally, Hispanic and non-Hispanic Black youth had higher odds of engaging with online tobacco marketing compared with non-Hispanic White youth (adjusted odds ratio [aOR] = 1.31 and aOR = 1.42, respectively). In the 2015 NYTS, Papaleontiou and colleagues (2020) found few differences in youth exposure to tobacco advertisements or promotions overall by race and ethnicity. However, the prevalence of exposure to advertising for conventional tobacco products via the Internet was higher among non-Hispanic Black youth (20.4%) than among Hispanic (15.3%), non-Hispanic White (13.3%), and non-Hispanic Asian (8.9%) youth; confidence intervals overlapped between non-Hispanic Black youth and youth of other or multiple races (17.6%). For e-cigarette advertising and promotions via the Internet, youth of other or multiple races reported higher exposure (16.5%) than non-Hispanic White (10.9%) and non-Hispanic Asian (6.1%) youth; confidence intervals overlapped for youth of other or multiple races, non-Hispanic Black youth (14.6%), and Hispanic youth (13.1%) (Papaleontiou et al. 2020). Carroll and colleagues (2020) found that American Indian and Alaska Native and Non-Hispanic Black adults reported higher exposure to e-mail marketing for tobacco products than did non-Hispanic White adults; non-Hispanic Asian adults reported lower exposure than that reported by non-Hispanic White adults. Additionally, commercial tobacco use was higher among adults who reported exposure to tobacco ads, mail, and email marketing. However, the study did not find interactions between marketing exposures and race and ethnicity on tobacco use outcomes. Still, research overall is lagging and does not yet fully explain how this increasingly complex media and communication landscape affects different populations of youth and young adults relative to their attitudes, beliefs, susceptibility, experimentation, initiation, and patterns of use across the diversifying landscape of tobacco products (Huang et al. 2019). Clearly, however, the promotion of tobacco products through digital and social media is proliferating and may contribute to disparities in exposure to tobacco product marketing and tobacco use.

Promoting Tobacco Products on Mass Media

Beyond social and other online media, numerous other forms of tobacco marketing continue to play a role in promoting tobacco use, including marketing through television, magazines, and movies. These approaches constitute both direct marketing attempts and indirect advertising, such as through depictions of tobacco use in movies.

Television

In terms of direct approaches, despite the digitization of the media landscape, television is still an important platform for news and information (Guttmann 2023; Navarro 2023). Television programming and advertising used to be distributed exclusively on broadcast television, but today television advertising encompasses both broadcast and digital streaming services.

Unlike conventional cigarettes, e-cigarettes have been subject to fewer marketing restrictions, providing e-cigarette companies with an opportunity to advertise to a broad television audience that includes millions of youth (Duke et al. 2014; USDHHS 2016). In 2019, several television broadcasters agreed to voluntary restrictions on advertising for e-cigarettes, potentially limiting such mass media exposures to marketing for these products (Booker 2019). Despite this, the Federal Trade Commission reported that e-cigarette companies spent $93.8 million on television advertising in 2019 (Federal Trade Commission 2022). Using data from the 2016 NYTS, Marynak and colleagues (2018) estimated that 37.7% of U.S. middle and high school students had been exposed to e-cigarette advertisements on television. In a study conducted from 2014 to 2015, television was the most frequently reported source of exposure to e-cigarette advertising for all age groups of adolescents (74.9%), young adults (70.7%), and adults over age 26 (66.9%) (Wagoner et al. 2019). Among adolescents, the remaining sources of exposure in descending order were retail, digital marketing, radio, print, and billboards (Wagoner et al. 2019). Farrelly and colleagues (2015) found that the top four highest rated e-cigarette ads among young people that aired during 2013 and 2014 included unproven health claims and youth-appealing themes, such as freedom and independence and using these products in locations where using cigarettes is prohibited as key messages (Farrelly et al. 2015). Marketing of newly deemed products, including e-cigarettes, with modified risk claims was prohibited when FDA asserted regulatory authority through the deeming rule in 2016 (*Federal Register* 2016).

Additionally, differences may exist in which groups are likely to be exposed to television advertising. In a national sample of adults conducted in 2012, among those who had heard of e-cigarettes in this early time period, television was the most common source, with 61.1% of Black respondents having heard of e-cigarettes on television compared with 47.4% of White, non-Hispanic respondents and 40.1% of Hispanic respondents (Zhu S-H et al. 2013). Exposure to ads about e-cigarettes on television was lower among young adults, 18–24 years of age (41.6%) and adults 65 years of age and older (57.3%). Furthermore, people with a high school education or less were more likely to have heard about e-cigarettes on television than people with greater levels of educational attainment (51.8% vs. 45.3%) (Zhu S-H et al. 2013). On the basis of data from the 2021 NYTS, exposure to marketing or advertising for any tobacco product on television, through streaming services, or through movies was higher among non-Hispanic Black youth (39.7%) than among non-Hispanic White youth (27.8%), Hispanic youth (31.9%), and youth of other, non-Hispanic races (27.7%) (Gentzke et al. 2022). Furthermore, exposure to e-cigarette advertising on television, streaming, and through movies was higher among non-Hispanic Black youth than youth of other races and ethnicities (Gentzke et al. 2022).

To assess the effects of the tobacco industry's marketing practices on youth and young adults, several scholars have examined these populations' quantity of exposure to television advertisements and evaluated their receptivity to these practices while also assessing their susceptibility to start using tobacco products. Duke and colleagues (2014) observed large increases for youth and young adults in the exposure to television advertisements for e-cigarettes from January 2011 to September 2013 and suggested a probable increase in the awareness and use of e-cigarettes in this population. Using data from the NYTS, e-cigarette experimentation and recent use doubled among U.S. middle and high school students during 2011–2012 (CDC 2013). Using data from Wave 1 of the PATH Study (2013–2014), Pierce and colleagues (2017) reported that a large proportion of U.S. adolescents who had never used any tobacco product, including e-cigarettes, were receptive to tobacco advertising, with the highest receptivity to ads for e-cigarettes followed by ads for cigarettes and smokeless tobacco. Additionally, among these youth who never used tobacco, the highest recall was for television advertising for e-cigarettes. Further, the study found that receptivity to advertising for each noncigarette tobacco product was associated with susceptibility to smoking conventional cigarettes. In addition, compared with non-Hispanic White youth who never used tobacco, non-Hispanic Black youth, Hispanic youth, and youth of other races had higher odds of susceptibility to any tobacco use.

Magazines

Magazine advertising continues to be an important channel for marketing tobacco products. NCI Tobacco Control Monograph 19 summarized a large body of literature on targeted marketing to a variety of audiences in magazines and concluded that "[p]aid tobacco advertising tends to suppress or reduce news coverage of tobacco-related issues, particularly in magazines" (NCI 2008, p. 15). Tobacco advertising in magazines has not only increased protobacco marketing cues but also suppressed coverage of the health hazards of smoking for magazine readers, particularly in magazines directed at women (Warner et al. 1992; USDHHS 2001). Reports from the Federal Trade Commission (2023a,b) show that the tobacco industry spent more than $9.6 million on magazine advertising for cigarettes and smokeless tobacco in 2022, although this amount has declined substantially from prior years (NCI 2008; Federal Trade Commission 2021a,b). Additionally, e-cigarette manufacturers spent $5.2 million on magazine advertising in 2018, increasing to $13 million in 2019 and declining to $2.7 million in 2020 (Federal Trade Commission 2022). Among U.S. adults in the 2013–2014 National Adult Tobacco Survey, for each additional e-cigarette advertisement in magazines to which an adult was exposed in the past 6 months, there was a 0.07-percentage-point increase in current cigarette smoking (Ali et al. 2021). However, there was no association between this advertising exposure and ever or current e-cigarette use. Among young adult college students in Texas who were followed for 2 years, after controlling for other covariates, those with higher exposure to tobacco ads in magazines used more tobacco products compared with those with less exposure (Loukas et al. 2021). In interaction models with the survey wave, young adults with greater exposure to tobacco ads reported a slower decline in the number of tobacco products they used over time (Loukas et al. 2021).

In an experimental study, Pokhrel and colleagues (2019) found that exposing young adults to social enhancement-themed ads for e-cigarettes (i.e., ads containing messages that promote e-cigarette use as a means of attaining a better social life or social status or self-image) in magazines and online communicated messages of reduced harm from e-cigarettes relative to cigarettes. These ads affected young adults' explicit and implicit attitudes relative to control ads of everyday items collected from real-world sources in 2014 and, as a result, increased their susceptibility to using e-cigarettes.

As depicted in Figure 5.2, the tobacco industry continues to use magazines to market specific tobacco products to specific populations. Richardson and colleagues (2015a) examined advertisements for menthol cigarettes from June 2012 to February 2013 and found that 61% of print advertisements for Newport brand cigarettes featured at least one African American model. Further, of the 20 magazines in which Newport ads were placed, 6 had greater than 10% African American readership, such as *Jet, Ebony,* and *Essence*. A study by Banerjee and colleagues (2015) provided a content analysis of tobacco print ads in various magazines, finding that these magazines (*Jet, Ebony,* and *Essence*) exclusively ran ads for cigarettes, including menthol brands Newport and Camel Crush. However, more general interest magazines, such as *Entertainment Weekly* or *Rolling Stone,* included ads for cigarettes, e-cigarettes, and snus (Banerjee et al. 2015).

The populations targeted by magazine ads from the tobacco industry include but are not limited to:

- People who identify as LGBTQI+ and have been targeted with ads for menthol and nonmenthol cigarettes (e.g., in *Out* magazine in 2016) (Trinkets & Trash 2016a, b, e) and e-cigarettes (e.g., in *Out* magazine in 2019) (Banerjee et al. 2015; Trinkets & Trash 2019e).

- Armed services personnel and veterans who have been targeted with ads for smokeless tobacco (e.g., "Copenhagen salutes our soldiers, our veterans, our heroes")—which appeared in multiple men's magazines in 2021 (Trinkets & Trash 2021a) and in periodicals, such as *Military Times* magazine in 2005 (Haddock et al. 2008)—and cigar advertisements (e.g., in *American Way* magazine (Trinkets & Trash 2013b)

- Hispanic readers, who have been targeted with ads for smokeless tobacco (Dave and Saffer 2013), menthol cigarettes (e.g., in *Latina* magazine in June 2016), and little cigars (e.g., in *People* Spanish in 2019 and 2020) (Trinkets & Trash 2016d, 2019b, 2020b).

- Women, with differentiation in the specific products marketed to them based on their income and race and ethnicity. One study examining e-cigarette and cigarette advertising in women's magazines found that, unlike cigarette marketing, which was equally distributed across magazines targeting higher and lower income readerships, more than 75% of e-cigarette advertising was featured in magazines for higher income audiences (Basch et al. 2016). This same study found that 64% of cigarette ads were in women's magazines targeted to Black or Latina audiences, and only 18% of e-cigarette ads were in magazines for this demographic.

Price Promotions

As described previously, the tobacco industry targets marketing in retail stores and promotes cheaper tobacco products and price promotions to populations of lower SES and minoritized racial and ethnic groups. Reduced price marketing for tobacco products extends well beyond the retail environment. For example, Tessman and colleagues (2014) found through the NYTS that 13.1% of middle and high school youth had been exposed to coupons from a tobacco company through the mail or a digital communication or on a tobacco package in the past 30 days; among those who lived with a person who used tobacco, 20.0% were exposed to tobacco coupons. Exposure to coupons through the mail or on packages was more common among non-Hispanic White students than among non-Hispanic Black students, and exposure to digital coupons from a tobacco company was more common among Hispanic students and non-Hispanic students of other races than among non-Hispanic White students. However, overall exposure to coupons was comparable among all assessed racial and ethnic groups. The study did not report exposure to coupons by type of tobacco product (Tessman et al. 2014). In another study from the Midwest, Choi and Forster (2014) found that people with lower levels of educational attainment were more likely than those with greater levels of educational achievement to receive cigarette coupons through the mail. Elsewhere, Rose and colleagues (2018) conducted a longitudinal study of youth who received tobacco-related coupons and found that female youth, nonurban youth, and youth with higher levels of internalized mental health symptoms were most likely to receive coupons. In addition, the study found that having received coupons was associated with higher odds of (a) tobacco use among people who had never used tobacco, (b) trying a new tobacco product, and (c) current tobacco use at 1-year follow-up (Rose et al. 2018). A systematic review of 27 studies examining exposure to coupons and risk for tobacco initiation and cessation found that receipt and redemption of tobacco product coupons were most prevalent among young adults, people in minoritized sexual orientation and gender identity groups, people with lower educational attainment, and people with higher tobacco use intensity (Liber et al. 2021). The review found some evidence across studies that coupon receipt was associated with increased odds of tobacco initiation among people who never used tobacco and that coupon receipt or redemption was associated with lower odds of cessation among people who used tobacco (Liber et al. 2021).

In addition to conventional tobacco products, youth are frequently exposed to price promotions from the tobacco industry for e-cigarettes (USDHHS 2016; Tattan-Birch et al. 2022; Chen-Sankey et al. 2023; Elhabashy et al. 2023). E-cigarette companies use marketing strategies that are similar to the strategies used to promote conventional cigarettes (Walley et al. 2019). Moran and colleagues (2019a) noted, however, that ads for conventional cigarettes were more likely than ads for e-cigarettes to use discounts and sweepstakes to increase brand loyalty, and ads for e-cigarettes were more likely than ads for conventional cigarettes to target new consumers by modeling the use of the products and highlighting their qualities.

Promotional Events and Sampling

Although event sponsorship by specific brand names of cigarettes and smokeless tobacco products was prohibited by the Master Settlement Agreement and by FDA under the *Tobacco Control Act*, tobacco companies can still sponsor events using their own corporate names. Altria reported sponsoring the Richmond Jazz Festival in 2017 and was the leading sponsor of that festival in 2018 (Richmond Jazz Festival at Maymont 2018; Altria n.d.a). The 2018 Richmond Jazz Festival included several prominent African American musicians (Richmond Jazz Festival at Maymont 2018). Event sponsorship also extends to noncigarette tobacco products. Ganz and colleagues (2018) found that Swisher Sweets, a popular cigar brand among African American young adults who smoke and among young people who smoke (Glasser et al. 2016), promoted the Artist Project on its website in 2017; the Artist Project included "Swisher Sweets Pack Nights" and "Convenience Store Sessions." The Pack Nights were sponsored concerts performed by emerging musical artists; concerts were held in major cities across the United States, including Atlanta, Detroit, Houston, and Los Angeles. The Convenience Store Sessions included video recording artists performing in convenience stores with substantial tobacco branding observable by viewers; videos were then placed on Swisher Sweets' website (Glasser et al. 2016).

E-cigarette manufacturers also sponsor events (e.g., sporting events, music concerts, comedy shows) (McCarthy 2014; USDHHS 2016), thereby enhancing the visibility and potentially the use of e-cigarettes, especially among young audiences. For example, according to data from Wave 2 of the PATH Study, youth and young adults who had never used tobacco and who reported past-30-day exposure to e-cigarette marketing at events like fairs, festivals, or sporting events in Wave 2 of the PATH Study were more likely to have experimented with e-cigarettes by Wave 3 of the study—defined as having ever used e-cigarettes, even one or two times—than those who were not exposed to such marketing (youth aOR = 1.72; 95% CI, 1.09–2.73; young adult aOR = 4.21; 95% CI, 1.49–11.96) (Chen-Sankey et al. 2019).

Elsewhere, Branstetter and colleagues (2015) conducted focus groups with adults in the rural Appalachian area of Pennsylvania to better understand how this population group perceives tobacco-related messages in the media. The study found that participants specifically recalled tobacco company sponsorship at sporting or other events, including the National Association for Stock Car Auto Racing (NASCAR) and other auto-racing sponsorships, as well as promotional tents and other activities at races and concerts (Branstetter et al. 2015). Furthermore, focus group participants recalled seeing tobacco promotional advertisements at gas stations and convenience stores, as well as seeing tobacco use in movies and by celebrities that were "encouraging of tobacco use" (Branstetter et al. 2015).

The tobacco industry has also marketed tobacco products at bars frequented by members of the LGBTQI+ community, historically providing free drinks, cigarette samples, and prizes (Leibel et al. 2011). Fallin and Davis (2016) examined the tobacco industry's promotional events in LGBTQI+ bars in San Jose, California, from 2013 to 2015, noting, for example, that representatives from Philip Morris provided "buy one, get one free" coupons for tobacco products and handed out free e-cigarettes and replacement cartridges. Under the *Tobacco Control Act*, FDA prohibited free cigarette samples in 2010 (*Federal Register* 2010). Free e-cigarettes and replacement cartridges became subject to the same prohibition on free samples upon adoption of the deeming rule in 2016 (*Federal Register* 2016).

Movies

In addition to traditional direct advertising, indirect marketing—such as depictions of tobacco use in movies—can strongly influence the initiation of smoking among youth and young adults. NCI Tobacco Control Monograph 19 concluded that "[t]he total weight of evidence from cross-sectional, longitudinal, and experimental studies . . . indicates a causal relationship between exposure to depictions of smoking in movies and youth smoking initiation" (NCI 2008, p. 12). The 2012 Surgeon General's report further noted that "[t]he evidence is sufficient to conclude that there is a causal relationship between depictions of smoking in the movies and the initiation of smoking among young people" (USDHHS 2012, p. 6). One study of a cohort of children, 9–12 years of age at baseline (in 2002–2003), who were from Vermont and New Hampshire and followed for 3 years found that youth were exposed to 149.6 instances of smoking in movies on average over a 3-year period, including 40.7 occurrences at baseline, 53.4 occurrences at Wave 2, and 55.9 occurrences at Wave 3 (Titus-Ernstoff et al. 2008). In modeling, exposure to instances of smoking in movies at baseline (Wave 1) was significantly associated with prediction of smoking initiation by Wave 3; this prediction was not improved by adjusting for additional exposures at Wave 2 and Wave 3, indicating that exposures in early childhood to instances of smoking in movies is similar in importance to exposures that occur closer to the time of smoking initiation (Titus-Ernstoff et al. 2008). Additional research has found that the number of scenes in movies that include smoking rises with each increase in movie rating, such as from Rated G (general audiences) to Rated PG (parental guidance suggested) to Rated R (restricted) (Tynan et al. 2019; Polansky et al. 2020). In a meta-analysis of 17 studies (9 cross-sectional studies, with a median sample size of 4,919, and 8 longitudinal studies, with a median sample size of 2,298), higher exposure to smoking in movies was associated with a 93% increase in the risk of ever trying smoking in the cross-sectional studies and a 46% increase in the risk of smoking initiation in the longitudinal studies

(Leonardi-Bee et al. 2016). In 1998, the Master Settlement Agreement prohibited paid product placement for cigarette brands in movies produced in the United States. Morgenstern and colleagues (2017) evaluated depictions of smoking in Hollywood movies and found a marked decrease in the number and duration of smoking depictions in movies in the 11 years after the Master Settlement Agreement compared with the 11 years before the agreement. Nonetheless, about half of top-grossing films from U.S. movie studios in 2018 continued to include tobacco use and imagery, with nearly one-third of youth-rated films including tobacco incidents (Tynan et al. 2019).

Various studies have examined depictions of smoking in movies targeted to particular populations. For example, among the 81 U.S. movies released from 2000 to 2011 identified as having LGBTQI+ themes or characters, tobacco use was depicted in 87% of a random sample (n = 45) of these movies, with, on average, four occurrences of tobacco use depicted every hour (or about once every 15 minutes) (Lee et al. 2014). Elsewhere, in a national study of initially nonsmoking adolescents (n = 2,341), Black adolescents had greater exposure to smoking in both Black-oriented and mainstream movies compared with teenagers from other racial and ethnic groups (Dal Cin et al. 2013). For teenage viewers who were Black, exposure to smoking in mainstream movies was not associated with smoking initiation, but exposure to smoking in Black-oriented movies was associated with smoking initiation. However, for other adolescents, exposure to smoking in both mainstream and Black-oriented movies was associated with smoking initiation (Dal Cin et al. 2013). Finally, an earlier study (Wilkinson et al. 2009) found that, for Mexican-born U.S. youth from Houston, Texas, increasing exposure to smoking in movies was associated with increased smoking initiation. However, for U.S. born youth, a ceiling effect was observed, in which smoking initiation increased with increasing exposure to smoking in the movies, but then plateaued at high levels of exposure (Wilkinson et al. 2009). As such, country of birth moderated the association between exposure to smoking in movies and smoking initiation.

Critical Differences Between Promoting Tobacco Products on Mass Media Versus Social Media

Communication to the public through the media reflects and shapes population-level understanding of important issues, including health-related issues. As information media and communication technologies evolve, health-related information is expanding to include social media platforms, such as Twitter, Instagram, and Facebook. Although the link between tobacco marketing through traditional media channels and tobacco use is well-established, the nature and mechanisms of the effects of social media are understudied (Depue et al. 2015; Hebert et al. 2017). Additionally, researchers have identified a need for more studies on how exposure to information and misinformation about tobacco products on social media affects attitudes toward tobacco products and tobacco use specifically among populations experiencing tobacco-related health disparities (Tan and Bigman 2020). Searches on mechanisms of effect revealed few studies that examined the differences between tobacco marketing on social media versus other media channels and in relation to specific groups. Thus, this section focuses primarily on differences in how social media versus mass media is theorized to work in general. Additional research is needed to better understand whether these theoretical relationships work similarly or differently for populations experiencing tobacco-related health disparities.

In a mass media environment, messages are typically encountered passively (Obermiller 1985; Southwell et al. 2002), but on social media, engagement can be both active and passive (Ramirez et al. 2002; Liang and Scammon 2013). As with other types of content, social media enables consumers to search for, engage with, and access information or to produce and share content about tobacco and related products, promotions, and opportunities to purchase these products.

A substantial amount of literature differentiates between the effects of passive exposure and active information-seeking behaviors (Johnson 1997; Niederdeppe et al. 2007). Information-seeking can lead to more intensive or enduring behavior change than passive exposure because active seeking involves greater scrutiny and depth of information processing (Slater 1997; Kahlor et al. 2002; Dutta-Bergman 2004). Research conducted in 2013 indicated that sharing information about tobacco products, notably e-cigarettes, was not a common practice among the general population, but it was far more common among young adult populations, and those who used tobacco were five times more likely than those who did not use tobacco to report sharing information about e-cigarettes (Emery et al. 2014). A nationally representative, cross-sectional study of youth and young adults, 13–25 years of age, found that (a) 18- to 25-year olds were more likely to share information about tobacco and e-cigarettes than 13- to 17-year-old youth, and (b) those who intended to use or currently used cigarettes were significantly more likely than their counterparts to share information about e-cigarettes (Jeong 2018). A longitudinal study of youth and young adults found that actively seeking information about e-cigarettes was associated with e-cigarette use

6 months later (Yang et al. 2019). Another study found that, among a cohort of young adults from Southern California, those who had shared pro-tobacco-related content on Twitter were more likely to use cigarettes and any tobacco products than were young adults who did not share such content (Unger et al. 2018). Finally, Sawdey and colleagues (2017) found positive and significant associations between viewing e-cigarette posts from peers on social media and both lifetime and current e-cigarette use among a convenience sample of college students.

Health campaigns on social media may be undermined by protobacco proponents, leading to a blunting of intended effects. Research on the potential for social media health messages to backfire is of particular importance for tobacco countermarketing campaigns because social media messages are subject to fewer regulations and often contain misinformation, making it difficult to monitor and improve them (Tan and Bigman 2020; Kong et al. 2022b). Further, tobacco companies use sophisticated strategies, such as Twitter bombing (i.e., spamming or posting messages from multiple accounts to flood conversations with one perspective), astroturfing (i.e., masking commercial message sources as organic or grassroots accounts), and hashtag hijacking (i.e., using the hashtag of a tobacco countermarketing campaign to signal opposition to the message, program, or policy initiative)—all of which contribute to potential undermining of countermarketing media campaigns (Harris et al. 2014; Allem et al. 2017a). For example, in response to a media campaign by the California Department of Public Health on the harms of e-cigarette use called *Still Blowing Smoke*, a nonprofit organization formed in response to the campaign launched its own pro-e-cigarette advocacy campaign called *NOT Blowing Smoke*. *NOT Blowing Smoke* had a higher tweet volume than *Still Blowing Smoke* over the campaign period, and 92% of tweets referencing the campaigns were coded as pro-e-cigarette (Allem et al. 2017b). In another campaign in 2014, the Chicago Department of Public Health used the hashtag #ecigtruths to disseminate messages about e-cigarettes before a city council vote to regulate e-cigarettes as tobacco products. An analysis of Twitter messages about the campaign found that 80% of messages using the hashtag expressed opposition to regulation, 14% included aspects indicative of astroturfing, and few Twitter users who were tweeting on the subject were from the Chicago area (Harris et al. 2014).

Marketing and Media Summary

Studies reaffirm the conclusions of prior Surgeon Generals' reports that a causal association exists between tobacco marketing and the initiation and use of tobacco products, especially for youth (Lovato et al. 2011; Singh et al. 2016a; Pierce et al. 2018; Chen-Sankey et al. 2019; Cruz et al. 2019a). Similar relationships have also been found for tobacco marketing exposure through television (Pierce et al. 2017), online marketing (Soneji et al. 2017, 2018; Choi et al. 2020), magazines (Loukas et al. 2021), and exposure to tobacco in the movies (Titus-Ernstoff et al. 2008; Leonardi-Bee et al. 2016) and among young adults through pro-tobacco content on social media (Clendennen et al. 2020). Marketing for e-cigarettes is also associated with e-cigarette initiation and use (Mantey et al. 2016; Agaku et al. 2017; Camenga et al. 2018). Social media marketing has some unique features relative to traditional media marketing, including enhanced targeting, searchability of content, and the use of influencers (Geyser 2023). The rapid growth and near ubiquitous use of social media platforms has increased accessibility to tobacco-related information, including promotions and depictions of use or implied use, which abounds on such platforms as Twitter, YouTube, and TikTok (Huang et al. 2014, 2016; Cranwell et al. 2015; Rutherford et al. 2022; Sun et al. 2023). Emerging research indicates that, similar to traditional media, seeking and sharing information about tobacco products on social media is associated with tobacco use (Unger et al. 2018; Yang et al. 2019). However, in the United States, there are few restrictions on marketing for tobacco products other than cigarettes and smokeless tobacco, and diverse groups of young people are exposed to pervasive and often stealthy marketing for tobacco products on digital and online media channels.

An abundance of literature documents how traditional tobacco product marketing tactics may contribute to disparities in tobacco use (USDHHS 1998; NCI 2008). However, few studies have documented how new marketing tactics, which increasingly incorporate both traditional media and social and digital media marketing in a complex media market, may contribute to disparities in the use of tobacco products. However, several factors are likely at play in the rapidly changing media environment, including (1) differential access to and use of media platforms across groups; (2) targeted marketing to specific groups across media platforms; and (3) differential impacts of marketing on tobacco use across groups, which is described in greater detail in the following section.

Differential Access To and Use of Media

First, research shows that access to digital media, including social media, has grown substantially in recent years. Although most youth and young adults can access the Internet and social media through smartphones, regardless of SES and geographic area of residence, there are racial and ethnic differences in social media use. African American and Hispanic adults use social media at higher rates than White adults, and almost constant social media use is more common among Black and Hispanic teens than among White teens (Auxier and Anderson 2021; Vogels et al. 2022), which could result in potential racial and ethnic disparities in exposure to tobacco product-related marketing via social media.

Targeted Marketing to Specific Groups Across Media Platforms

Tobacco marketing is broadly available online, and marketing for noncigarette tobacco products is available through traditional media, such as television, because of differential regulatory oversight for such products as e-cigarettes (Duke et al. 2014; USDHHS 2016). Such marketing narrowly targets certain racial and ethnic groups. For example, African American audiences are frequently targeted with tobacco marketing and advertising across media platforms through music promotions, influencers, magazines, messages about menthol cigarettes, and tobacco industry websites (Cruz et al. 2010; Richardson et al. 2014, 2015a; Ganz et al. 2018; Escobedo et al. 2020b). Exposure to targeted marketing messages online is also higher among Hispanic youth and Black youth than among non-Hispanic White youth (Soneji et al. 2019a). Additional research is needed that examines media and non-retail marketing strategies that specifically target Asian American and Pacific Islander, American Indian and Alaska Native, and multiracial and multiethnic people (Carroll et al. 2020). Additionally, as noted previously, evidence suggests that e-cigarette advertising in women's magazines was initially targeted to higher income and White women (Basch et al. 2016). In 2019, several television broadcasters agreed to voluntary restrictions on advertising for e-cigarettes—potentially limiting such mass media exposure to marketing for these products (Booker 2019). Additionally, FDA began authorizing the marketing of some e-cigarette products through the Premarket Tobacco Product Application (PMTA) process. These authorizations include restrictions on digital advertising and television and radio advertising (FDA 2021b). Research should continue to examine the potential for differential exposure to mass media marketing among different populations, including for tobacco products with PMTA authorization, to better understand the potential impact of these marketing restrictions, the industry's responses, and the unanticipated effects.

There are also disparities in exposure to tobacco product marketing by sexual orientation and gender identity. People who identify as LGBTQI+ are exposed to more tobacco marketing and engage with such content on social media at higher rates compared with non-LGBTQI+ people (Emory et al. 2019; Soneji et al. 2019a). Differences in marketing exposure may also exist within LGBTQI+ populations, with increased exposure documented among bisexual women compared with gay or heterosexual women and even greater disparities in exposure among bisexual men and women from some racial and ethnic groups (Tan et al. 2021).

Despite having less access to the Internet and social media, populations with lower SES experience higher levels of exposure to tobacco product marketing (Zhu S-H et al. 2013; Assari 2020). An analysis of data from the PATH Study found that coupon receipt was associated with increased odds of progression to current smoking, continuing smoking, and progression to or continuation of daily smoking (Choi et al. 2020). Receipt of tobacco coupons also appeared to be more prevalent among persons with lower levels of educational attainment than among those with higher levels of educational attainment (Choi and Forster 2014; Osman et al. 2019; Assari 2020; Liber et al. 2021).

Differential Impacts of Marketing on Tobacco Use Across Groups

Several studies have found interactions between demographic characteristics and marketing exposure on tobacco product use outcomes; however, these interactions vary by type of exposure and population. For example, among participants in Wave 1 of the PATH Study who never used tobacco products, African American youth and those with a lower SES had greater recall of ads related to cigarettes and cigars (Moran et al. 2019b). Also, compared with non-Hispanic White and Hispanic youth, African American youth were significantly more likely to report using e-cigarettes because the e-cigarette advertising appealed to them. Tobacco use disparities related to tobacco marketing are likely driven more by differential exposure to targeted marketing among racial and ethnic and lower SES populations than by differential effects of marketing exposure on tobacco use for these groups, but the research in this area is not robust. More research is needed to examine differences in exposure to tobacco marketing and the resulting impact on tobacco use attributable to the intersection of different identities, such as one's race and ethnicity, sexual orientation and gender identity, and SES. Furthermore, disparities arising from targeted marketing and advertising may be made worse by inequities in communication and in media literacy. However, additional research is needed that examines the roles of inequities in communication (such as differences in the ability to generate, access, disseminate, share, and act on information) and media literacy with respect to the impact of tobacco product marketing and advertising on use, initiation, and cessation.

A limitation of the literature is that few studies investigated the link between commercial tobacco marketing and engagement on social media with individual tobacco use or tobacco-related health disparities. The large and growing amount of promotional content for tobacco products that is available online presents a pressing need to monitor this content and to develop strategies to curb digital marketing for tobacco products on social media. However, the methodologic basis needed to systematically audit and engage with the tobacco-related content on these sites is only beginning to develop (Kim et al. 2017; Chew et al. 2021, 2022). Research is warranted that examines how tobacco companies use digital marketing and promotional content to target certain populations and ultimately contribute to tobacco product-related disparities in the rapidly changing social media environment.

Finally, given the swift innovation in the tobacco marketplace, continued surveillance is needed to track (a) marketing trends and use patterns of newer and/or rapidly changing tobacco products—such as e-cigarettes, heated tobacco products, and nicotine pouches—among diverse populations and (b) the impact of these emerging products on tobacco-related health disparities.

Tobacco Industry Tactics to Counter Tobacco Prevention and Control Efforts

Aligning with the 1998 Surgeon General's report, this section reviews evidence on the tobacco industry's political, legal, economic, corporate, and community tactics to counter tobacco control efforts among minoritized racial and ethnic groups and other populations that have been disproportionately affected by tobacco-related health disparities in the United States. It specifically examines how the tobacco industry has supported organizations serving several disparate communities, including diverse minoritized racial and ethnic groups and sexual orientation and gender identity groups (e.g., those who identify as LGBTQI+), people in certain geographic locations (e.g., rural areas), and people with behavioral health conditions. Such approaches have been named as part of the "vector" in the HAVE model, which focuses on the marketing activities of the tobacco industry (Cruz 2009; Giovino et al. 2009).[2]

Literature Review Methods

A literature search was conducted in the PubMed and Web of Science electronic databases for studies published in English between 2008 and 2021 that focused on the tobacco industry's political, economic, corporate, and community responses to tobacco control among racially and ethnically diverse groups and other specific populations impacted by tobacco-related health disparities. Studies that examined tobacco companies' responses to tobacco control efforts before 2000 were largely excluded. Appendix 5.1 presents a list of search terms. Other potentially relevant articles were identified from the reference lists of articles found in the literature search. The search was supplemented with literature nominated by colleagues and reviewers with relevant expertise and from additional resources, such as relevant news articles and reports about funding from tobacco companies. On the global scale, additional information about such tactics is available from the University of Bath's Tobacco Tactics website (http://tobaccotactics.org).

Political Tactics of the Tobacco Industry

The tobacco industry uses both direct and indirect or grassroots political lobbying and other tactics that counter tobacco control efforts (Ulucanlar et al. 2016; Tangcharoensathien et al. 2017). Tobacco companies have a documented history of promoting their agenda through the use of campaign contributions, donations to the political parties of legislators, and gifts and payments to policymakers (USDHHS 1998; Campaign for Tobacco-Free Kids 2020; Action on Smoking & Health 2021; OpenSecrets 2021). During the 2019–2020 election cycle, Political Action Committees for tobacco companies contributed more than $1.5 million to federal political candidates (Campaign for Tobacco-Free Kids 2020). Lobbying on behalf of tobacco companies occurs throughout the United States at the local, state, and national levels. In 2021, 918 lobbyists or lobbying firms for the tobacco

[2]For historic context and a broader view of the tobacco industry's role and tactics in shaping tobacco use patterns, the tobacco marketplace, and the broader environment, see the judicial decision in United States v. Philip Morris USA Inc. (2009) and the review by Tobacco Control Legal Consortium (2006)

industry were registered at the state level and 236 lobbyists were registered at the federal level, of whom more than 78% were former government employees (Action on Smoking & Health 2021).

Tobacco lobbyists often work to oppose effective tobacco control policies, and tobacco companies contribute to the campaigns of political candidates (Givel and Glantz 2001; Morley et al. 2002; Bero 2003; Levin 2015). In addition, some major tobacco companies and/or their foundations make contributions to high-profile political organizations and Congressional caucuses that advocate on behalf of people from racial and ethnic groups and LGBTQI+ rights groups, among many others (Altria n.d.b). In addition to funding political organizations, tobacco companies have selectively donated to African American politicians when legislative decisions about menthol cigarettes were pending (Levin 2015). According to an analysis of records from the Center for Responsive Politics, Lorillard, Inc. contributed to the campaigns of half of all African American members of Congress in 2014 when a policy decision to add menthol to the list of characterizing flavors was being considered (Levin 2015). Lorillard had a vested interest in blocking menthol restrictions because at that time, the company manufactured Newport brand cigarettes, which is the most popular brand of menthol cigarettes in the United States (Sharma et al. 2016) and which is used by the majority of African American people who smoke (Villanti et al. 2016). In 2015, Reynolds American finalized the acquisition of Lorillard, including its Newport brand, and divested some brands to Imperial Tobacco (Mickle and Brent 2015).

As noted in the 1998 Surgeon General's report, the tobacco industry also uses indirect or grassroots lobbying to promote its agenda among the general electorate (USDHHS 1998; Ulucanlar et al. 2016). Figure 5.3 displays several present-day examples of indirect or grassroots lobbying, including in-store displays and direct-to-consumer emails encouraging the public to oppose cigarette tax increases and federal and state restrictions on menthol cigarettes.

Furthermore, the tobacco industry contributes financial support to advocacy groups, including groups whose positions align with the tobacco industry's agenda. For example, in 2010, representatives from groups with "a history of tobacco industry ties" (Cheyne et al. 2014, p. e57, citing Yerger and Malone 2002) argued against banning menthol cigarettes before a public meeting of the Tobacco Products Scientific Advisory Committee (TPSAC), a congressionally mandated advisory committee of FDA (Healy 2010; Cheyne et al. 2014). Arguments against a ban on menthol cigarettes advanced by both industry participants and participants representing the aforementioned groups during the TPSAC meeting included concerns that a ban would start an illicit market and result in greater police activity in communities where menthol cigarettes were preferred (Healy 2010; Cheyne et al. 2014; Levin 2017). Such arguments continue to be used to oppose policies that prohibit menthol cigarettes, including FDA's proposed product standard. However, many Black leaders have rejected these arguments and tactics, for example:

- The National Association for the Advancement of Colored People (NAACP) stopped accepting tobacco industry funds more than two decades ago as a result of the industry's targeted marketing strategies. In a 2022 letter to HHS and White House leadership, NAACP's president Derrick Johnson "reject[ed]" the "tobacco industry's message and strategy presented by a few Black leaders [that] prohibiting menthol cigarettes would be discriminatory." Instead, he noted that "the failure to prohibit the sale of menthol cigarettes and products would be discriminatory" (National Association for the Advancement of Colored People 2022a, b).

- Rev. Horace Sheffield, a prominent Black pastor and civil rights leader in Detroit, said he declined more than $200,000 from R.J. Reynolds to oppose a menthol cigarette ban and was told that others had received as much or more for doing so. Sheffield said in an interview with the Bureau for Investigative Journalism that "[the offer] was between $200,000 and $250,000 one time, plus additional money going forward if I would actually say, 'I thought about it, I'm on the wrong side'"(Stockton 2023).

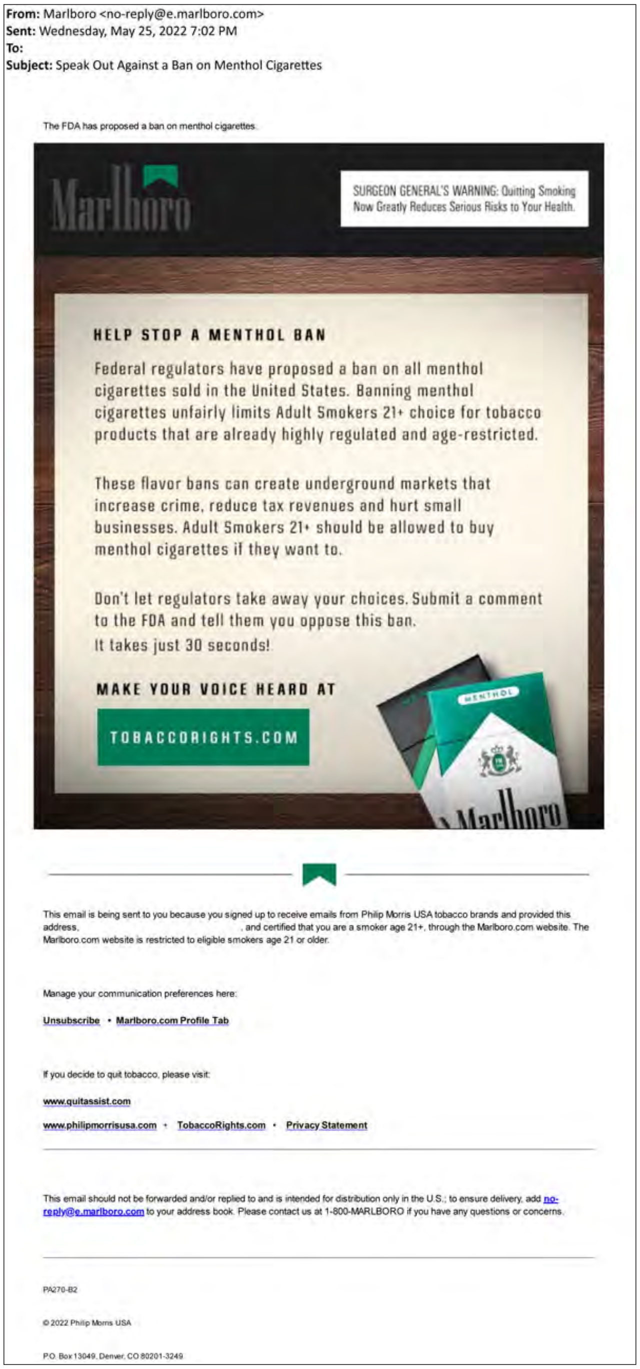
- In 2023, members of the Congressional Black Caucus Health Braintrust wrote to the FDA Commissioner in support of a product standard to prohibit menthol cigarettes and reinforcing that "[the] FDA cannot and will not enforce against individual consumers for possession or use of a menthol cigarette or flavored cigars. . . . For too long, tobacco companies have been enabled to promote menthol cigarettes to the Black community . . ." (Congressional Black Caucus Health Braintrust 2023a, b).

Legal Tactics of the Tobacco Industry

Tobacco companies also engage in legal actions to contest legislation and policy aimed at regulating the tobacco industry (Ulucanlar et al. 2016). With respect to FDA's regulation of tobacco products, this includes, but is not limited to, constitutional challenges to multiple provisions of the *Tobacco Control Act* (*Discount Tobacco*

Figure 5.3 Examples of (a) indirect or grassroots lobbying to oppose tobacco prevention and control initiatives and (b) community engagement efforts of the tobacco industry

A. Indirect or grassroots lobbying



From: Marlboro <no-reply@e.marlboro.com>
Sent: Wednesday, May 25, 2022 7:02 PM
To:
Subject: Speak Out Against a Ban on Menthol Cigarettes

The FDA has proposed a ban on menthol cigarettes.

Marlboro

SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks to Your Health.

HELP STOP A MENTHOL BAN

Federal regulators have proposed a ban on all menthol cigarettes sold in the United States. Banning menthol cigarettes unfairly limits Adult Smokers 21+ choice for tobacco products that are already highly regulated and age-restricted.

These flavor bans can create underground markets that increase crime, reduce tax revenues and hurt small businesses. Adult Smokers 21+ should be allowed to buy menthol cigarettes if they want to.

Don't let regulators take away your choices. Submit a comment to the FDA and tell them you oppose this ban.
It takes just 30 seconds!

MAKE YOUR VOICE HEARD AT

TOBACCORIGHTS.COM

MENTHOL

Marlboro

This email is being sent to you because you signed up to receive emails from Philip Morris USA tobacco brands and provided this address, , and certified that you are a smoker age 21+, through the Marlboro.com website. The Marlboro.com website is restricted to eligible smokers age 21 or older.

Manage your communication preferences here:

Unsubscribe • Marlboro.com Profile Tab

If you decide to quit tobacco, please visit:

www.quitassist.com

www.philipmorrisusa.com • TobaccoRights.com • Privacy Statement

This email should not be forwarded and/or replied to and is intended for distribution only in the U.S.; to ensure delivery, add no-reply@e.marlboro.com to your address book. Please contact us at 1-800-MARLBORO if you have any questions or concerns.

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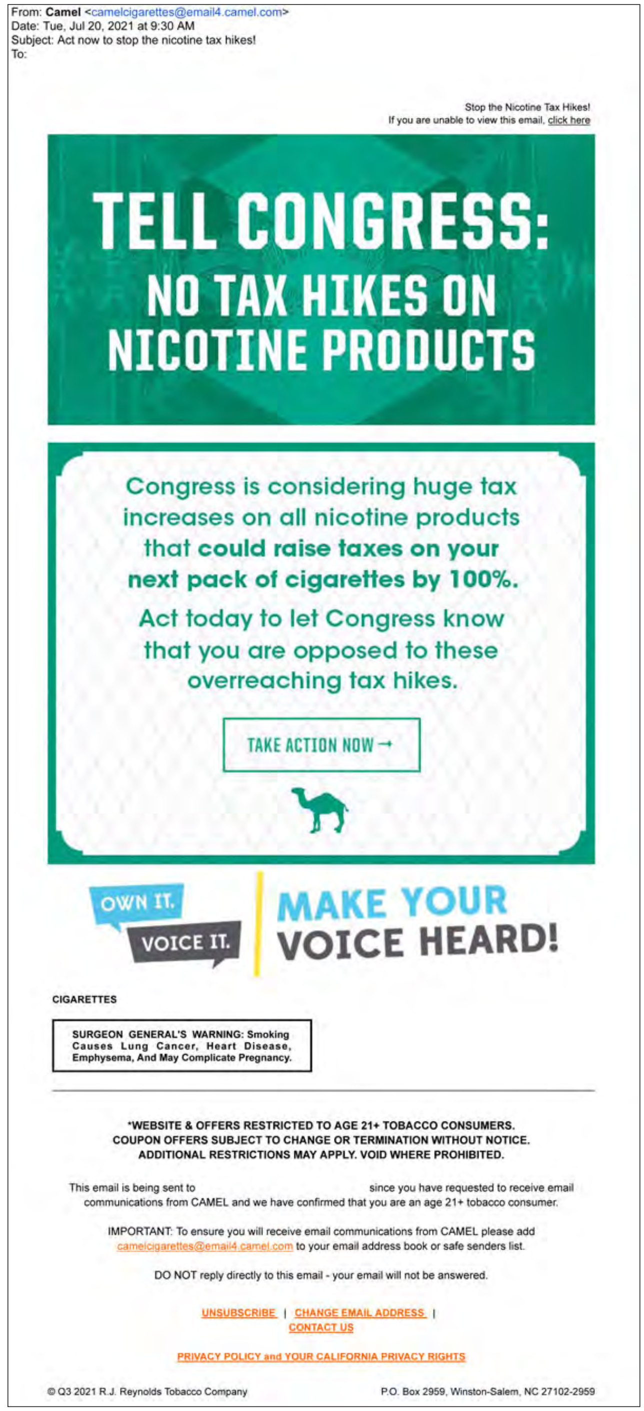
P.O. Box 13049, Denver, CO 80201-3249

Source: Email from Altria's Marlboro brand cigarettes in May 2022 asking consumers to help stop a menthol ban by leaving comments on a website (Trinkets & Trash 2022b).

Source: Signage attached to a window of a liquor store in 2022 in New Jersey urging consumers to speak to lawmakers about not banning menthol cigarettes (Trinkets & Trash 2022c).

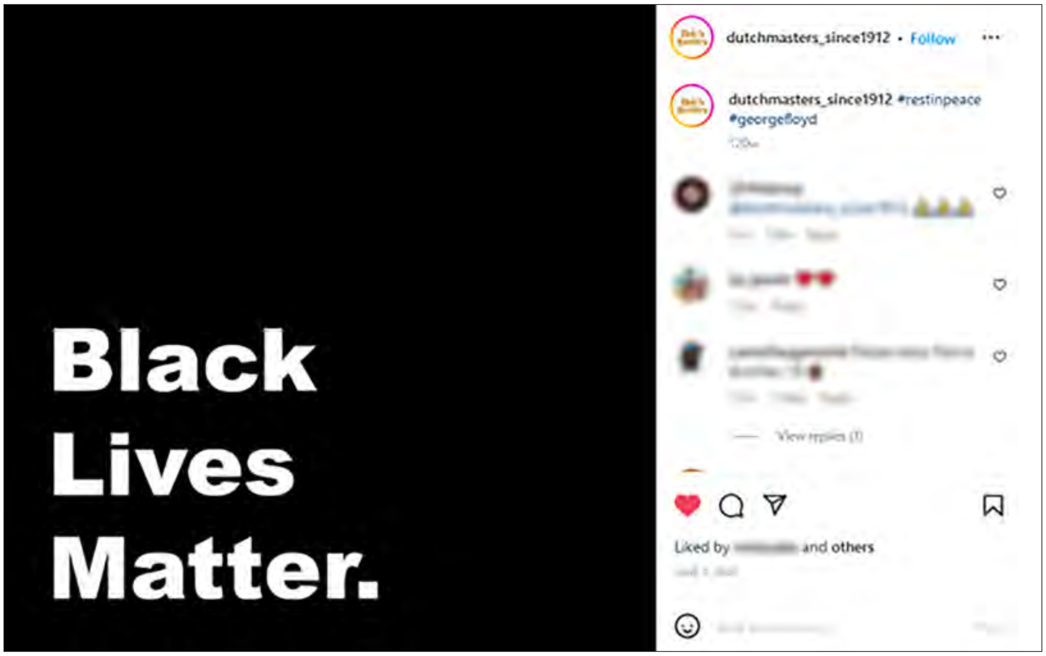
A. Continued

Source: Instagram post by Backwoods brand cigars in 2022 that linked consumers to a form where they could comment against FDA's ban on cigar flavors (Trinkets & Trash 2022a).

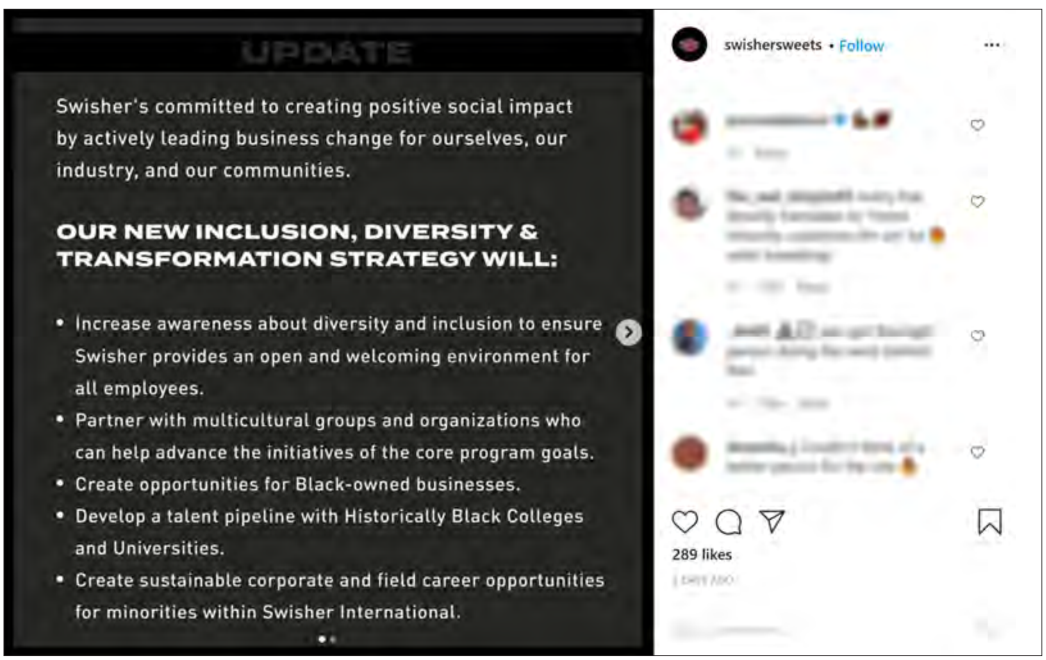


Source: Email from Camel brand cigarettes in 2021 asking recipients to visit a website to voice their opposition to tax increases on all nicotine products (Trinkets & Trash 2021d).

B. Community engagement

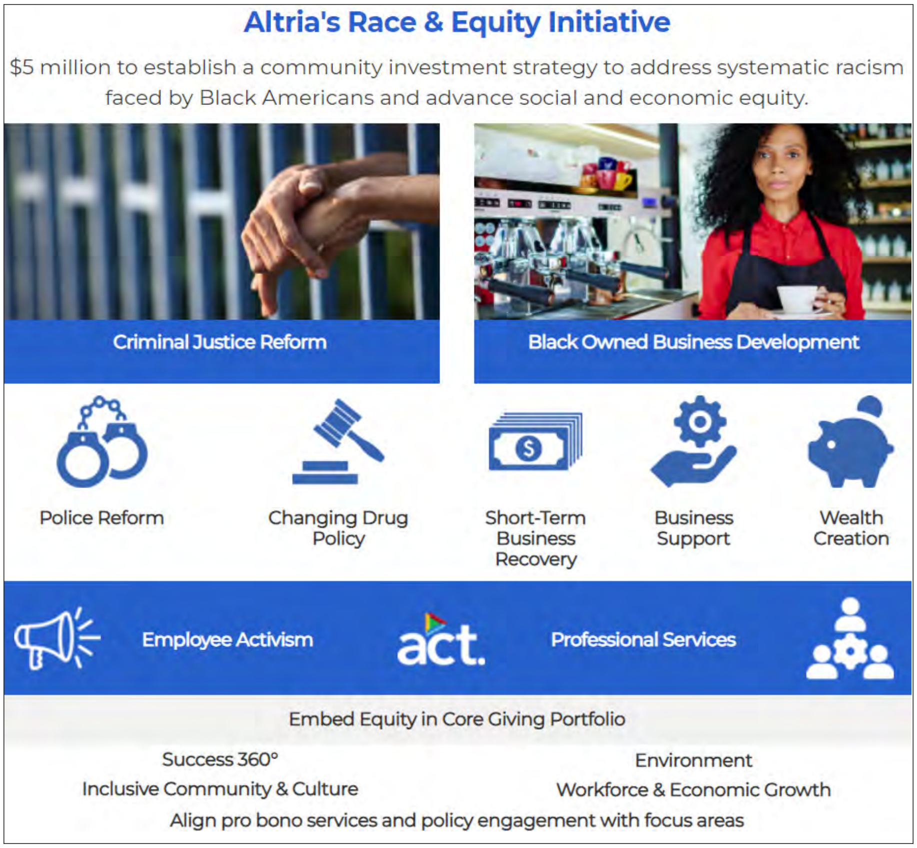


Source: Instagram post by ITG Brands' Dutch Masters brand cigars in June 2020 showing the company's support for Black Lives Matter and Black populations (Dutch Masters 2020).



Source: Instagram post by Swisher Sweets brand cigars in July 2020 that provides an update about the company's inclusion, diversity, and transformation strategy in support of Black Lives Matter (Trinkets & Trash 2020a).

B. Continued



Source: Screenshot from Altria's website in 2022 about its Race & Equity Initiative. Started in 2020, the initiative aims to address systemic racism and advance social and economic equity (Altria n.d.c).

Source: Screenshot from Reynold American's website in 2023 describing the Santa Fe Natural Tobacco Company Foundation and highlighting the foundation's financial assistance to "172 organizations serving Native American communities" to "support the preservation, promotion, and advancement of American Indian self-sufficiency and culture in the United States" (Reynolds American n.d.).

City & Lottery, Inc. v. United States 2012; Keighley 2012) and the 2016 deeming rule, statutory and constitutional challenges to FDA's 2011 text-and-image warnings for cigarette packaging (*R.J. Reynolds Tobacco Co. v. U.S. Food & Drug Administration* 2012), text warnings for cigars and pipe tobacco under the 2016 deeming rule (*Cigar Association of America v. U.S. Food & Drug Administration* 2020), 2020 text-and-image warnings for cigarettes (*R.J. Reynolds Tobacco Co. v. U.S. Food & Drug Administration* 2022), and statutory and constitutional challenges to FDA's application of the *Tobacco Control Act* to e-cigarettes under the 2016 deeming rule (*Nicopure Labs, LLC v. U.S. Food and Drug Administration* 2019; *Big Time Vapes v. FDA* 2020; Curfman 2021).

After conducting a detailed review of the scientific evidence, FDA's Tobacco Products Scientific Advisory Committee issued a lengthy report in 2011, concluding that prohibiting the sale of menthol cigarettes would benefit the public's health. Two manufacturers of menthol cigarettes, Lorillard and R.J. Reynolds Tobacco, then sued FDA, alleging conflict of interest for three members of the advisory committee (Dooren 2011). U.S. District Judge Richard J. Leon issued rulings in the tobacco companies' favor in 2012 and again in 2014 and ordered FDA not to use or rely on the report (Clarke 2016). These rulings were overturned by the U.S. Court of Appeals for the D.C. Circuit in 2016 (Clarke 2016).

The tobacco industry also acts at the state and local levels by contesting laws that regulate the sale of flavored tobacco products (Lester and Gagosian 2017). For example, policymakers passed ordinances prohibiting the sale of any flavored noncigarette tobacco product in New York City (adopted in October 2009) and Providence, Rhode Island (approved in January 2012) (City of Providence 2012; Brown et al. 2019). The tobacco industry filed lawsuits against both regulatory policies, but the ordinances were upheld after going through an appeals court process (Lester and Gagosian 2017). The industry has contested similar local policies in California, Illinois, Massachusetts, Minnesota, and Pennsylvania and in other Rhode Island communities (e.g., see Public Health Law Center [n.d.a]).

Additionally, R.J. Reynolds and tobacco industry trade groups challenged, through ballot measures at the state and local levels, laws prohibiting the retail sale of certain flavored tobacco products in California. Proponents of the California statewide flavored tobacco referendum included an attorney for Reynolds American Inc., and a lobbyist for the National Association of Tobacco Outlets and the Vapor Technology Association. Voters upheld the referendum (Agenbroad et al. 2020; Raymond 2022).

Preemption (which is described in more detail in Chapter 7) refers to the ability of a higher level of government to block or override the action of a lower level of government. Major tobacco companies and affiliated retailer trade groups have repeatedly gone to court to argue that the federal *Tobacco Control Act* preempts state and local restrictions on menthol and other flavored tobacco products (Twinamatsiko 2022). As of late 2022, this argument had been rejected by every court to consider it (Twinamatsiko 2022). The U.S. Supreme Court declined to hear R.J. Reynolds' challenges to flavor restrictions on these grounds in California in 2022, in Los Angeles County in 2023, and again in California in 2024 (Raymond 2022, 2024).

The tobacco industry also has a history of using litigation to deter the adoption of certain policies by local jurisdictions that are unable to defend against lengthy and costly legal challenges, even if such challenges are ultimately unsuccessful in court (Nixon et al. 2004). NCI Tobacco Control Monograph 21 discusses these approaches in more detail in the international context, concluding that, "The tobacco industry also uses the threat of litigation, with its attendant costs, and lobbying campaigns to deter governments from advancing tobacco control policies, especially in low- and middle-income countries" (NCI and WHO 2016, p. 16).

Economic Tactics of the Tobacco Industry

One of the most effective ways to prevent tobacco initiation and reduce consumption is to increase the price of tobacco products (Chaloupka et al. 2011; NCI and WHO 2016). Increasing the price of cigarettes may also be an effective way to reduce disparities in smoking behavior because several studies have shown that people from some racial and ethnic groups, people with substance use and mental health conditions, and people from lower income groups who smoke are more sensitive to price increases than are White people who smoke and those in higher income groups (Farrelly et al. 2001; Ong et al. 2010; Golden et al. 2016). Chapter 7 discusses the impact of price increases on disparate groups. The tobacco industry uses multiple strategies to avoid the imposition of tax increases, including front groups (i.e., seemingly independent organizations that are directed and funded by the tobacco industry in an effort to influence policy and public opinion), direct lobbying, and publicity campaigns (Apollonio and Bero 2007; Smith et al. 2013; Action on Smoking & Health 2021). Once tax increases are passed, to counter the reduced consumption among groups sensitive to price hikes, the tobacco industry uses price discounting marketing strategies (e.g., coupons) to reduce the cost of tobacco products for consumers, which, as noted in Chapter 4, are often received and redeemed by people from various disparate groups.

Tobacco companies also use multiple strategies to mitigate the impact of tax increases, such as stockpiling products, relabeling them, offering coupons, and overshifting and undershifting prices (Ross et al. 2017). Stockpiling, also known as forestalling or frontloading, is a method of oversupplying the marketplace before a tax increase goes into effect. This strategy is used to postpone the effects of a tax increase by (a) increasing product sales before the tax increase goes into effect and (b) reducing sales after the increase. The tobacco industry also relabels tobacco products in response to tax increases. For example, although roll-your-own tobacco and pipe tobacco differ in terms of physical characteristics, tobacco manufacturers relabeled roll-your-own tobacco as pipe tobacco in 2009 following a Federal excise tax on roll-your-own tobacco that created a large tax disparity between these two products (Tynan et al. 2015; Ross et al. 2017). As such, pipe tobacco was taxed at a lower rate than roll-your-own tobacco, resulting in a shift in sales to pipe tobacco during this time (Tynan et al. 2015).

Tobacco companies strategically use coupons to mitigate the effects of taxes. In one specific example, shortly before a 62-cent-per-pack increase in the national cigarette excise tax went into effect in 2009, Philip Morris USA contacted consumers—including women, youth, and other price-sensitive groups—and provided them with coupons to purchase cigarettes at a cost below the retail price (Ross et al. 2017). Additional details on price promotions can be found in the "Influences of the Tobacco Retail Environment" section of this chapter.

The term overshifting refers to raising the retail price of cigarettes by more than the tax increase (Ross et al. 2017). Overshifting can be used selectively on higher priced brands so that discount brands can remain at lower prices while company profits are maintained. However, overshifting has the potential to undermine the pro-equity impact of excise taxes because discount brands typically purchased by price-sensitive people with lower incomes who smoke are offset less due to cigarette excise tax increases, while premium and ultra-premium brands targeted to people with higher incomes who smoke are offset more due to tax increases (Henriksen et al. 2019). Thus, this practice attenuates the primary intent of increasing tobacco taxes, which is to discourage cigarette purchases and reduce tobacco use (Evans et al. 1999; Henriksen et al. 2019). Brock and colleagues (2016) reported that the tobacco industry overshifted prices on premium-brand cigarettes—Marlboro Gold and Camel Blue—in response to a 2013 tobacco tax increase in Minnesota.

In the practice of undershifting, the industry lowers the retail price in response to a tax increase to maintain price-sensitive consumers. Price increases for tobacco products are timed so that consumers can gradually adjust to price fluctuations (Ross et al. 2017). Tobacco companies can increase profits by raising prices for less price-sensitive consumers. In addition, companies can lower prices through the use of coupons to those who are more price sensitive, such as young adults who smoke and people of lower income levels who smoke (Levy et al. 2019).

Tobacco companies also change quantities in packages to influence the behavior of consumers. In a review of historical tobacco industry documents from 1980 to 2009, Persoskie and colleagues (2019) reported that tobacco companies had extensive consumer research on the use of smaller packages for tobacco products—which can be sold at lower per-package prices—as a marketing tool to promote the trial of a product and to offset tobacco tax increases. Larger packages, on the other hand, can have higher per-unit value and suggest an economical option to consumers. Federal regulations require packs of cigarettes to contain a minimum number of 20 cigarettes, but no such minimum pack size exists for cigars and other combusted tobacco products. Delnevo and colleagues (2017) found that cigar companies take advantage of small package sizes (e.g., packages containing only two or three cigars) to attract consumers to low-priced tobacco products and ultimately facilitate their continued smoking behavior.

Cruz and colleagues (2010) described price-related marketing strategies in "focus communities" used by La Tanisha Wright, who was a former trade marketing and controlling manager for tobacco manufacturer Brown & Williamson. Wright later became a tobacco control advocate. Wright disclosed that Brown & Williamson used the term *focus communities* to hide "allusions to variations in marketing due to race and ethnicity;" focus stores served predominantly lower income, urban, Black communities with high sales of menthol cigarettes (Cruz et al. 2010, p. S147). Wright, who worked for Brown & Williamson in Detroit, Michigan, and Atlanta, Georgia, from 2001 to 2004, reported providing premium tobacco contracts to focus stores. These contracts allowed focus stores to sell their tobacco products at lower prices than in non-focus stores. For example, focus stores could receive manufacturer rebates that let them reduce the retail price of cigarettes by up to $1.50 per pack for an entire year, and non-focus stores would receive rebates that let them reduce the retail price of cigarettes by only $0.50 per pack for only 6 months. Wright reported that focus stores also received more allocations of coupons and that these coupons provided an incentive for consumers to use a particular tobacco product (Cruz et al. 2010).

According to Brown-Johnson and colleagues (2014), in the late 1990s and early 2000s, Philip Morris Companies, Inc., and R.J. Reynolds developed credit cards to attract lower income female consumers. Several credit cards were piloted, including the Marlboro Unlimited Card, Marlboro Club Card, and Camel Gas Cash card. The Camel Gas Cash card was preloaded with $15 that could be redeemed for gasoline. Teams at Philip Morris proposed the Pioneer Card, with the target population for the card described by the company as "unbanked" (i.e., people without a checking or savings account) (Federal Deposit Insurance Corporation 2022). This population consisted mainly of urban, lower income Latino and African American women with below-average educations.

Corporate Social Responsibility Tactics of the Tobacco Industry

In the 1990s, the tobacco industry received extensive negative news coverage linked to multiple lawsuits and the release of previously confidential documents that described and exposed its marketing, advertising, scientific research, and political practices (Hirschhorn 2004). To promote a positive image, the tobacco industry embraced a corporate social responsibility model and campaign, which included the allocation of funding to corporate philanthropy (Hirschhorn 2004; NCI 2008; Tesler and Malone 2008; Fooks et al. 2013). As described by Luo and Bhattacharya (2006), the corporate social responsibility model includes a company's activities related to a perceived commitment and accountability to stakeholders and society. The largest U.S.-based tobacco companies (Philip Morris USA, Altria, and Reynolds American, Inc.) all appeared to embrace the corporate social responsibility model (McDaniel et al. 2016).

Today, tobacco companies share and promote information about their corporate social responsibility practices through a large online presence and in the news media. McDaniel and colleagues (2016) reported that in February 2014, Altria, Philip Morris USA, Lorillard, and Reynolds American, Inc., had 24, 40, 15, and 50 corporate social responsibility web pages, respectively. These web pages described several focus areas of corporate social responsibility, including funding for the arts, reducing hunger or poverty, philanthropy in the local community, education, disaster relief, smoking cessation, youth tobacco prevention, and domestic violence, among others. Philip Morris USA and Altria's web pages included a goal of contracting with women- and minority-owned businesses as evidence of responsible supply chain management. Later, McDaniel and colleagues (2018) found that U.S. media coverage of social responsibility activities by tobacco companies often occurred at the local level (e.g., through local newspapers) and in the South, which is home to headquarters of several tobacco companies. In a content analysis of 649 news items, the majority (77.2%) conveyed a positive impression of the tobacco industry. Coverage of funding for education and arts, domestic violence programs, disaster relief, food aid, and tobacco company partnerships with local governments or tobacco company employees volunteering was most likely to have a positive slant toward the tobacco industry. Conversely, coverage of funding for youth smoking prevention, other youth issues, and disease prevention was least likely to have a positive slant, and the slant of coverage about funding for "minority issues" and the environment was statistically indistinguishable from that of donations in general (McDaniel et al. 2018).

Several studies have focused on the corporate social responsibility activities of Philip Morris USA and its parent company, Altria (Hirschhorn 2004; Tesler and Malone 2008; Smith et al. 2016). Hirschhorn (2004) reported that during the litigation that resulted in the Master Settlement Agreement, Philip Morris USA developed the *Philip Morris in the 21st Century* campaign, also known as PM21, a public relations strategy to improve the company's image by emphasizing its social responsibility activities. Later, Tesler and Malone (2008) reported that, based on tobacco industry documents (Burson-Marstellar 2000), target groups for the PM21 campaign were opinion leaders, suburban parents, members of Generation X, Hispanic people, active moms, and women from diverse racial and ethnic groups. Philip Morris, which had previously focused on market success, had changed its narrative for both the public and its employees to that of a "good corporate citizen" (Hirschhorn 2004; Tesler and Malone 2008). Although the PM21 campaign yielded more positive media coverage for tobacco companies than did the social responsibility activities of the tobacco industry in general (McDaniel et al. 2018), analyses of internal company documents reveal that Philip Morris's then new responsibility-oriented narrative was unpersuasive to company employees (McDaniel and Malone 2015).

In 2017, the Foundation for a Smoke-Free World (FSFW) was established with funding from Philip Morris International (*The Lancet* 2017; Yach 2017). According to Derek Yach, the inaugural president of FSFW, the aim of FSFW is to eliminate cigarette smoking worldwide and help people who smoke switch to reduced-risk tobacco products (*The Lancet* 2017; Yach 2017). Yach also argued that a harm-reduction approach is the best way to reduce tobacco-related harm (Yach 2017). Philip Morris International committed $1 billion in funding to FSFW over a 12-year period (*The Lancet* 2017) and subsequently modified FSFW's founding agreements to allow for more interaction between Philip Morris International and the foundation (Cohen et al. 2021). An analysis of

FSFW's 2019 tax return revealed that nearly one-third of its $80 million annual budget paid salaries, public relations, and legal fees; many grants were for public relations and advocacy projects (Cohen et al. 2021). In a review of peer-reviewed and pre-print articles funded by FSFW, Legg, Clift and Gilmore concluded that the publications were "safe" research "which distract attention from industry harms, frame industry products as part of the 'solution' and promote interventions that minimise damage to product sales" (Legg et al. 2023, p. 4). In 2023, after accepting a final grant of $122.5 million from Philip Morris, FSFW announced that its agreement with Philip Morris International was terminated (Tobacco Tactics 2023). Then, in December 2023, FSFW changed its name to Global Action to End Smoking, Inc. (New York State, Department of State, Division of Corporations n.d.).

The corporate social responsibility activities of tobacco companies have often been criticized. For example, the World Health Organization (2003, p. 1) stated that corporate social responsibility among tobacco companies is an "inherent contradiction," and Tesler and Malone (2008, p. 2123) reported that Philip Morris's image makeover activities "explicitly linked philanthropy to government affairs and used contributions as a lobbying tool against public health policies." The United Nations General Assembly (2012, p. 5) recognized a "fundamental conflict of interest between the tobacco industry and public health." Moreover, several studies have argued that improving the tobacco industry's image through social responsibility activities at the corporate level allows the industry to access policymakers, make political allies, and affect legislation on tobacco control (Tesler and Malone 2008; Apollonio and Malone 2010; McDaniel et al. 2016). The World Health Organization (2017) more recently noted that the FSFW and similar entities are "working to further the interests [of the tobacco industry]" and stated that "if [Philip Morris International] were truly committed to a smoke-free world, the company would support [strengthening implementation of the Framework Convention on Tobacco Control policies]. . . . Instead, [Philip Morris International] opposes them. . . . WHO will not partner with the Foundation."

Community Tactics of the Tobacco Industry

Tobacco companies have long promoted themselves in racial and ethnic communities and other underserved communities by sponsoring organizations and events. Beginning in the 1990s, researchers highlighted the role of such tactics in promoting tobacco products to a variety of groups, including African American and Latino populations and women, by making an "enormous investment in civic, social, political, media, and fraternal organizations serving these respective populations" (Robinson et al. 1992, p. S24). The 1998 Surgeon General's report on tobacco use among four racial and ethnic groups also highlighted the tobacco industry's long-term practice of providing employment opportunities to specific population groups and making financial donations to causes, community-serving groups, and political organizations that advocate for social justice issues (USDHHS 1998). Research, including from industry documents, suggests that the tobacco industry has gotten involved with communities to normalize tobacco use, develop brand loyalty, and build opposition to health-protective tobacco control policies (Yerger and Malone 2002; Portugal et al. 2004; Offen et al. 2008; Wailoo 2021; Yerger 2022). For example, Brown & Williamson (B&W), the original manufacturer of Kool brand cigarettes, explained the intent of this association with particular transparency: "Association with a national civil rights organization can be viewed, in its most positive sense, as an endorsement of Brown & Williamson and its products to the minority community. . . . Clearly, the sole reason for B&W's interest in the black and Hispanic communities is the actual and potential sales of B&W products within these communities and the profitability of these sales"(MAB 1984, p. 1).

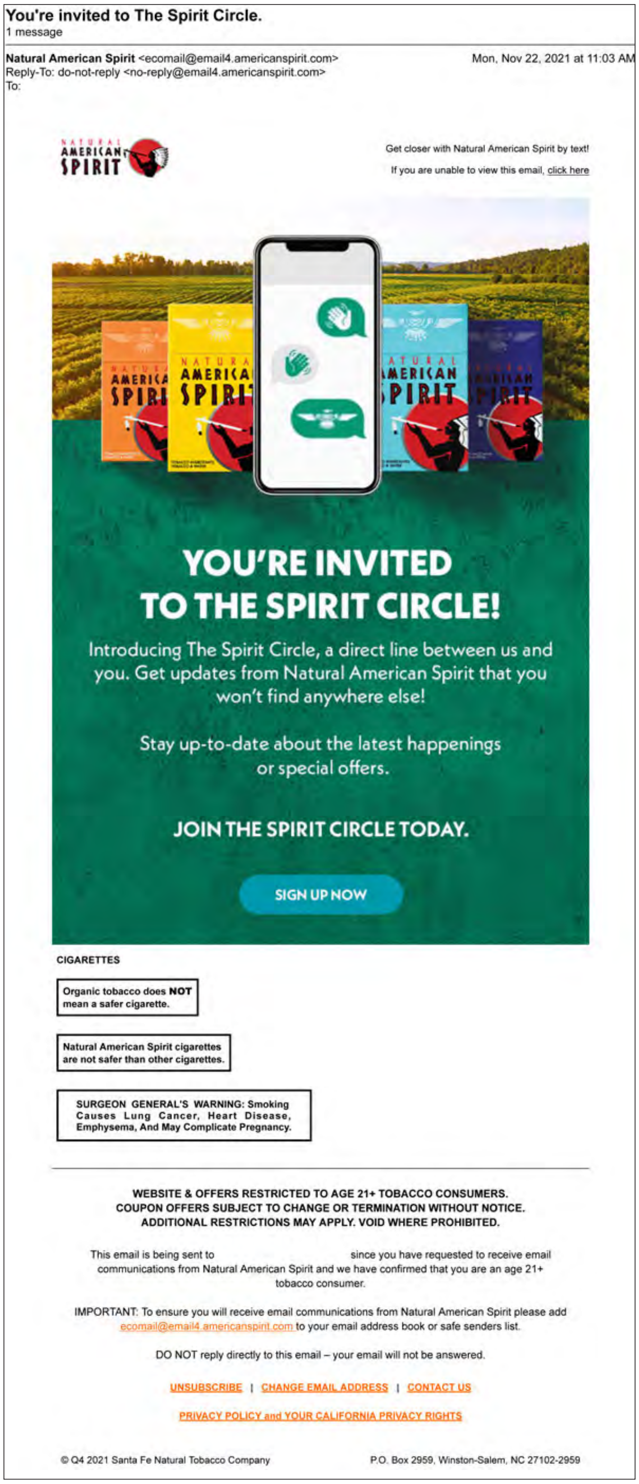
The sections that follow provide examples of the involvement of tobacco companies in Black or African American, Hispanic or Latino, American Indian and Alaska Native, Asian American and Pacific Islander, sexual orientation and gender identity, and rural population groups; with people experiencing homelessness; and with people with behavioral health conditions. Figure 5.2 provides present-day examples of these tactics, and Figure 5.4 provides examples of how the tobacco industry uses cultural appropriation and racial and ethnic stereotyping in commercial tobacco advertising.

Although this section focuses on tobacco industry activities in communities, it is important to acknowledge innovative efforts that have emerged from communities to counter these activities, for example:

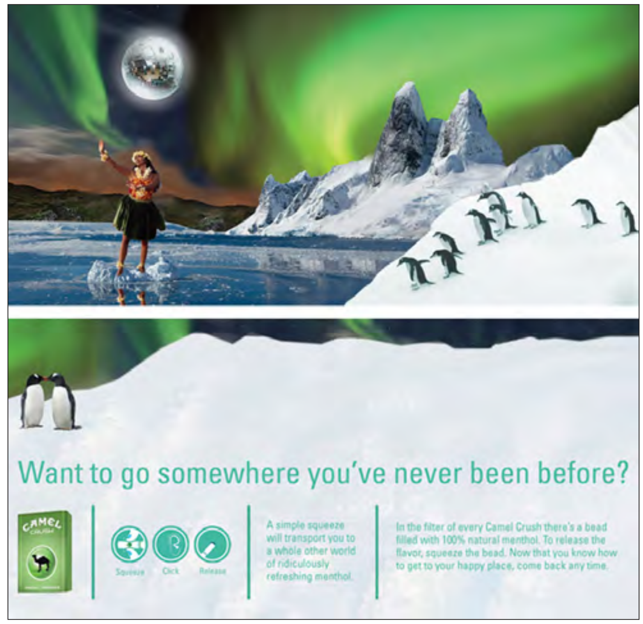
- Minnesota's *Keep Tobacco Sacred* campaign and California's *Stop the Sale of Our Image: Don't Buy the Lie* campaign leverage messages about Indigenous community assets to reclaim Native culture and restore the traditional meanings of tobacco (North Coast Journal 2003; D'Silva et al. 2018; National Native Network n.d.).

- Organizations that serve LGBTQI+ populations, such as the Bradbury-Sullivan LGBT Community

Figure 5.4 Examples of cultural appropriation and stereotyping in commercial tobacco advertising



Source: Email from American Spirit brand tobacco products in November 2021 inviting recipients to sign up for The Spirit Circle to receive text messages about promotions for the company's products (Trinkets & Trash 2021e).



Source: Ad for R.J. Reynolds Tobacco's Camel Crush brand mentholated squeezers coopting Native Hawaiian imagery (date unknown) (Stanford Research into the Impact of Tobacco Advertising n.d.b).

Source: Starbuzz hookah tobacco in Exotic Asian Persuasion flavor in 2016 (Stanford Research into the Impact of Tobacco Advertising 2016a).

Center in Allentown, Pennsylvania, collaborate with public health partners, such as the American Lung Association, to promote smokefree Pride events (Bradbury-Sullivan LGBT Community Center n.d.).

- The Center for Black Health & Equity initiated "No Menthol Sunday," an annual faith-based observance day to engage faith communities in discussions about the impact of menthol cigarettes on community health (The Center for Black Health & Equity 2023).

- In 2023, the Hawaii Department of Health, Coalition for a Tobacco-Free Hawai'i, and Hawai'i Public Health Institute launched the *Stronger Together* campaign, noting that "the people of Hawai'i are fighting back and holding Big Tobacco accountable for the harm it causes." The campaign includes messages from tobacco industry documents about industry targeting of Native Hawaiian people, LGBTQI+ populations, people with lower incomes, people with behavioral health conditions, and youth (Hawaii State Department of Health n.d.).

Black or African American Communities

For decades, the tobacco industry has provided financial support to African American community and civil rights organizations (Robinson et al. 1992; USDHHS 1998; Yerger and Malone 2002). According to industry documents, these efforts were often conducted to build opposition to health-protective tobacco control policies, such as cigarette excise taxes and bans on provisions of free samples of cigarettes, and to build support for pro-tobacco policies (Yerger and Malone 2002; Yerger 2022). Similarly, tobacco companies have developed relationships with leaders and governing committees of African American organizations. For example, Altria reported providing charitable contributions in 2021 to several African American business and civil rights groups, educational entities, and arts organizations (Altria n.d.b).

For many decades, the tobacco industry was a commercial sponsor for the African-American press at a time when resources were scarce, and the industry used the resulting platform to embed the use of cigarettes within African-American communities and Black identity (Jones and Perry Jr 2022). From the Civil Rights era onward, the tobacco industry has supported the National Newspaper Publishers Association (formerly the National Negro Publishers Association [NNPA]), a group representing more than 200 African American newspapers and more recently electronic media outlets, with advertising and NNPA-related sponsorships, in turn garnering media support for industry positions (McCandless et al. 2012; Mangun and Perry Jr 2020). Marginal comments on one internal tobacco-industry document indicate that the industry provided such funding with the expectation of a quid pro quo (McCandless et al. 2012).

In 2016, Reynolds American, Inc., hosted a discussion titled "Panel Discussion, Criminal Justice Reform—Hosted by RAI Company" at the annual convention of the NNPA. A Black former congressmember and the former president of a national organization serving Black law enforcement were listed as part of this program. A year earlier, Reynolds American, Inc., had contributed $250,000 to the National Newspaper Publishers Association (Levin 2017). These exchanges could obscure a clear understanding of the impacts that may occur when proposed restrictions on—for example, menthol cigarettes and flavored cigars (FDA 2021a; *Federal Register* 2022a, b)—are finalized in diverse communities across the United States.

Hispanic American Communities

Hispanic American people are the largest ethnic group in the United States. Like other industries, tobacco companies have focused a substantial percentage of their marketing efforts on this diverse, growing, and geographically clustered group. In market research, R.J. Reynolds determined that brand choices among Hispanic people were influenced by SES, experiences of discrimination, and "not feeling wanted and appreciated, 'which in turn created' a strong need for recognition" (Iglesias-Rios and Parascandola [2013], p. e17, citing Research Resources [1988]; R.J. Reynolds Records Collection [1989]). The company leveraged these findings to inform advertisements that incorporated the Spanish language and Hispanic culture. R.J. Reynolds also sought to "establish a presence and a positive image within the Hispanic community" by participating in Cinco de Mayo celebrations, sponsoring local events, and performing outreach to such Hispanic community leaders; Hispanic civic, educational, and social organizations; and Hispanic members of Congress (Iglesias-Rios and Parascandola 2013, p. e20).

For 2021, Altria, which is headquartered in Richmond, Virginia, reported making charitable contributions to several Hispanic-serving business, civic, and educational organizations (Altria n.d.b).

American Indian and Alaska Native Communities

Tobacco companies have also built relationships with American Indian and Alaska Native organizations, providing sponsorships and charitable contributions to their community organizations. Lempert and Glantz (2019) found that, in 2001, Philip Morris granted $476,161 to an initiative that promoted healthy lifestyles among

American Indian youth in Arizona, Montana, New Mexico, Oklahoma, and South Dakota.

The tobacco industry has misappropriated American Indian imagery in its marketing tactics since at least the 1930s (D'Silva et al. 2018). Tobacco industry documents reveal that the industry marketing has incorporated the cultural significance of ceremonial tobacco to "validate" commercial tobacco (D'Silva et al. 2018). These tactics were heightened by the emergence of the Santa Fe Natural Tobacco Company (SFNTC) in 1982, maker of the American Spirit brand of "natural" cigarettes, which has coopted images of traditional headdresses and peace pipes on packaging (D'Silva et al. 2018). The SFNTC Foundation was founded in 1997 to provide grants to the American Indian community to "support the preservation, promotion, and advancement of American Indian self-sufficiency and culture in the United States" (Lempert and Glantz 2019; Reynolds American n.d.). As cited in D'Silva and colleagues (2018), facing criticism in 2000 about its misappropriation of American Indian imagery, SFNTC executives cited the company's charitable giving, saying, "We'd like to think that we're giving something back to these people in exchange for using this imagery" (Crellin 2000). As with the industry's expectations of a "quid pro quo" for its financial support of the National Newspaper Publishers Association, such statements from tobacco industry executives provide insight into the industry's transactional motives for corporate giving (McCandless et al. 2012).

In 2002, Reynolds American, Inc. acquired SFNTC (Lempert and Glantz 2019). According to a 2008 corporate social responsibility report from Reynolds American Inc., this foundation donated in 2006 and 2007 nearly $500,000 to American Indian and Alaska Native educational, cultural, arts, and civil rights organizations (Reynolds American 2009). The SFNTC Foundation remains active (Reynolds American n.d.).

Asian American and Pacific Islander Communities

Research is limited on the tobacco industry's involvement in Asian American and Pacific Islander communities. An earlier study of tobacco industry documents found that industry representatives understood the importance of the Asian American and Pacific Islander market as early as the late 1980s. Native Hawaiians were specifically viewed as an important market for menthol cigarettes, as an industry document noted, "the menthol smoker in Hawaii seems to be the native" (All Ways Advertising 1985, p. 5). Philip Morris considered using "corporate goodwill" strategies to reach out to the Asian American and Pacific Islander communities via corporate contributions and sponsorships. In 1988, Philip Morris provided corporate sponsorship for various Asian American and Pacific Islander community-sponsored festivals, races, or concerts, many of which were open to people of all ages (Muggli et al. 2002). In its report about charitable contributions in 2021, Altria (n.d.b) reported giving to multiple foundations and organizations serving Asian populations and their business interests.

Sexual Orientation and Gender Identity Groups

The tobacco industry has targeted the LGBTQI+ community in multiple ways. The industry has not only advertised in magazines that market to this group, as described previously in this chapter, but has also positioned itself indirectly as a supporter of this community by touting the industry's donations to organizations focused on addressing HIV/AIDS and its support for LGBTQI+ pride. In 2002, Philip Morris proclaimed itself, in an advertisement in *PRIDE .02* (a U.S.-based gay pride magazine), as one of the largest corporate contributors to the fight against AIDS (Stevens et al. 2004).

Offen and colleagues (2008), who interviewed 74 leaders of LGBTQI+ organizations in the United States between 2002 and 2004, found that 22% reported accepting funding from the tobacco industry. These leaders noted the moral dilemma in taking money from the tobacco industry but also reported the fiscal need for funding, suggesting the importance of efforts to supplant tobacco industry financial support to LGBTQI+ causes with sustainable support from sources that do not profit from the sale of products that harm the health of community members. For 2021, Altria reported charitable contributions to multiple LGBTQI+-serving legal, business, and civil rights organizations (Altria n.d.b).

Rural Communities

Exposure to tobacco marketing via event sponsorships has been associated with increased risk of smoking (DiFranza et al. 2006). Before FDA banned tobacco company sponsorship of sports and entertainment events in 2010, as directed in the *Tobacco Control Act*, Ling and colleagues (2010) reported that tobacco companies sponsored sporting events, such as rodeos, to gain access to rural audiences. Rodeos are popular among children, and according to tobacco industry documents, an estimated 25–30% of attendees at rodeos are younger than 18 years of age (Ling et al. 2010). Additionally, from 1974 to 2009, before the acquisition of the U.S. Smokeless Tobacco Company (USSTC) by Altria Group, Inc. in 2009, the USSTC awarded more than $4 million in rodeo college scholarships (Morton 2009). USSTC was also a sponsor of the National Intercollegiate Rodeo Association College National Finals Rodeo competition, providing free samples of Copenhagen and Skoal smokeless tobacco at the event (Morton 2009; Ling et al. 2010).

More recently, Altria's list of 2022 regional charitable giving includes donations to the organizations serving rural communities and farmers in multiple Southeastern states (Altria 2022).

People Experiencing Homelessness and Those with Behavioral Health Conditions

The tobacco industry has also targeted marketing toward people experiencing homelessness and people with behavioral health conditions (Apollonio and Malone 2005). For example, R.J. Reynolds's Project SCUM (subculture urban marketing) initiative was aimed at "street people" and gay men in San Francisco (R.J. Reynolds Records Collection 1995). In a review of tobacco industry documents, Apollonio and Malone (2005) found that, in 1988, Philip Morris awarded a 2-year grant of $100,000 to the National Coalition for the Homeless, then requested that the Coalition for the Homeless in New York perform outreach to lawmakers to encourage them to focus on ending homelessness instead of focusing on passing smokefree indoor air laws. More recently, Altria's list of 2022 regional charitable giving includes donations to organizations working to address homelessness and to provide or improve homes for veterans, first responders, and their families (Altria 2022).

People with behavioral health conditions—including any mental health conditions or substance use disorders in the past year—consume as much as 40% of cigarettes smoked by adults in the United States (Substance Abuse and Mental Health Services Administration 2013). Research into tobacco industry documents found evidence of indirect promotion of smoking to psychiatric patients and opposition to rules banning smoking in mental health facilities through financial support and ties to advocacy groups for patients with schizophrenia (Prochaska et al. 2008). Altria's list of 2022 charitable giving (Altria 2022) identifies donations to organizations serving the behavioral health needs of LGBTQI+ individuals and providing physical and psychological rehabilitation services to U.S. combat veterans.

Although peer-reviewed research is lacking on the extent to which the tobacco industry's ties to these populations persist, newer efforts to promote noncigarette tobacco products to people with behavioral health conditions have emerged. For example, as of 2022, the Arizona-based Vape A Vet project, a nonprofit organization supported by e-liquid manufacturer BRV Liquids, offered free e-cigarettes (including electronic smoking devices used to deliver cannabis) to veterans "to allow unfettered access to veterans wounded in battle and dealing with PTSD [posttraumatic stress disorder]" (Vape A Vet n.d.). Vape A Vet's Twitter account shared branded content about available vaping products, and Twitter users posted testimonials about vaping, suggesting the promotional potential of engaging with the veteran community, particularly those with PTSD.

A systematic review found that people with PTSD show high levels of nicotine dependence and heavy tobacco use (Pericot-Valverde et al. 2018), suggesting they are an important priority population to reach with tobacco cessation treatments, including behavioral therapies and FDA-approved medications. However, tobacco products, including e-cigarettes, are not a safe or effective treatment for PTSD. Nicotine withdrawal is commonly accompanied by symptoms of anxiety and depression, and relief of these symptoms may be an important component of addiction among people who use tobacco products (USDHHS 2014). Furthermore, whereas cigarette smoking is associated with worse mental health symptoms and outcomes among people with behavioral health conditions, quitting smoking is associated with improvements in mental health (Prochaska et al. 2017).

Tactics of the Tobacco Industry Summary

As also documented in the 1998 Surgeon General's report, the tobacco industry has used political, legal, economic, corporate social responsibility, and community tactics to circumvent tobacco control efforts, including those intended to promote tobacco-related health equity. Tactics include direct lobbying through campaign contributions and donations to policymakers, sponsoring efforts to oppose tobacco control policies in ballot initiatives, and funding political organizations that represent the interests of minoritized groups. The industry also engages in legal tactics by contesting tobacco control legislation at the local, state, and federal levels (Ulucanlar et al. 2016).

Tobacco companies have used several economic strategies to mitigate the impact of tax increases on profits, including stockpiling, relabeling tobacco products, offering coupons, overshifting and undershifting prices, and changing quantities in packages (Tynan et al. 2015; Ross et al. 2017). These tactics undermine tobacco control efforts, such as tax increases, which are aimed at protecting populations that are already targeted by the industry. Further, to promote a positive image, the tobacco industry has embraced a corporate social responsibility model, which includes funding corporate philanthropy (Tesler and Malone 2008; Fooks et al. 2013).

Tobacco companies have promoted themselves in specific communities by funding and donating to various political groups and nonprofit organizations and by sponsoring organizations and events in Black or African American, Hispanic American, American Indian and Alaska Native, Asian American and Pacific Islander, and LGBTQI+ communities. The companies have also promoted themselves to people living in rural areas, people experiencing homelessness, and people with behavioral health conditions, including veterans. Research suggests that the tobacco industry donates to these communities to normalize tobacco use, develop brand loyalty, and build opposition to tobacco control policies that are intended to protect public health (Yerger and Malone 2002; Portugal et al. 2004; Offen et al. 2008). These community-level strategies and practices of the tobacco industry continue to exacerbate tobacco product-related disparities and inequities.

Summary of the Evidence

This chapter applied the HAVE (Host-Agent-Vector-Environment) model (Figure 5.1) to examine multiple industry activities that encourage a social environment of normalized tobacco use patterns, which can differ by population group and neighborhood characteristics. The studies reviewed in this chapter demonstrate disparities in the tobacco retail environment (e.g., community-level retail density) and consumer or store environment (e.g., advertising, promotions, pricing). The density of tobacco retailers is greater in neighborhoods with higher percentages of Black and African American residents and lower income residents in urban areas across the United States. Mixed evidence also suggests that tobacco retailer density is also greater in neighborhoods with greater percentages of Hispanic or Latino residents. Advertisements for menthol-flavored cigarettes and for cigars and cigarillos are also common in neighborhoods with greater percentages of Black residents, youth, and residents of lower SES. The evidence also suggests that the price of cigarettes is lower in neighborhoods with higher percentages of minoritized racial and ethnic groups, youth, and lower income residents. These targeted marketing and advertising techniques can encourage experimentation and initiation of tobacco product use among people who have never used tobacco.

The evidence described in this chapter reaffirms the conclusions of previous Surgeon Generals' reports that a causal association exists between tobacco marketing and the initiation and use of tobacco products, especially among youth. As communication technologies have evolved, the introduction of social media platforms—such as Twitter, Facebook, and Instagram—has caused a seismic shift in how the tobacco industry interacts with, recruits, and maintains consumers. Influencer marketing, sponsored content (e.g., advertorials, blogs, and brand journalism), and native advertising (i.e., advertising that is integrated seamlessly into existing content) represent new frontiers for advertising and marketing commercial tobacco products and pose serious challenges for tobacco prevention and control. Because these tactics allow for more focused and segmented targeting, they have the potential to exacerbate existing disparities in initiation and use of specific products. Efforts to monitor and counter these tactics require innovative methods and dedicated resources.

A growing body of evidence suggests that middle and high school students' exposure to e-cigarette advertising and promotional efforts via social media platforms is associated with e-cigarette initiation and daily use among those in this population. The evidence from the studies reviewed in this chapter further demonstrates disparities by race and ethnicity, SES, and sexual orientation and gender identity in receipt and use of coupons or discounts on tobacco products. The wide array of media platforms (e.g., social media, online, television, etc.) enables the tobacco industry to continue to utilize targeted marketing and advertising of tobacco products to adolescents and adults.

Finally, the tobacco industry continues to employ political, legal, economic, public relations, and community tactics that undermine tobacco prevention and control efforts. The evidence shows that tobacco companies seek to improve how they are perceived in minoritized racial and ethnic communities by funding and donating to various political groups and nonprofit organizations and by sponsoring organizations and events. Through these tactics, the industry promotes normalization of tobacco use and brand loyalty and builds opposition to health-protective tobacco control policies (Yerger and Malone 2002; Portugal et al. 2004; Offen et al. 2008; Wailoo 2021; Yerger 2022). The industry also utilizes economic tactics, such as price discounts and coupons, to minimize the impact of tax increases on profits and consumption. These tactics have the potential to hinder tobacco prevention and control efforts aimed at advancing health equity.

Conclusions

1. Tobacco marketing in general and marketing for menthol cigarettes in particular are more prevalent in neighborhoods with greater percentages of African American residents or of residents with lower incomes compared with neighborhoods with lower percentages of African American residents or of residents with higher incomes.

2. Communities with high concentrations of people from diverse racial and ethnic population groups, residents with lower income, and adolescents tend to have greater availability of cheaper tobacco products, including menthol cigarettes, that are widely available at local retailers.

3. Members of the LGBTQI+ community and people with lower socioeconomic status are more likely to receive and use a coupon or price discount code to purchase tobacco products compared with their heterosexual and cisgender counterparts and those of higher socioeconomic status. Use of coupons appears to increase the likelihood of tobacco initiation among people who have never used tobacco and to reduce the likelihood of quitting among people who use tobacco.

4. Seismic shifts in the media environment have produced rapid changes in marketing strategies for commercial tobacco. Tactics such as influencer marketing that allow more focused and segmented targeting have the potential to exacerbate existing disparities in tobacco initiation and use.

5. The tobacco industry continues to employ political, legal, economic, corporate social responsibility, and community tactics to enhance its image among the communities it targets in marketing—including minoritized racial and ethnic groups and sexual orientation and gender identity groups that are subject to tobacco-related health disparities—and/or to counter efforts that would benefit public health and advance health equity.

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Chapter 5 Appendix

Appendix 5.1: Search Terms Used for Chapter 5 *465*

Appendix 5.1: Search Terms Used for Chapter 5

Table 5A.1 Search terms used for Chapter 5

Topic	Search terms
Tobacco industry influence	
Retail (Indexes: PubMed and Web of Science Core Collection)	**PubMed:** ((tobacco[Title] OR cigarettes[Title] OR cigarette[Title] OR smoking[Title] OR cigar[Title] OR cigarillo[Title] OR smoking[Title] OR "tobacco industry"[Title] OR hookah[Title] OR snus[Title]) AND (ethnic[Title/Abstract] OR disparity[Title/Abstract] OR disparities[Title/Abstract] OR inequality[Title/Abstract] OR disadvantage[Title/Abstract] OR race[Title/Abstract] OR racial[Title/Abstract] OR minority[Title/Abstract] OR "African American"[Title/Abstract] OR "African-American"[Title/Abstract] OR "African"[Title/Abstract] OR black[Title/Abstract] OR Latino[Title/Abstract] OR Hispanic[Title/Abstract] OR Asian[Title/Abstract] OR "Native American"[Title/Abstract] OR "Alaska Native"[Title/Abstract] OR "Pacific Islander"[Title/Abstract] OR economic[Title/Abstract] OR socioeconomic[Title/Abstract] OR SES[Title/Abstract] OR low-income[Title/Abstract] OR poverty[Title/Abstract] OR gay[Title/Abstract] OR lesbian[Title/Abstract] OR bisexual[Title/Abstract] OR transgender[Title/Abstract] OR homosexual[Title/Abstract] OR LGBT[Title/Abstract] OR homeless[Title/Abstract] OR mentally ill[Title/Abstract] OR substance use[Title/Abstract] OR geographic[Title/Abstract] OR rural[Title/Abstract] OR occupation[Title/Abstract])) AND (retail[Title] OR shop[Title] OR retailer[Title] OR retailers[Title] OR pharmacy[Title] OR supermarket[Title] OR grocer[Title] OR grocery[Title] OR vendor[Title] OR supermarket[Title] OR "gas station"[Title] OR outlet[Title] OR price[Title] OR density[Title] OR marketing[Title] OR advertising[Title] OR ad[Title] OR ads[Title] OR promotion[Title] OR placement[Title] OR signs[Title] OR discount[Title] OR display[Title] OR "point of sale"[Title] OR "point-of-sale"[Title] OR "residence characteristics"[Title] OR neighborhood[Title] OR targeting[Title]) **Web of Science Core Collection:** TITLE: (tobacco OR cigarettes OR cigarette OR smoking OR cigar OR cigarillo OR smoking OR "tobacco industry" OR hookah OR snus) AND TITLE: (ethnic OR disparity OR disparities OR inequality OR disadvantage OR race OR racial OR minority OR African American OR African-American OR African OR black OR Latino OR Hispanic OR Asian OR Native American OR Alaska Native OR Pacific Islander OR economic OR socioeconomic OR SES OR low-income OR poverty OR gay OR lesbian OR bisexual OR transgender OR homosexual OR LGBT OR homeless OR mentally ill OR substance use OR geographic OR rural OR occupation) AND TITLE: (retail OR shop OR retailer OR retailers OR pharmacy OR supermarket OR grocer OR grocery OR vendor OR supermarket OR gas station OR outlet OR price OR density OR marketing OR advertising OR ad OR ads OR promotion OR placement OR signs OR discount OR display OR point of sale OR point-of-sale OR residence characteristics OR neighborhood OR targeting) Refined by: [excluding] DOCUMENT TYPES: (MEETING ABSTRACT) AND LANGUAGES: (ENGLISH) **Timespan:** 2008–2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC

Table 5A.1 Continued

Topic	Search terms
Marketing and media (Index: PubMed)	**Search #1:** (tobacco[ti] OR cigarette*[ti] OR smoking[ti] OR smoker*[ti] OR nicotine[ti] OR juul[ti] OR cigar*[ti] OR cigarillo*[ti] OR snus[ti] OR smokeless[ti] OR heat-not-burn[ti] OR hookah[ti] OR waterpipe[ti] OR secondhand smoke[ti] OR second-hand smoke[ti]) AND (disparity[tw] OR disparities[tw] OR inequalit*[tw] OR equity[tw] OR inequit*[tw]) (race[tw] OR racial*[tw] OR ethnic*[tw] OR black*[tw] OR African American*[ti] OR Asian American*[ti] OR minority[tw] OR minorities[tw] OR Hispanic*[ti] OR Mexican American*[ti] OR Latino*[ti] OR Latina*[ti] OR underserved[tw] OR underprivileged[tw] OR urban[tw] OR rural[tw] OR geographic*[ti] OR demographic*[ti] OR sex*[ti] OR gender[ti] OR homosexual*[tw] OR lesbian*[tw] OR bisexual[tw] OR lgbt*[tw] OR age[ti] OR youth*[ti] OR teen*[ti] OR elderly[ti] OR mentally ill*[ti] OR mental health[ti] OR disabled[ti] OR transgender*[ti] OR social class[ti] OR socio-economic*[ti] OR socioeconomic*[ti] OR income[ti] OR poverty[ti] OR poor[ti] OR occupation*[ti] OR military[ti] OR veteran*[ti] OR education*[ti]) AND (social media OR social networking site*[tw] OR social networking[tw] OR Twitter[tw] OR Instagram[tw] OR Facebook[tw] OR Reddit[tw] OR social marketing OR influencer marketing OR digital media[tw] OR digital marketing[tw]) Sort by: Publication Date Filters: Abstract; Publication date from 2008/01/01; English **Search #2:** Add Search (tobacco[ti] OR cigarette*[ti] OR smoking[ti] OR smoker*[ti] OR nicotine[ti] OR juul[ti] OR cigar*[ti] OR cigarillo*[ti] OR snus[ti] OR smokeless[ti] OR heat-not-burn[ti] OR hookah[ti] OR waterpipe[ti] OR secondhand smoke[ti] OR second-hand smoke[ti]) AND (social media[tw] OR social networking site*[tw] OR social networking[tw] OR Twitter[tw] OR Instagram[tw] OR Facebook[tw] OR Reddit[tw] OR social marketing OR influencer marketing OR digital media[tw] OR digital marketing[tw]) Sort by: Publication Date Filters: Abstract; Publication date from 2018/01/01; English
E-cigarettes and emerging tobacco products (Indexes: Google Scholar, Ovid, and PsycInfo)	(“LGBT” OR “rural” OR “SES” OR “psychiatric” OR “homeless” OR “minority” OR “age”) AND (“e-cigarette,” “JUUL,” “pod mod,” “heat not burn,” and “heated tobacco product”, “nicotine pouch”, “modern oral nicotine”, “tobacco-free nicotine”)

Table 5A.1 Continued

Topic	Search terms
Tobacco industry response: Political (Indexes: PubMed and Web of Science)	**PubMed:** (((tobacco[Title/Abstract] OR cigarettes[Title/Abstract] OR cigarette[Title/Abstract] OR smoking[Title/Abstract]) AND (company[Title/Abstract] OR companies[Title/Abstract] OR industry[Title/Abstract] OR industries[Title/Abstract] OR corporate[Title/Abstract] OR corporation[Title/Abstract] OR (business[Title/Abstract] OR business'[Title/Abstract] OR business's[Title/Abstract] OR business'wo[Title/Abstract] OR businesscase[Title/Abstract] OR businesse[Title/Abstract] OR businesses[Title/Abstract] OR businesses'[Title/Abstract] OR businessess[Title/Abstract] OR businessess'[Title/Abstract] OR businessification[Title/Abstract] OR businessification'[Title/Abstract] OR businessization[Title/Abstract] OR businesslike[Title/Abstract] OR businessman[Title/Abstract] OR businessman's[Title/Abstract] OR businessmen[Title/Abstract] OR businessmen's[Title/Abstract] OR businessobjects[Title/Abstract] OR businesspeak[Title/Abstract] OR businesspeo[Title/Abstract] OR businesspeople[Title/Abstract] OR businessperson[Title/Abstract] OR businesspersons[Title/Abstract] OR businesssource[Title/Abstract] OR businesssourcecomplete[Title/Abstract] OR businesstrade[Title/Abstract] OR businessweek[Title/Abstract] OR businessweek's[Title/Abstract] OR businesswide[Title/Abstract] OR businesswoman[Title/Abstract] OR businesswomen[Title/Abstract]))) AND (ethnic[Title/Abstract] OR disparity[Title/Abstract] OR disparities[Title/Abstract] OR inequality[Title/Abstract] OR disadvantage[Title/Abstract] OR race[Title/Abstract] OR racial[Title/Abstract] OR minority[Title/Abstract] OR "African American"[Title/Abstract] OR "African-American"[Title/Abstract] OR "African"[Title/Abstract] OR black[Title/Abstract] OR Latino[Title/Abstract] OR Hispanic[Title/Abstract] OR Asian[Title/Abstract] OR "Native American"[Title/Abstract] OR "Alaska Native"[Title/Abstract] OR "Pacific Islander"[Title/Abstract] OR economic[Title/Abstract] OR socioeconomic[Title/Abstract] OR SES[Title/Abstract] OR low-income[Title/Abstract] OR poverty[Title/Abstract] OR gay[Title/Abstract] OR lesbian[Title/Abstract] OR bisexual[Title/Abstract] OR transgender[Title/Abstract] OR homosexual[Title/Abstract] OR LGBT[Title/Abstract] OR homeless[Title/Abstract] OR mentally ill[Title/Abstract] OR substance use[Title/Abstract] OR geographic[Title/Abstract] OR rural[Title/Abstract] OR occupation[Title/Abstract])) AND (political[Title/Abstract] OR politics[Title/Abstract] OR "political party"[Title/Abstract] OR legislator[Title/Abstract] OR senate[Title/Abstract] OR congress[Title/Abstract] OR representative[Title/Abstract] OR litigation[Title/Abstract] OR ballot[Title/Abstract] OR lobby[Title/Abstract] OR pre-emption[Title/Abstract] OR front group[Title/Abstract] OR election[Title/Abstract] OR ally[Title/Abstract] OR allies[Title/Abstract]) **Web of Science:** TITLE: (tobacco OR cigarettes OR cigarette OR smoking) AND TITLE: (company OR companies OR industry OR industries OR corporate OR corporation OR business*) AND TOPIC: (ethnic OR disparity OR disparities OR inequality OR disadvantage OR race OR racial OR minority OR African American OR African-American OR African OR black OR Latino OR Hispanic OR Asian OR Native American OR Alaska Native OR Pacific Islander OR economic OR socioeconomic OR SES OR low-income OR poverty OR gay OR lesbian OR bisexual OR transgender OR homosexual OR LGBT OR homeless OR mentally ill OR substance use OR geographic OR rural OR occupation) AND TOPIC: (political OR politics OR political party or legislator OR senate OR congress OR representative OR litigation OR ballot OR lobby OR pre-emption OR front group OR election OR ally OR allies) Refined by: LANGUAGES: (ENGLISH) **Timespan:** 2008–2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC

Table 5A.1 Continued

Topic	Search terms
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Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC. TITLE: (tobacco OR cigarettes OR cigarette OR smoking) AND TITLE: (company OR companies OR industry OR industries OR corporate OR corporation OR business*) AND TOPIC: (over-shifting OR over-shift OR over-shifted) **Timespan:** 2008–2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC

Table 5A.1 Continued

Topic	Search terms
Tobacco industry response: Corporate social responsibility and community (Indexes: PubMed and Web of Science)	**PubMed:** (((tobacco[Title/Abstract] OR cigarettes[Title/Abstract] OR cigarette[Title/Abstract] OR smoking[Title/Abstract]) AND (company[Title/Abstract] OR companies[Title/Abstract] OR industry[Title/Abstract] OR industries[Title/Abstract] OR corporate[Title/Abstract] OR corporation[Title/Abstract] OR (business[Title/Abstract] OR business'[Title/Abstract] OR business's[Title/Abstract] OR business'wo[Title/Abstract] OR businesscase[Title/Abstract] OR businesse[Title/Abstract] OR businesses[Title/Abstract] OR businesses'[Title/Abstract] OR businessess[Title/Abstract] OR businessess'[Title/Abstract] OR businessification[Title/Abstract] OR businessification'[Title/Abstract] OR businessization[Title/Abstract] OR businesslike[Title/Abstract] OR businessman[Title/Abstract] OR businessman's[Title/Abstract] OR businessmen[Title/Abstract] OR businessmen's[Title/Abstract] OR businessobjects[Title/Abstract] OR businesspeak[Title/Abstract] OR businesspeo[Title/Abstract] OR businesspeople[Title/Abstract] OR businessperson[Title/Abstract] OR businesspersons[Title/Abstract] OR businesssource[Title/Abstract] OR businesssourcecomplete[Title/Abstract] OR businesstrade[Title/Abstract] OR businessweek[Title/Abstract] OR businessweek's[Title/Abstract] OR businesswide[Title/Abstract] OR businesswoman[Title/Abstract] OR businesswomen[Title/Abstract]))) AND (ethnic[Title/Abstract] OR disparity[Title/Abstract] OR disparities[Title/Abstract] OR inequality[Title/Abstract] OR disadvantage[Title/Abstract] OR race[Title/Abstract] OR racial[Title/Abstract] OR minority[Title/Abstract] OR "African American"[Title/Abstract] OR "African-American"[Title/Abstract] OR "African"[Title/Abstract] OR black[Title/Abstract] OR Latino[Title/Abstract] OR Hispanic[Title/Abstract] OR Asian[Title/Abstract] OR "Native American"[Title/Abstract] OR "Alaska Native"[Title/Abstract] OR "Pacific Islander"[Title/Abstract] OR economic[Title/Abstract] OR socioeconomic[Title/Abstract] OR SES[Title/Abstract] OR low-income[Title/Abstract] OR poverty[Title/Abstract] OR gay[Title/Abstract] OR lesbian[Title/Abstract] OR bisexual[Title/Abstract] OR transgender[Title/Abstract] OR homosexual[Title/Abstract] OR LGBT[Title/Abstract] OR homeless[Title/Abstract] OR mentally ill[Title/Abstract] OR substance use[Title/Abstract] OR geographic[Title/Abstract] OR rural[Title/Abstract] OR occupation[Title/Abstract])) AND (social[Title/Abstract] OR responsibility[Title/Abstract] OR community[Title/Abstract] OR communities[Title/Abstract] OR philanthropy[Title/Abstract] OR "public relations"[Title/Abstract] OR funding[Title/Abstract] OR education[Title/Abstract] OR festival[Title/Abstract] OR music[Title/Abstract] OR sponsor[Title/Abstract] OR sport[Title/Abstract] OR event[Title/Abstract] OR marketing[Title/Abstract] OR advertising[Title/Abstract] OR advocacy[Title/Abstract] OR contribution[Title/Abstract] OR gift[Title/Abstract]) **Web of Science:** TITLE: (tobacco OR cigarettes OR cigarette OR smoking) AND TITLE: (company OR companies OR industry OR industries OR corporate OR corporation OR business*) AND TOPIC: (ethnic OR disparity OR disparities OR inequality OR disadvantage OR race OR racial OR minority OR African American OR African-American OR African OR black OR Latino OR Hispanic OR Asian OR Native American OR Alaska Native OR Pacific Islander OR economic OR socioeconomic OR SES OR low-income OR poverty OR gay OR lesbian OR bisexual OR transgender OR homosexual OR LGBT OR homeless OR mentally ill OR substance use OR geographic OR rural OR occupation) AND TOPIC: (social OR responsibility OR community OR communities OR philanthropy OR "public relations" OR funding OR education OR festival OR music OR sponsor OR sport OR event OR marketing OR advertising OR advocacy OR contribution OR gift) Refined by: LANGUAGES: (ENGLISH) **Timespan:** 2008–2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI, CCR-EXPANDED, IC

Chapter 6
Disparities in Smoking-Caused Disease Outcomes and Smoking-Attributable Mortality

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Introduction

According to the 2014 Surgeon General's report, more than 20 million Americans died as a result of smoking or exposure to secondhand tobacco smoke in the 50 years since the first Surgeon General's report was released in 1964 (U.S. Department of Health and Human Services [USDHHS] 2014). The 2014 Surgeon General's report showed that smoking impacts nearly every organ of the body (USDHHS 2014). Smoking is causally associated with 12 cancers and is the leading cause of lung cancer, which is the largest cause of cancer deaths in the United States (USDHHS 2014; Cronin et al. 2022). In addition, smoking is a major contributor to incidence and mortality from cardiovascular disease (including coronary heart disease, stroke, congestive heart failure, coronary artery disease, and peripheral arterial disease) and chronic obstructive pulmonary disease (COPD; including chronic bronchitis and emphysema) (USDHHS 2014; Tsao et al. 2023; Centers for Disease Control and Prevention [CDC] n.d.b). Exposure to secondhand tobacco smoke causes lung cancer, coronary heart disease and stroke (USDHHS 2014).

The current report fills critical gaps by describing disparities in incidence and mortality due to smoking-caused diseases including cancer, COPD, and cardiovascular disease, and in smoking- and secondhand tobacco smoke-attributable mortality using various analytic and modeling techniques. This chapter begins by providing a brief overview of differences in select smoking-related health outcomes by sociodemographic characteristics, using the latest available published reports. Modeling is also used to conduct a comprehensive analysis of recent trends and disparities in smoking-attributable mortality by sex and age, race and ethnicity, educational attainment, geographic region, and urbanicity (urban versus rural residency). Data from multiple sources are used to estimate the number of deaths caused by cigarette smoking and exposure to secondhand tobacco smoke in the United States overall and by race and ethnicity. Data sources include the American Community Survey, the National Health Interview Survey (NHIS), the National Health and Nutrition Examination Survey (NHANES), the linked NHIS-National Death Index (NHIS-NDI), the National Vital Statistics System Multiple Cause of Death file, and National Center for Health Statistics' National Vital Statistics Reports.

The chapter also reviews the findings from various simulation models which are important tools to project the potential effects of large-scale interventions on smoking-attributable morbidity and mortality and on disparities in tobacco use. The chapter concludes with a discussion about gaps in data and research that can be used to further assess the health impacts of tobacco-related health disparities.

Conclusions from Previous Surgeon General's Reports

The 1998 Surgeon General's report was the first to focus exclusively on tobacco use and health outcomes among members of four racial and ethnic population groups. That report concluded that cigarette smoking is a major cause of disease in African American, American Indian and Alaska Native, Asian American and Pacific Islander, and Hispanic people; African American people experienced the greatest health burden from cigarette smoking; and lung cancer is the leading cause of cancer deaths for each of the aforementioned racial and ethnic groups (USDHHS 1998).

The 2014 Surgeon General's report provided a comprehensive review of the health consequences of smoking and reflected on 50 years of progress in tobacco prevention and control. The 2014 Surgeon General's report acknowledged that tobacco use causes or worsens cardiovascular diseases, diabetes, eye diseases, pneumonia, COPD, tuberculosis, periodontitis, adverse reproductive health outcomes, congenital defects, hip fractures, rheumatoid arthritis, male sexual dysfunction, and immune dysfunction and diminishes overall health (USDHHS 2014). Additionally, exposure to secondhand tobacco smoke causes lung cancer, stroke, cardiovascular disease, adverse reproductive health outcomes, middle ear disease, impaired lung function, lower respiratory illness, and sudden infant death syndrome (USDHHS 2014). Lower relative risks (RRs) for smoking in women than men in earlier studies reflected historical differences in population-level smoking patterns. However, by the 1960s, smoking patterns had largely converged for men and women and by the 21st century, the disease risks from smoking for women are now similar to those of men for lung cancer, COPD, and cardiovascular disease. The 2014 report also concluded that very large disparities in tobacco use remain across groups defined by race, ethnicity, level of educational attainment, socioeconomic status (SES), and geographic region.

A major conclusion of the 2020 Surgeon General's report on tobacco cessation was that smoking cessation is beneficial at any age (USDHHS 2020). The 2020 report showed that quitting smoking reduces the risk of premature death and the risk of 12 types of cancer compared with continued smoking. It also concluded that disparities in the prevalence of smoking persist, aligning with the conclusions of the 2014 Surgeon General's report. The 2020 Surgeon General's report also identified disparities in key indicators of smoking cessation, including quit attempts, having received advice to quit smoking from a health professional, and using counseling and medications to facilitate quitting (USDHHS 2020). As described in Chapter 2 of the present report, the prevalence of smoking is higher among some population groups than it is among others in the United States. Furthermore, cessation behaviors, such as quit attempts, are lower among some groups than among other groups based on level of educational attainment, poverty status, age, health insurance status, race and ethnicity, and geographic region.

Differences in Smoking-Caused Diseases Across Population Groups

The 2010 and 2014 Surgeon General's reports outlined the biologic mechanisms linking active smoking and exposure to secondhand tobacco smoke with cancer, COPD, cardiovascular disease, and other conditions (USDHHS 2010, 2014). Substantial declines in the prevalence of smoking contributed to a 46.4% decline in the age-standardized rate of years of life lost (YLL) due to premature death associated with smoking from 1990 to 2019, although smoking remained the leading risk factor for YLL during this period (Tsao et al. 2023). Smoking was also the leading risk factor for years of life lived with disability or injury (YLD) in 1990. However, the age-standardized YLD rate attributable to smoking declined by 25.8% from 1990 to 2019, such that smoking ranked as the third most common risk factor for YLD in 2019 (Tsao et al. 2023).

This section provides a brief overview of differences in select smoking-related outcomes by sociodemographic characteristics, using data from the latest available published reports. Consistent with Chapter 2 of this report, differences in select outcomes by sociodemographic characteristics are reported where 95% confidence intervals (CIs) do not overlap, when applicable.

Cancer

Smoking is a causal factor for at least 12 cancers, including cancers of the oropharynx, larynx, esophagus, lung, bronchus and trachea, stomach, liver, pancreas, kidney and ureter, cervix, bladder, colon, and rectum (USDHHS 2014). It is also a causal factor in acute myeloid leukemia (USDHHS 2014). The National Cancer Institute (NCI), the American Association for Cancer Research, the American Cancer Society, and the CDC have published multiple reports that describe overall cancer disparities (Singh et al. 2003; American Association for Cancer Research 2022; Cronin et al. 2022; American Cancer Society n.d.).

Cancer disparities are defined as differences in cancer measures, such as cancer incidence, prevalence, and survival; morbidity and mortality; survivorship (i.e., experiences and challenges resulting from cancer diagnosis); quality of life after cancer treatment; and the burden of cancer or such related conditions as financial costs, screening rates, and stage of diagnosis (International Agency for Research on Cancer 2012; Cancer.Net 2021; NCI 2022).

Consistent socioeconomic disparities in cancer incidence, mortality, and stage of diagnosis have been observed in the United States, particularly for cancers with a high smoking-attributable burden, such as those of the lung, cervix, stomach, and liver (Singh et al. 2003, 2004; Clegg et al. 2009; Du et al. 2011; Singh and Jemal 2017; Withrow et al. 2021). These disparities have been observed among White, Black, Hispanic, Asian and Pacific Islander, and American Indian and Alaska Native people (Singh et al. 2003, 2004; Singh and Jemal 2017). The remainder of this section summarizes key findings on cancer incidence (diagnosed from 2001 to 2018) and mortality (from 2001 to 2019) by sex and race and ethnicity as presented in the most recent *Annual Report to the Nation on the Status of Cancer* (Cronin et al. 2022). Data for other indicators, such as survival rates and stage of diagnosis by the intersection of race and ethnicity with other sociodemographic factors, are often difficult to report due to small sample sizes.

Cronin and colleagues (2022) presented age-standardized, overall cancer incidence rates (pooled across a fixed 5-year interval from 2014 to 2018) and death rates (pooled across a fixed 5-year interval from 2015 to 2019). Rates were adjusted for delays in the time between diagnosis and reporting to the cancer registry. Rates were presented overall and by sex and race and ethnicity. Race and ethnicity were categorized into five mutually exclusive racial and ethnic groups: non-Hispanic White, non-Hispanic Black, non-Hispanic American Indian and Alaska Native, non-Hispanic Asian and Pacific Islander, and Hispanic. Data on race and ethnicity were abstracted from information reported in medical records (for incident cases) or on death certificates (for deaths). Information was not available for disaggregated racial and ethnic population groups. Hispanic people could be of any race and thus, for brevity, these population groups are referred to as White, Black, American Indian and Alaska Native, Asian and Pacific Islander, and Hispanic.

Additionally, Cronin and colleagues (2022) presented temporal trends in delay-adjusted incidence and death rates from joinpoint regression analyses, allowing for up to three joinpoints for incidence (across a 17-year period from 2001 to 2018) and death (across an 18-year period from 2001 to 2019) rates. The line segments resulting from the joinpoint analyses were reported as the annual percent change (APC). The average APC (AAPC) was presented as the weighted average of the APC over the most recent fixed 5-year interval (incidence: 2014–2018; death: 2015–2019). Statistically significant ($p < 0.05$) temporal trends in the APC or AAPC were considered increasing when the slope was greater than 0 or decreasing when the slope was less than 0. Otherwise, the slope was considered stable. See Cronin and colleagues (2022) for a complete description of the data sources and methodology.

Cancer Incidence Rates

Among men from 2001 to 2018, joinpoint trend analysis found that overall cancer incidence rates were stable from 2001 to 2007, declined by an average of 2.1% per year from 2007 to 2013, and stabilized again from 2013 to 2018. Among women, overall cancer incidence rates were stable from 2001 to 2003 and increased slightly (by about 0.2% per year) from 2003 to 2018. The overall age-adjusted cancer incidence rate during 2014–2018 was 457.5 per 100,000 population; rates were higher rates among men (497.4 per 100,000 population) than among women (430.9 per 100,000 population) (Cronin et al. 2022).

Among the 18 most common sites for cancer for which incidence rates are reported in the *Annual Report to the Nation on the Status of Cancer* by Cronin and colleagues (2022), more than half were identified in the 2014 Surgeon General's report as being causally associated with smoking: lung and bronchus, colon and rectum, urinary bladder, kidney and renal pelvis, oral cavity and pharynx, pancreas, liver and intrahepatic bile duct, stomach, esophagus, larynx, and cervix (USDHHS 2014). The incidence of cancers that have been causally associated with smoking have largely declined over time, coinciding with declines in the prevalence of smoking (see Chapter 2). However, the smoking-attributable burden differs by cancer site such that the presence of other risk factors (e.g., alcohol consumption or obesity) may contribute to changing trends. This section describes trends in incidence rates for cancers that have been causally associated with smoking.

Among men during 2014–2018, the incidence of pancreatic (AAPC = 1.1%) and kidney (AAPC = 0.7%) cancers increased. Incidence decreased for cancers of the lung and bronchus (AAPC = -2.6%), larynx (AAPC = -2.4%), bladder (AAPC = -2.1%), stomach (AAPC = -1.8%), and colon and rectum (AAPC = -1.2%). From 2014 to 2018, the incidence of liver, esophageal, and oral cavity and pharyngeal cancers was stable.

Among women during 2014–2018, incidence of cancers of the liver (AAPC = 1.6%), kidney (AAPC = 1.2%), pancreas (AAPC = 1.0%), and oral cavity and pharynx (AAPC = 0.5%) increased. Incidence decreased for cancers of the lung and bronchus (AAPC = -1.1%), colon and rectum (AAPC = -1.2%), and bladder (AAPC = -0.9%). During this period, incidence was stable for cervical and stomach cancers.

During 2014–2018, cancers of the lung and bronchus were the second most common types of cancer diagnosed among men (66.1 per 100,000 population, behind prostate cancer) and women (51.0 per 100,000 population, behind breast cancer). By race and ethnicity, statistically significant declines in lung and bronchus cancers were observed across men of all races and ethnicities and among White, Black, and Hispanic women.

Among men, incidence of lung and bronchus cancers was higher among Black men (78.3 per 100,000 population) than among American Indian and Alaska Native men (73.0 per 100,000 population), White men (70.0 per 100,000 population), Asian and Pacific Islander men (43.3 per 100,000 population), and Hispanic men (34.9 per 100,000 population). During this 5-year fixed interval, the steepest decreasing trends in lung and bronchus cancers were observed among American Indian and Alaska Native men (-5.3% per year) and Black men (-3.2% per year) followed by White men (-2.8% per year), Hispanic men (-2.7% per year), and Asian and Pacific Islander men (-1.5% per year).

Among women, incidence of lung and bronchus cancers was higher among American Indian and Alaska Native women (61.5 per 100,000 population) than it was among White women (56.8 per 100,000 population), Black women (47.8 per 100,000 population), Asian and Pacific Islander women (28.6 per 100,000 population), and Hispanic women (23.1 per 100,000 population). During this 5-year fixed interval, the steepest decreasing trend in lung and bronchus cancers was observed among Black women

(-1.6% per year), followed by White women (-0.8% per year) and Hispanic women (-0.7% per year). No significant changes were observed for Asian and Pacific Islander women and American Indian and Alaska Native women.

For a few cancers, the directionality of the trend in incidence from 2014 to 2018 was consistent across all racial and ethnic population groups of men, including the declines in lung and bronchus cancer and stomach cancer, and the increase in pancreatic cancer. For some other cancers, the trends were mostly consistent, but for some racial or ethnic population groups, the trend did not reach statistical significance (such as the decreases in colon and rectum cancer and laryngeal cancer among men).

However, the directionality of trends in cancer incidence were not always consistent across racial and ethnic groups. In some cases, the overall result hid significant changes among some populations. For example, the incidence of esophageal cancer in men did not change significantly overall, but significant decreases were observed for Black, Hispanic, and Asian and Pacific Islander men. Results for some cancers were discordant across racial and ethnic groups. For example, incidence of bladder cancer in men decreased overall and for every racial and ethnic group except American Indian and Alaska Native men, for which incidence increased significantly. Oral cavity and pharyngeal cancer also had discordant results. Overall and among White men, the incidence of cancers of the oral cavity and pharynx remained stable, but incidence of both cancers decreased significantly for Black and Hispanic men and increased significantly for Asian and Pacific Islander men and American Indian and Alaska Native men. Incidence of liver cancer was stable from 2014 to 2018 among men overall as well as for Black men and Hispanic men, but incidence increased for White and American Indian and Alaska Native men and decreased among Asian and Pacific Islander men. These results demonstrate the importance of disaggregated data when measuring incidence trends.

Among women, increases in the incidence of kidney and pancreatic cancer were observed across all racial and ethnic groups. Incidence of cancers of the lung and bronchus, bladder, and colon and rectum decreased among women for most racial and ethnic population groups, although some racial and ethnic population groups showed no significant change. However, the overall trend at times hid significant changes among some population groups. For example, incidence of cervical cancer was stable from 2014 to 2018 among women overall, as well as among White, American Indian and Alaska Native, and Hispanic women, but there were significant decreases in the incidence of cervical cancer among Black women and Asian and Pacific Islander women. Similarly, incidence of stomach cancer did not change overall or for White women and American Indian and Alaska Native women, but it decreased significantly among Black, Asian and Pacific Islander, and Hispanic women.

Finally, among women, the directionality of incidence for some cancers was discordant among the various racial and ethnic populations. For example, incidence of oral and pharyngeal cancer increased overall and for White women, but it decreased significantly for Black women. Incidence of liver cancer increased overall and for White, Hispanic, and American Indian and Alaska Native women, but decreased significantly for Asian and Pacific Islander women. These differences in cancer disparities by race and ethnicity are likely due to a combination of complex factors, including SES and cultural, social, and environmental factors, which may warrant further investigation (American Association for Cancer Research 2022).

Cancer Death Rates

As reported by Cronin and colleagues (2022), from 2001 to 2019, the decline in the overall rate of death from cancer among men averaged 1.8% per year from 2001 to 2015 and accelerated to 2.3% per year during 2015–2019. Among women, the decline in the rate of death from cancer averaged 1.4% per year during 2001–2016 and accelerated to 2.1% per year during 2016–2019. During 2015–2019, the overall death rate from cancer among men and women was 152.4 per 100,000 population; the rate was higher among men (181.4 per 100,000 population) than among women (131.1 per 100,000 population).

Lung and bronchus cancers were the leading cause of cancer deaths among men of all racial and ethnic population groups from 2015 to 2019. By race and ethnicity, the rate of death from lung and bronchus cancers was highest among Black men (54.0 per 100,000 population), followed by White men (47.0 per 100,000 population), American Indian and Alaska Native men (42.3 per 100,000 population), Asian and Pacific Islander men (26.9 per 100,000 population), and was lowest among Hispanic men (22.1 per 100,000 population).

Over the fixed 5-year interval from 2015 to 2019, the largest decline in the death rate from cancer was reported for lung and bronchus cancers among men (AAPC = -5.4%). Statistically significant declines in the death rate for lung and bronchus cancers were observed among men overall (AAPC = -5.0%) and among each racial and ethnic population group. The AAPC ranged from -4.9% among American Indian and Alaska Native men and Hispanic men to -6.1% among Asian and Pacific Islander men, though confidence intervals overlapped across groups.

Among women from 2015 to 2019, lung and bronchus cancers were the leading cause of cancer death for all racial and ethnic population groups with the exception of Hispanic women, for which lung cancer was the second most common cancer death (after breast cancer). From 2015 to 2019, the death rate of lung and bronchus cancers was highest among White (34.2 per 100,000 population), American Indian and Alaska Native (31.0 per 100,000 population) and Black women (29.2 per 100,000 population) and lowest for Asian and Pacific Islander (15.9 per 100,000 population) and Hispanic women (11.8 per 100,000 population). Over this fixed 5-year interval, the largest AAPC was observed for the decline in the death rate of lung and bronchus cancers among women (AAPC = -4.2%). By race and ethnicity, the steepest declines in the death rate of lung and bronchus cancers were observed among Hispanic women (AAPC = -4.7%) and Black women (AAPC = -4.4%); declines were less steep for White (AAPC = -3.9%), Asian and Pacific Islander (AAPC = -3.3%), and American Indian and Alaska Native (AAPC = -2.2%) women.

For other smoking-caused cancers, significant declines in the death rate from 2015 to 2019 were observed for urinary bladder cancer (men: AAPC = -1.5%; women: AAPC = -0.6%), cervical cancer (women: AAPC = -0.8%), esophageal cancer (men: AAPC = -1.2%; women: AAPC = -1.5%), kidney and renal pelvis cancers (men: AAPC = -2.6%; women: AAPC = -1.5%); colon and rectum cancers (men: AAPC = -2.1%; women: AAPC = -2.0%), laryngeal cancer (men, only: AAPC = -2.5%), and stomach cancer (men: AAPC = -2.5%; women: AAPC = -1.9%). A significant increase in the rate of death from pancreatic cancer (AAPC = 0.2% among both men and women) was observed during this period. Death rates for other smoking-caused cancers (liver cancer and cancers of the oral cavity and pharynx) were stable from 2015 to 2019.

For men, mortality trends across racial and ethnic populations were consistent with the overall trend for the decreases in lung and bronchus cancer and stomach cancer and mostly consistent with the overall decrease in mortality for esophageal, kidney, larynx and for colon and rectal cancer. However, for the increase in pancreatic cancer and the decrease in bladder cancer mortality, overall results were driven by the significant trends for White men with the other racial and ethnic populations demonstrating stable mortality rates from 2014 to 2018. Discordant trends were observed for liver cancer mortality. There was no change in liver cancer mortality observed overall or for White or Hispanic men, but significant decreases in mortality were reported for Black and for Asian and Pacific Islander men and a significant increase was seen for American Indian and Alaska Native men. Discordant trends were also reported for oral and pharyngeal cancer mortality. There was no change in oral and pharyngeal cancer mortality overall or among Asian and Pacific Islander or American Indian and Alaska Native men, but there was a significant increase in oral and pharyngeal cancer mortality for White men and a significant decrease in mortality for Black and Hispanic men, once again demonstrating the importance of disaggregated data.

For women, trends in mortality from 2014 to 2018 were consistent across racial and ethnic populations for the decreases in mortality for lung and bronchus, kidney, and stomach cancers. These trends were also mostly consistent across racial and ethnic populations for the decreases in mortality for cancers of the bladder, esophagus, and cervix and for colon and rectal cancer. For pancreatic cancer, despite an overall increase in mortality, significant decreases were reported for Black women and for Asian and Pacific Islander women; mortality rates were stable for White, Hispanic, and American Indian and Alaska Native women. Discordant results were also observed for liver cancer. There was no change in liver cancer mortality overall or for White, Black, or for American Indian and Alaska Native women, but a significant increase in liver cancer mortality among Hispanic women and a significant decrease in mortality among Asian and Pacific Islander women was observed. Oral cavity and pharyngeal cancer also had discordant mortality trends. The death rate was stable for oral cavity and pharyngeal cancer overall and among Hispanic women, but oral cavity and pharyngeal cancer mortality increased significantly among White women and decreased significantly among Black and Asian and Pacific Islander women. As previously described, discordant mortality trends by race and ethnicity are likely due to a combination of complex socioeconomic, cultural, social, and environmental factors (American Association for Cancer Research 2022).

Chronic Obstructive Pulmonary Disease

COPD includes a group of diseases causing restricted airflow and breathing issues; emphysema and chronic bronchitis are included in COPD (CDC n.d.b). The most common symptoms of COPD include coughing and wheezing; excess production of phlegm, mucus, or sputum; shortness of breath; and trouble breathing deeply (CDC n.d.b).

Cigarette smoking is a primary cause of COPD and the primary risk factor for the worsening of COPD (CDC 2012; USDHHS 2014). On the basis of data from the 2017 Behavioral Risk Factor Surveillance System (BRFSS), 6.2% (95% CI, 6.0–6.3) of U.S. adults indicated that they had been diagnosed with COPD by a healthcare provider (Wheaton et al. 2019). The prevalence of a diagnosis of COPD was higher among adults who currently smoke (15.2%; 95% CI, 14.7–15.7) and adults who formerly smoked (7.6%; 95% CI, 7.3–8.0) than among adults who never smoked (2.8%; 95% CI, 2.7–2.9) (Wheaton et al. 2019). Among all adults, the prevalence of a COPD diagnosis was higher among (a) women (6.8%; 95% CI, 6.6–7.0) than among men (5.5%; 95% CI, 5.4–5.7) and (b) older adults (≥65 years: 12.8%; 95% CI, 12.5–13.2) than among younger adults (55–64 years: 10.6%; 95% CI, 10.2–11.0; 45–54 years: 6.3%; 95% CI, 6.0–6.7; and 18–44 years: 2.7%; 95% CI, 2.5–2.8).

The prevalence of COPD also varies across racial and ethnic population groups. Using data from the 2017 BRFSS, Wheaton and colleagues (2019) found that the prevalence of COPD was significantly higher among American Indian and Alaska Native adults (11.9%; 95% CI, 10.3–13.7) than among non-Hispanic White (6.7%; 95% CI, 6.5–6.8), non-Hispanic Black (6.6%; 95% CI, 6.1–7.1), Hispanic (3.6%; 95% CI, 3.2–3.9), and Asian (1.7%; 95% CI, 1.2–2.5) adults. The prevalence of COPD was significantly lower among Hispanic adults than among White, Black, and American Indian and Alaska Native adults. The prevalence of COPD was significantly lower among Asian adults than it was among all other racial and ethnic population groups.

Using data from the 2017 BRFSS, Wheaton and colleagues (2019) also reported that the prevalence of COPD was higher among adults with other health conditions than adults without such conditions. For example, the prevalence of COPD was higher among adults with asthma (19.5%; 95% CI, 19.0–20.1) than it was among adults without asthma (4.1%; 95% CI, 4.0–4.2). Additionally, the prevalence of COPD increased with an increasing number of other chronic conditions (including coronary heart disease, stroke, diabetes, cancer, arthritis, kidney disease, and depressive disorder): no other chronic conditions (2.5%; 95% CI, 2.4–2.7), one chronic condition (5.8%; 95% CI, 5.5–6.1), two chronic conditions (12.6%; 95% CI, 11.9–13.4), three chronic conditions (20.2%; 95% CI, 18.1–22.5), and four or more chronic conditions (34.4%; 95% CI, 30.3–38.8). On the basis of data from the 2020 NHIS, as reported by the American Lung Association, the prevalence of a diagnosis of anxiety or depression is more than twice as high among people with COPD (43.5%) than it is among people without COPD (20.5%)[1] (American Lung Association n.d.).

COPD is the primary cause of death from chronic lower respiratory diseases, which was the fourth leading cause of death in the United States in 2019 (Xu et al. 2021). Using the NCHS's Underlying Causes of Death data compiled from the CDC Wonder Online database, the American Lung Association reported that the overall number of deaths from COPD in 2020 was higher among women (77,252) than among men (72,302); however, the age-adjusted rate of death from COPD was higher among men (39.2 per 100,000 men) than among women (36.3 per 100,000 women) (American Lung Association n.d.). Although COPD death rates have declined overall, declines have been limited to men in recent years (Zarrabian and Mirsaeidi 2021; Carlson et al. 2022; American Lung Association n.d.). For example, during 1999–2019, overall age-adjusted death rates for COPD did not change significantly among women but declined significantly among men by an average of 1.3% per year (AAPC = -1.3%) (Carlson et al. 2022). In general, rates of misdiagnosis or delayed diagnosis of COPD tend to be higher among women than among men, which may lead to more advanced disease at diagnosis and potentially less effective treatments in women (Carlson et al. 2022; CDC n.d.b). Other anatomical, hormonal, and behavioral differences by sex may influence differences in COPD morbidity and mortality between men and women (Aryal et al. 2014; CDC n.d.b).

By race and ethnicity, the highest rate of death from COPD in 2020 was observed among White adults (43.6 per 100,000 men and 37.9 per 100,000 women) followed by American Indian and Alaska Native adults (35.8 per 100,000 men and 26.5 per 100,000 women), Black adults (34.8 per 100,000 men and 22.5 per 100,000 women), Hispanic adults (18.7 per 100,000 men and 12.4 per 100,000 women), and Asian and Pacific Islander adults (13.8 per 100,000 men and 6.6 per 100,000 women) (American Lung Association n.d.). From 1999 to 2020, the absolute decline (i.e., the magnitude of difference) in the rate of death from COPD was similar among White (by 6.6 per 100,000 population; from 47.0 to 40.4 per 100,00 population), Black (by 6.2 per 100,000 population; from 29.9 to 23.7 per 100,000 population), and Hispanic (by 6.6 cases per 100,000 population; from 21.6 to 15.0 per 100,000 population) people (American Lung Association n.d.).

In 2019, death rates from COPD were higher in nonmetropolitan areas than in urban areas. From 1999 to 2019, urban–rural disparities in COPD death rates became more pronounced among both women and men (Carlson et al. 2022). The absolute disparity in the COPD death rate between large, central metropolitan areas (urban) and noncore areas (rural) increased by 34.5 deaths per 100,000 population among women and by 13.3 deaths per 100,000 population among men. Among women from 1999 to 2019, the rate of death from COPD increased significantly in 18 states, with the steepest increase observed in Arkansas (AAPC = 2.9%); death rates among women declined in 17 states, with the steepest decline observed in California (AAPC = -1.9%). Among men, the rate of death from COPD increased in one state (Arkansas, AAPC = 0.5%) and declined in 45 states, with the steepest decline observed in Alaska (AAPC = -4.2%) (Carlson et al. 2022).

Analyses of data from numerous reports suggest a clear association between socioeconomic gradients and

[1]Corresponding confidence intervals were not available for estimates presented in American Lung Association (n.d.).

COPD prevalence, mortality, severity, and quality of life (Hersh et al. 2011; CDC 2012; Jackson et al. 2013; Pleasants et al. 2013, 2015; Wheaton et al. 2015, 2016, 2019; Helms et al. 2017; Carlson et al. 2023; American Lung Association n.d.). For example, on the basis of 2017 BRFSS data, the prevalence of COPD was inversely associated with educational attainment; the prevalence of COPD was highest among people with less than a high school diploma (10.4%, 95% CI, 9.9–11.0) and lowest among people with a college degree or above (2.7%; 95% CI, 2.6–2.9) (Wheaton et al. 2019). Additionally, on the basis of 2020 NHIS data as reported by the American Lung Association (n.d.), the prevalence of COPD decreased with increasing family income (income-to-poverty ratio: <1 = 10.1%; 1–<2 = 7.5%; and ≥2 = 3.6%).

Using data from 16 states administering the Social Determinants of Health module on the 2017 BRFSS, Carlson and colleagues (2023) analyzed the relationship between self-reported COPD and measures of economic instability and stress. Findings suggest that adults with COPD were more likely to report financial instability (not having enough money or having just enough money at the end of the month; being unable to pay mortgage, rent, or utility bills; and inability to afford food or to eat well balanced meals) than adults without COPD. Similarly, adults with COPD were more likely to report experiencing stress (all or most of the time) than adults without COPD.

Cardiovascular Disease

Cardiovascular disease encompasses a range of clinical heart and circulatory conditions, including coronary heart disease, stroke, congestive heart failure, coronary artery disease, and peripheral arterial disease (USDHHS 2014; Tsao et al. 2023). The association between cigarette smoking and coronary heart disease was first established in the 1964 Surgeon General's report (U.S. Department of Health, Education, and Welfare 1964). The evidence of a causal association between smoking and cardiovascular disease was further elucidated in subsequent Surgeon General's reports, and a major conclusion of the 1983 report, *The Health Consequences of Smoking: Cardiovascular Disease,* was that "cigarette smoking is a major cause of coronary heart disease in the United States for both men and women. Because of the number of persons in the population who smoke and the increased risk that cigarette smoking represents, it should be considered the most important of the known modifiable risk factors for CHD" (USDHHS 1983, p. 6).

This section summarizes key findings from the annual Statistical Update from the American Heart Association, *Heart Disease and Stroke Statistics–2023 Update: A Report from the American Heart Association* (Tsao et al. 2023).

On the basis of NHANES data during 2017 to March 2020 (combined 2017–2018 cycle with the partial 2019–2020 cycle that was halted due to the COVID-19 pandemic), the prevalence of cardiovascular disease (including coronary heart disease, heart failure, and stroke) was 9.9%[2] among adults 20 years of age and older, corresponding to an estimated 28.6 million adults (Tsao et al. 2023). Among men, the prevalence of cardiovascular disease was similar among non-Hispanic Black (11.3%) and non-Hispanic White (11.3%) men, followed by Hispanic men (8.7%) and non-Hispanic Asian men (6.9%). Among women, the prevalence of cardiovascular disease was highest among non-Hispanic Black women (11.1%), followed by non-Hispanic White (9.2%), Hispanic (8.4%), and non-Hispanic Asian (4.9%) women (Tsao et al. 2023).

The prevalence of cardiovascular disease and hypertension—a risk factor for the development of cardiovascular disease—was 48.6% among adults 20 years of age and older, corresponding to an estimated 127.9 million adults (Tsao et al. 2023). Among men, the prevalence of cardiovascular disease and hypertension was highest for non-Hispanic Black men (58.9%) and similar among Hispanic (51.9%), non-Hispanic Asian (51.5%), and non-Hispanic White (51.2%) men (Tsao et al. 2023). Among women, the prevalence of cardiovascular disease and hypertension was highest for non-Hispanic Black women (59.0%) followed by non-Hispanic White women (44.6%), non-Hispanic Asian women (38.5%), and Hispanic women (37.3%) (Tsao et al. 2023).

Using data from the 2011–2016 NHANES, Bundy and colleagues (2021) estimated that 12.8% of cardiovascular disease events (including incident nonfatal as well as fatal events) were attributable to smoking. By race and ethnicity, the proportion of cardiovascular disease events attributable to smoking was higher among Black adults (population-attributable fraction [PAF] = 17.2%) than among adults who were White, Mexican American, other Hispanic, and non-Hispanic Asian, as well as adults of other races (combined; PAF = 10.1%), although confidence intervals overlapped (Bundy et al. 2021). Using data from adults 20 years and older from the 1988 to 2016 NHANES, Han and colleagues (2019) estimated that the PAF of mortality from cardiovascular disease attributable to smoking was 10.7%.

For the United States overall during 2018–2020, the age-adjusted death rate for cardiovascular disease

[2]Corresponding confidence intervals for the prevalence of cardiovascular disease overall and by race and ethnicity were unavailable (Tsao et al. 2023)

(defined using the *International Classification of Diseases, 10th Revision* codes [ICD 10] I00 to I99) was 218.8 per 100,000 population, which represented a 9.8% decline in the cardiovascular disease death rate from 2008 to 2010 (Tsao et al. 2023). By U.S. state and territory (including the District of Columbia and Puerto Rico), the age-adjusted death rate during 2018–2020 ranged from 146.7 per 100,000 population in Puerto Rico and 167.0 per 100,000 population in Minnesota to 307.4 per 100,000 population in Mississippi. The age-adjusted death rate for coronary heart disease (defined as ICD 10 codes I20 to I25) during 2018–2020 was 90.2 per 100,000 population overall, which was a 27.2% decline from 2008 to 2010. By state, the age-adjusted death rate for coronary heart disease ranged from 59.3 per 100,000 population in Minnesota to 131.0 per 100,000 population in Arkansas. The age-adjusted death rate of stroke (ICD 10 codes I60 to I69) during 2018–2020 was 37.6 per 100,000 population overall, which was a 10.8% decline from 2008 to 2010. The age adjusted death rate of stroke ranged from 23.7 per 100,000 population in Puerto Rico and 24.3 per 100,000 population in New York to 52.8 per 100,000 population in Mississippi.

Of all deaths attributable to cardiovascular disease in the United States in 2020, 41.2% were due to coronary heart disease, 17.3% to stroke, 12.9% to high blood pressure, 9.2% to heart failure, 2.6% to diseases of the artery, and 16.8% to other cardiovascular disease categories (Tsao et al. 2023). Cigarette smoking is causally associated with many of these diseases, including coronary heart disease and stroke, which account for the majority of cardiovascular disease deaths in the United States (USDHHS 1983, 2014). Although cigarette smoking can cause temporary increases in blood pressure (Rhee et al. 2007), evidence is evolving about the long-term impacts, including the possibly synergistic interactions, of cigarette smoking and high blood pressure on cardiovascular disease outcomes (USDHHS 1983, 2014). Additionally, using data from the Coronary Artery Risk Development in Young Adults study, Luehrs and colleagues (2021) found evidence of higher pulse pressure (difference between systolic blood pressure and diastolic blood pressure) among people who smoked compared with people who never smoked, which may confer, at least partially, a higher risk of cardiovascular disease among people who smoke.

Cardiovascular Health

According to the American Heart Association, the use of tobacco products (including combustible tobacco products and e-cigarettes) and exposure to secondhand tobacco smoke have adverse effects on overall cardiovascular health (Tsao et al. 2023).

Using the American Heart Association's Life's Simple 7—a composite score of heath metrics including smoking status, body mass index, physical activity, healthy diet, total cholesterol, blood pressure, and blood glucose—data from the 2011–2016 NHANES estimated that 70% of major cardiovascular disease events in the United States, including non-fatal myocardial infarction, stroke, heart failure, or death from cardiovascular disease, were attributable to having low (0–8 points [out of a possible 14 points]) or moderate (9–11 points) cardiovascular health scores (Bundy et al. 2021). Better overall cardiovascular health scores can attenuate the risk of mortality from cardiovascular diseases (Tsao et al. 2023). Bundy and colleagues (2021) estimate up to 2 million cardiovascular disease events could be prevented per year if people with low and moderate cardiovascular health scores could achieve high (12–14 points) cardiovascular health scores.

Life's Simple 7 was updated and rescored in 2022 as Life's Essential 8 (Lloyd-Jones et al. 2022). This composite metric assigns scores for specific health behaviors (nicotine exposure—including combustible tobacco and e-cigarette use; diet; physical activity; and sleep health) and health factors (body mass index, blood lipids, blood glucose, and blood pressure). The Life's Essential 8 cardiovascular health scores can be measured or analyzed on a continuous scale (with scores ranging from 0 to 100) or categorized as low (scores of 0–49), moderate (scores of 50–79), or high (scores of 80–100) (Lloyd-Jones et al. 2022). By race and ethnicity, mean overall cardiovascular health scores—as measured by the Life's Essential 8 using data from the 2013 to March 2020 NHANES—were significantly lower among non-Hispanic Black adults (59.7; 95% CI, 58.4–60.9) than among Hispanic (63.5; 95% CI, 62.2–64.8), non-Hispanic White (66.0; 95% CI, 64.8–67.2), and Non-Hispanic Asian (69.6; 95% CI, 68.1–71.1) adults (Tsao et al. 2023). Notably, cardiovascular health scores were significantly higher among Non-Hispanic Asian adults than among adults in other racial and ethnic groups.

As described earlier, better overall cardiovascular health scores can attenuate the risk of mortality from cardiovascular diseases (Tsao et al. 2023). Findings from multiple studies have reported this strong inverse and stepwise association between the number of cardiovascular health components at ideal levels and (a) all-cause mortality from cardiovascular disease and ischemic heart disease and (b) morbidity associated with cardiovascular disease, heart disease, and subclinical measures of atherosclerosis (Folsom et al. 2015; Shay et al. 2015; González et al. 2016; Ogunmoroti et al. 2017; Spahillari et al. 2017; Oyenuga et al. 2019; Tsao et al. 2023). Additionally, several studies have found disparities in achieving high cardiovascular health scores or in having worsening cardiovascular health scores over time. For example, less ideal cardiovascular health outcomes have been observed among adults with lower income and lower educational attainment

(Caleyachetty et al. 2015; Jankovic et al. 2021; Johnson et al. 2022; Lassale et al. 2022), from minoritized population groups (specifically non-Hispanic Black adults) (Caleyachetty et al. 2015; Zheng et al. 2021; Lassale et al. 2022), among males (Jankovic et al. 2021), and by geographic region (specifically clustered in the southern United States among women of childbearing age) (Zheng et al. 2021). As discussed in Chapter 2, tobacco use is higher among many of these population groups.

Summary of the Evidence

This section described recent trends in incidence, prevalence, and mortality due to major smoking-caused diseases (i.e., cancer, COPD, and cardiovascular disease) by sociodemographic characteristics, including race and ethnicity, income level, educational attainment, and urbanicity, where available.

The incidence of smoking-related cancers of the pancreas, kidney and renal pelvis, liver, and oral cavity and pharynx increased among men and women from 2014 to 2018, and the trends for liver and for oral and pharyngeal cancers varied among racial and ethnic population groups (Cronin et al. 2022). Multiple factors likely contribute to the increasing incidence of some cancers, with smoking potentially interacting with some of these factors, such as alcohol consumption, to increase cancer risk (Boffetta and Hashibe 2006; Scoccianti et al. 2013; Connor 2017). For example, increasing incidence trends of cancers of the oral cavity and pharynx are limited to subsites that are strongly associated with human papillomavirus infection (Chaturvedi et al. 2011; Ellington et al. 2020; Islami et al. 2021). Additionally, the incidence of cancers associated with overweight and obesity, including kidney and liver cancers, are increasing (Lauby-Secretan et al. 2016; Islami et al. 2021; Cronin et al. 2022). Furthermore, increasing incidence of liver cancer has been attributed to a high prevalence of hepatitis C virus infection in the birth cohort born between 1945 and 1965 (Ryerson et al. 2016; Hofmeister et al. 2019).

The decreasing incidence of many smoking-caused cancers—including lung and bronchus cancers—primarily reflects declines in the prevalence of smoking and other risk factors, as well as improvements in cancer screening behaviors and diagnostic practices that have contributed to improved detection of disease and improvements in treatment (Howlader et al. 2020; Cronin et al. 2022; Shiels et al. 2023). For example, use of lung cancer screening in the United States increased slightly between 2015 (3.9%) and 2020 (6.5%) (Jemal and Fedewa 2017; Cronin et al. 2022; Fedewa et al. 2022), which may have contributed to increases in the proportion of cases of lung cancer diagnosed at localized stages beginning around 2013 (Siegel et al. 2022). Additionally, the reduction in overall cancer mortality during 2015–2019 has been driven largely by steep declines in lung cancer death rates among men and women (Cronin et al. 2022). Despite this progress, lung cancer remains the leading cause of cancer death among men and women in the United States (Cronin et al. 2022; Siegel et al. 2022). As such, interventions, including tobacco use prevention, increased smoking cessation, increased use of cancer screening, and increased access to more effective treatments are important to further reduce the incidence and mortality of tobacco-related cancers. Furthermore, opportunities to reduce disparities in access and use of screening and more effective treatments are warranted (Shiels et al. 2023).

Although this chapter does not examine these factors in detail, cancer disparities exist across multiple measures—including survival, screening rates, and stage at diagnosis (NCI 2022). Together with additional social and structural barriers, bias from healthcare providers, whether conscious or unconscious, or mistrust of the healthcare system can influence whether people who smoke from different population groups seek care, get screened, or get treatment for tobacco cessation (NCI 2022). Because multiple, often compounding factors influence disparities in cancer incidence and mortality, addressing them requires comprehensive efforts to prevent and reduce commercial tobacco use and systemic, racial and ethnic, and institutional inequities (NCI 2017a, 2022a).

Cigarette smoking is a primary cause of COPD and the primary risk factor for the worsening of COPD (CDC 2012; USDHHS 2014). The overall prevalence of COPD is highest among American Indian and Alaska Native adults and is lowest among Asian adults (Wheaton et al. 2019), which is consistent with patterns in tobacco product use by race and ethnicity (see Chapter 2). Data also indicate a clear socioeconomic gradient associated with COPD, whereby the prevalence of and mortality from COPD is higher among people with lower income levels and lower educational attainment than among their respective counterparts (Wheaton et al. 2019; American Lung Association n.d.). Additionally, the prevalence of COPD is higher among people with other comorbidities (Wheaton et al. 2019; American Lung Association n.d.). Evidence also suggests that rates of COPD are higher among people who live in rural areas than among those who live in urban areas, and that, over time, the disparity in COPD mortality increased between urban and rural areas, particularly among women (Carlson et al. 2022).

About 1 in 10 U.S. adults (9.9%) have cardiovascular disease, including coronary heart disease, heart failure, and stroke, while nearly half of U.S. adults (48.6%) have cardiovascular disease and hypertension (a risk factor for cardiovascular disease) (Tsao et al. 2023). By race and ethnicity, the prevalence of cardiovascular disease and hypertension is highest among non-Hispanic Black women (59.0%) and men (58.9%) and lowest among Hispanic women (37.3%) (Tsao et al. 2023). Tobacco product use and exposure to secondhand tobacco smoke have adverse effects on overall cardiovascular health. Mean overall cardiovascular health scores are lower (i.e., worse) among non-Hispanic Black adults compared with adults from other racial and ethnic population groups and highest (i.e., better) among Non-Hispanic Asian adults. Additionally, disparities in attaining high cardiovascular health scores or in having worsening scores over time have been observed among non-Hispanic Black adults compared to non-Hispanic White adults, as well as by educational attainment, income level, and geographic region. These findings underscore the need to identify barriers to achieving high cardiovascular health across different population groups (Tsao et al. 2023).

When conducting research involving race and ethnicity, reporting separately the data for as many groups as possible helps to elucidate similarities and differences in the incidence and mortality of smoking-caused diseases. Further, efforts are warranted to explore health outcomes and the intersection of race and ethnicity and additional sociodemographic characteristics such as socioeconomic status. In 1997, the Office of Management and Budget required that the category for “Asian and Pacific Islander” people be reported separately as “Asian” people and as “Native Hawaiian or Other Pacific Islander” people (Federal Register 1997; Office of Minority Health 2021). Information presented in this section is not available for disaggregation within racial and ethnic population groups, but recent evidence from 2018 to 2020 suggests that large disparities in cancer mortality rates exist between the aggregate categories of Asian and Native Hawaiian or Other Pacific Islander people (Haque et al. 2023). Within each of these major categories of racial groups, data show that the prevalence of smoking varies (see Chapter 2). Therefore, the interpretation of the data for racial and ethnic population groups presented in this section must be approached with caution because aggregation may mask disparities within these populations.

Examining overall trends in the incidence and mortality of smoking-caused outcomes provides valuable data to inform progress and challenges related to eliminating smoking-caused morbidity. Disparities in incidence, prevalence, and mortality of smoking-caused cancers, COPD, and cardiovascular disease reflect multiple intersecting factors, including risk factors other than smoking—such as alcohol use, dietary intake, physical inactivity, or exposure to bacterial and viral infections (Singh and Jemal 2017; Goding Sauer et al. 2019; American Association for Cancer Research 2022; Cronin et al. 2022; NCI 2022; Tsao et al. 2023)—social determinants of health (i.e., the conditions where people are born, live, learn, work, play, worship, and age that affect health, functioning, and quality of life), behavior, biology, and genetics (American Association for Cancer Research 2022; Cronin et al. 2022; NCI 2022; Tsao et al. 2023; Office of Disease Prevention and Health Promotion n.d.). Examining these data for specific population groups can also provide insight into groups to prioritize for future interventions and resource allocation.

Smoking-Attributable Mortality Across U.S. Populations

CDC has produced estimates of the health and economic burdens attributable to cigarette smoking for almost 30 years through the Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) system. Epidemiologists, policymakers, public health practitioners, and other professionals have used these estimates to inform and support programs and policy initiatives that are intended to reduce smoking in the United States. The common approach for calculating PAF is as follows:

$$PAF = \frac{P(RR - 1)}{P(RR - 1) + 1}$$

where P is the prevalence of exposure and RR is the relative risk for mortality associated with that exposure. CDC’s calculation for smoking-attributable fraction (SAF) adapts the PAF as follows:

$$SAF = \frac{P_{cs}(RR_{cs} - 1) + P_{fs}(RR_{fs} - 1)}{P_{cs}(RR_{cs} - 1) + P_{fs}(RR_{fs} - 1) + 1}$$

such that P_{cs} and P_{fs} represent the prevalence of current and former smoking, respectively, at the population level and RR_{cs} and RR_{fs} represent the RR of mortality associated with current and former smoking, respectively, relative to people who never smoked.

Chapter 12 of the 2014 Surgeon General’s report offers additional details about the SAMMEC methodology, including its assumptions and limitations, and how SAFs are influenced by underlying RRs (USDHHS 2014). The health burden component of SAMMEC is based on the approach of Levin (1953), which involves the computation of PAFs (known as SAFs in SAMMEC) for diseases determined by the U.S. Surgeon General to have a causal relationship with cigarette smoking (Levin 1953; USDHHS 2004, 2014). In this chapter, estimates of the number of deaths attributable to smoking are calculated by multiplying the corresponding SAF for each population group by the total number of deaths in that population group.

As of 2014, cigarette smoking was causally associated with 27 diseases or adverse outcomes (Table 6.1). Five of these chronic diseases—lung cancer, coronary heart disease, other heart disease, cerebrovascular disease, and COPD—account for an estimated 80% of smoking-attributable mortality in the United States (USDHHS 2014). According to the 2014 Surgeon General's report, cigarette smoking is causally linked to 12 cancers (USDHHS 2014). A range of estimates exists for the PAF of smoking for all cancer deaths, which represent calculations of specific population groups, prevalence estimates, and RR estimates for a given time period (USDHHS 2014). Additionally, analyses suggest that the PAF of cancer deaths attributable to smoking has declined over time due to the decline in the prevalence of smoking. For example, an analysis of the PAF for cancer deaths attributable to cigarette smoking in 2011 estimated PAFs of 51.5% for men and 44.5% for women (Siegel et al. 2015). More recently, Islami and colleagues (2022) estimated that, of the 418,563 total cancer deaths in 2019 among adults 25–79 years of age, 122,951 were attributable to smoking, for an overall PAF of 29.4% (men: 74,508 deaths, PAF = 33.1%; women: 48,536 deaths, PAF = 25.0%). By state, the estimated proportion of cancer deaths attributable to smoking in 2019 was lowest in Utah (PAF = 16.5%) and highest in Kentucky (PAF = 37.8%), which corresponds to states with lower and higher prevalence of smoking (see Chapter 2).

Historically, national and state-based estimates of smoking-attributable mortality have been generated and reported by sex. However, reports on smoking-attributable mortality that are stratified by other factors relevant to health and smoking-related disparities, such as race and ethnicity, level of educational attainment, urbanicity, and geographic region (e.g., U.S. Census Region) are lacking, representing an important knowledge gap.

One reason for the absence of such estimates has been the general lack of group-specific RR estimates for smoking-attributable diseases, which are needed to estimate smoking-attributable mortality. Such data are often lacking because many population groups are underrepresented in large cohort studies of people who smoke and do not smoke. For example, some ethnic populations with lower SES are underrepresented in the Cancer Prevention Study II (Calle et al. 2002; USDHHS 2004), which is a well-known cohort study of 1.2 million American men and women volunteers that serves as a common source of data for RR estimates in analyses of SAFs (Calle et al. 2002; USDHHS 2004). Although analyses using estimates

Table 6.1 Diseases that are causally associated with or worsened by cigarette smoking

Diseases	ICD-10
Cancers	
Trachea, bronchus, and lung	C33-C34
Lip, oral cavity, pharynx	C00-C14
Esophagus	C15
Stomach	C16
Colon and rectum	C18, C20
Liver	C22
Pancreas	C25
Larynx	C32
Cervix uteri	C53
Kidney, renal pelvis, ureter	C64-C66
Urinary, bladder	C67
Acute myeloid leukemia	C92.0
Cardiovascular diseases and diabetes	
Coronary heart disease	I20-I25
Other heart disease	
Rheumatic heart disease	I00-I09
Pulmonary heart disease	I26-I28
Other forms of heart disease	I29 I51
Cerebrovascular disease	I60-I69
Atherosclerosis	I70
Aortic aneurysm	I71
Other arterial disease	I72-I78
Diabetes	E10-E14
Pulmonary diseases	
Pneumonia	J10-J11
Influenza	J12-J18
Tuberculosis	A16-A19
Chronic obstructive pulmonary disease	
Bronchitis	J40-J42
Emphysema	J43
Chronic airways obstruction	J44

Source: USDHHS (2014).
Note: **ICD-10 =** International Classification of Diseases, 10th Revision.

of smoking-attributable mortality based on Cancer Prevention Study II and other cohorts are considered scientifically sound for the overall U.S. population (Malarcher et al. 2000; USDHHS 2004, 2014), contemporary cohorts that are more representative of the current U.S. population are needed to produce appropriate population group estimates of smoking-attributable mortality.

The National Health Interview Survey and Linked Mortality Files

The National Center for Health Statistics (NCHS) links records from participants in large national surveys, such as the NHIS and the NHANES, which are designed to be representative of the civilian, noninstitutionalized U.S. population, to mortality information in the NDI. Information from these data sources enables researchers to conduct longitudinal analyses that describe health outcomes in relation to the baseline characteristics measured in these surveys.

RRs for mortality were computed using the NHIS Linked Mortality File (LMF) by current and former smoking status. To protect the privacy of decedents, work was conducted in the NCHS Research Data Center (CDC 2020). Specifically, this analysis used NHIS respondents who were surveyed during 1999 to 2014 with linked mortality data beginning in 2000 through December 31, 2015. All participants with sufficient identifying data were eligible for mortality linkage. Each survey record was screened to determine if it contained at least one of the following combinations of identifying data elements:

1. Social Security number (SSN) (nine digits [SSN9] or last four digits [SSN4]), last name, first name

2. SSN (SSN9 or SSN4), sex, month of birth, day of birth, year of birth

3. Last name, first name, month of birth, year of birth

Any survey participant records that did not meet these minimum data requirements were ineligible for record linkage. On average, an estimated 94.8% of NHIS participants for the years 1999 to 2014 were eligible for mortality follow-up (NCHS 2019). Mortality for eligible survey respondents was primarily determined by matching identifying data between survey records to the NDI and supplemented with information from NHIS linkages with other sources, such as the Social Security Administration and Centers for Medicare & Medicaid Services. If a match was found for the NHIS respondent in the NDI, the respondent was assumed to be dead; if no match was found, the participant was assumed to be alive as of December 31, 2015.

The respondent's smoking status was collected only at the time of their NHIS interview and not at mortality follow-up. To minimize bias in RR estimates attributable to potential changes in smoking status over time (e.g., initiation, relapse, or quitting), follow-up was restricted to 10 years, and participant data were censored thereafter. The demographic characteristics of the NHIS-NDI cohort by race (for non-Hispanic people or people of Hispanic origin) are shown in Table 6.2.

Cause of Death

The NHIS-NDI LMF reports respondents' specific underlying cause of death, which was coded using ICD-10 (Table 6.1). Initially, lung cancer, coronary heart disease, other heart disease, cerebrovascular disease, and COPD were examined as causes of death, as were grouped conditions that included all smoking-attributable diseases, all cancers, and all deaths. However, preliminary analyses of individual causes of death for sociodemographic groups resulted in small sample sizes, introducing sizeable error into the resulting estimates. Therefore, the following analyses focus on mortality from all causes combined (hereafter referred to as "all-cause mortality").

Demographic Variables

All demographic variables—including smoking status—among respondents in the NHIS-NDI LMF cohort were determined based on respondents' answers at the time of their NHIS interview. Baseline demographic characteristics and smoking status were assumed to be consistent during follow-up.

Age

Following standard SAMMEC methodology for estimating smoking-attributable mortality for adults (Levin 1953; USDHHS 2004, 2014), participants younger than 35 years of age at the time of their NHIS interview were excluded from analysis. Participants were categorized into four age strata: 35–54 years of age, 55–64 years of age, 65–74 years of age, and 75 years of age and older.

Race and Ethnicity

The analysis used NHIS-NDI data from 1999 to 2015 among non-Hispanic White, non-Hispanic Black, and Hispanic people only. Although other racial and ethnic groups were and remain of interest (e.g., American Indian and Alaska Native people, Asian American, Native Hawaiian, and Other Pacific Islander people), the small numbers of

Table 6.2 Demographic characteristics of participants by race and ethnicity,[a] NHIS Linked Mortality File, 1999–2014

Demographic characteristics	Hispanic: N (%)[b]	Non-Hispanic Black: N (%)[b]	Non-Hispanic White: N (%)[b]
Sex			
Male	23,473 (43.7)	20,596 (39.6)	108,074 (44.3)
Female	30,201 (56.3)	31,475 (60.4)	135,656 (55.7)
Age group (in years)			
35–54	34,658 (64.57)	28,194 (54.15)	113,533 (46.58)
55–64	8,882 (16.55)	10,963 (21.05)	52,506 (21.54)
65–74	6,181 (11.52)	7,570 (14.54)	39,430 (16.18)
≥75	3,953 (7.36)	5,344 (10.26)	38,261 (15.70)
Education			
≤8th grade	15,255 (28.8)	3,823 (7.4)	9,761 (4.0)
9th–12th grade, no diploma	8,492 (16.0)	8,502 (16.5)	19,597 (8.1)
High school diploma or GED	12,438 (23.5)	15,443 (30.0)	71,906 (29.7)
Some college, no degree	10,402 (19.7)	14,778 (28.7)	69,395 (28.7)
≥College graduate	6,344 (12.0)	8,873 (17.3)	71,317 (29.5)
Urbanicity			
Urban	35,033 (67.3)	33,194 (64.0)	107,438 (44.1)
Rural	17,031 (32.7)	18,655 (36.0)	136,022 (55.9)
Region			
Northeast	7,702 (15.3)	7,892 (16.1)	43,847 (19.2)
South	3,576 (7.1)	8,773 (17.9)	61,943 (27.1)
Midwest	18,464 (36.6)	28,066 (57.1)	75,637 (33.1)
West	20,659 (41.0)	4,383 (8.9)	47,039 (20.6)
Smoking status			
Current	8,001 (15.0)	11,461 (22.3)	47,664 (19.7)
Former	9,878 (18.5)	10,399 (20.2)	73,306 (30.3)
Never	35,390 (66.4)	29,551 (57.5)	120,664 (49.9)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Note: **NHIS =** National Health Interview Survey.
[a]Sample sizes were too small to report data for other racial and ethnic groups.
[b]Numbers in parentheses are unweighted percentages. Percentages may not add up to exactly 100% due to rounding.

deaths for these population groups in the NHIS-NDI LMF precluded further analysis. Respondents indicated Hispanic ethnicity by responding affirmatively to the question “Do you consider yourself to be Hispanic or Latino?” They then were asked “What race or races do consider yourself to be? Please select one or more of these categories.”

For the analyses related to smoking-attributable mortality, the term *Hispanic* refers to people from any race who identify as Hispanic. American Indian and Alaska Native, Asian American, Black, Hispanic, Native Hawaiian, Other Pacific Islander, and White populations exclude those who identify as Hispanic. Although the risk of death for Hispanic ethnicity is not the same across all racial groups, due to sample sizes, race-Hispanic and race-non-Hispanic ethnicity could not be analyzed separately.

Level of Educational Attainment

Level of educational attainment at the time of respondents’ NHIS interview was based on responses to the question “What is the highest level of school you have completed or the highest degree you have received?” The survey included five mutually exclusive categories: (1) 8th grade or lower; (2) 9th–12th grade, no diploma; (3) high school diploma or GED (General Educational Development certificate); (4) some college, no degree; and (5) college degree or above.

Geographic Region

The analysis examined four census geographic regions based on the respondents' state of residence at the time of the NHIS interview.

- Northeast: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, and Pennsylvania;
- Midwest: Indiana, Illinois, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota;
- South: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas; and
- West: Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, Wyoming, Alaska, California, Hawai‘i, Oregon, and Washington state.

Urbanicity

The Office of Management and Budget determines metropolitan statistical areas using census data. Over time, however, the categorization of counties may change as fewer urban areas become essentially metropolitan areas because of population changes. The NCHS urbanization schemes are updated regularly to reflect changes to settlement patterns (Ingram and Franco 2014).

For the current analysis, among NHIS-NDI LMF participants, urbanicity at the time of the NHIS interview was determined by the 2013 NCHS Urban-Rural Classification Scheme for counties (Ingram and Franco 2014). These data are available only through the NCHS Research Data Center to protect the privacy of decedents (CDC 2019). Briefly, all counties in the United States were assigned to one of the six urbanization levels (large central metro, large fringe metro, medium metro, small metro, micropolitan, and noncore) ranging from the most urban to the most rural on the basis of the 2010 Office of Management and Budget metropolitan-nonmetropolitan classification of counties. Metropolitan counties (e.g., urban) included large central metro, large fringe metro, medium metro, and small metro counties; nonmetropolitan counties (e.g., rural) included micropolitan, and noncore communities.

Smoking Status

Respondents in the NHIS-NDI LMF were categorized as people who currently smoked, people who smoked in the past, or people who never smoked based on their responses at the time of their NHIS interview. People who currently smoked were defined as those who reported having smoked 100 or more cigarettes in their lifetime and who smoked every day or on some days at the time of the interview. People who smoked in the past were defined as those who reported having smoked at least 100 cigarettes during their lifetime but were not smoking at the time of the interview. People who never smoked were defined as those who had never smoked, or who had reported having smoked less than 100 cigarettes in their lifetimes (NCHS n.d.).

Trends and disparities in the prevalence of smoking by race and ethnicity, level of educational attainment, geographic region, and urbanicity are described in Chapter 2.

Estimates of Relative Risk of Mortality for Selected Sociodemographic Groups

Weighted NHIS-NDI LMF data were used to estimate the RR of mortality by group. The original NHIS adult sample weights were adjusted to account for respondents who were ineligible for linkage to the mortality follow-up (through December 31, 2015). Following standard procedures, the adjusted adult sample weights were divided by 17 (equal to the number of NHIS survey years) to compute the final analytic weights per person; more details about the NHIS-NDI LMF methodology can be found elsewhere (NCHS 2019).

The RRs for smoking-attributable diseases were computed for people who currently smoked and people who smoked in the past; the referent group was people who never smoked. For all sociodemographic groups considered, computed RRs were stratified by gender[3] and age group. Deaths were assumed to be Poisson-distributed

[3]Gender was categorized as male or female only. Other gender identities, including nonbinary, were not assessed in the NHIS during this period.

and conditional on number of years of follow-up. A multivariable Poisson regression model was built to compute RRs by smoking status for each age group and racial ethnic group. RRs were computed with a 95% CI; CIs were based on a normal approximation for the natural log RRs. RR estimates for American Indian and Alaska Native and Asian American, Native Hawaiian, and Other Pacific Islander people are omitted from this section because of insufficient numbers of deaths in each age group during the period of analysis.

Relative Risks of All-Cause Mortality

Race and Ethnicity

Table 6.3 presents estimated RRs of all-cause mortality by gender, race and ethnicity, and age group. For Hispanic, non-Hispanic White, and non-Hispanic Black men, and non-Hispanic White women who currently smoked (at the time of their interview), compared with people who never smoked, the RR of all-cause mortality increased from the 35- to 54-year-old age group to the 55- to 64-year-old age group before declining for the oldest age groups (65–74 years of age and 75 years of age and older). For non-Hispanic Black and Hispanic women who currently smoked compared with women who never smoked, the RR of all-cause mortality increased from the 35- to 54-year-old age group to the 65- to 74-year-old age group before declining among women 75 years of age and older. In general, these estimates were largest for non-Hispanic White people, followed by non-Hispanic Black adults, and lowest for Hispanic adults. This was true across all age groups and among men and women.

Non-Hispanic White men and women who currently smoked and were 35–64 years of age had the highest RR estimates for all-cause mortality, with more than three times the mortality risk of people who never smoked. For Hispanic men and women 75 years of age and older, current smoking was not associated with a statistically significantly elevated RR of mortality compared with never smoking, although these results may have been the product of small numbers of observed deaths in those categories. White women who were younger than 65 years of age and currently smoked had an estimated risk of death that was three times that of their never-smoking counterparts. Black women who were younger than 75 years of age and who currently smoked had more than twice the risk of death compared with Black women in that age group who never smoked. Estimates of RR were generally highest in the 55- to 64-year-old age group across the three racial and ethnic groups for men and for non-Hispanic White women. For Black and Hispanic women, estimates of RR were highest in the 65- to 74-year-old age group.

For most population groups, people who smoked in the past (at the time of interview) had a moderately increased risk of mortality by gender, age group, and race or Hispanic origin compared with people who never smoked (RR <2.0). Specific groups of people who smoked in the past had RR estimates that were not statistically significantly different from that of people who never smoked, as indicated by the CIs crossing 1.0: non-Hispanic Black men (75 years of age and older: RR = 1.08), Hispanic women (35–64 years of age: RR = 0.81; 55–64 years of age: RR = 1.24; 75 years of age and older: RR = 1.14), and non-Hispanic Black women (35–54 years of age: RR = 1.23; 75 years of age and older: RR = 1.12). These non-significant findings may reflect declining RRs with increasing time since quit smoking (USDHHS 2020) or may be due to small sample sizes resulting in wider CIs.

Level of Educational Attainment

Table 6.4 presents RR estimates of all-cause mortality for men and women who, at the time of interview, currently smoked and people who smoked in the past by level of educational attainment and age group compared with people of the same level of educational attainment and age who never smoked. Across all age groups, genders, and levels of educational attainment, people who currently smoked had a significantly higher RR of all-cause mortality compared with their never-smoking counterparts. Currently smoking, college-educated men 65–74 years of age and currently smoking college-educated women 55–64 years of age at the time of interview had the highest RR (3.39 and 3.43, respectively) for mortality compared with their never-smoking counterparts.

With some exceptions, the magnitude of the RR was generally lower among people with an eighth-grade education or less who currently smoked at the time of interview (compared to their never-smoking counterparts) than were RRs among people with other levels of educational attainment. Furthermore, with some exceptions, RR estimates were generally higher among people with more than an eighth-grade education but less than a college degree who smoked (compared to their never-smoking counterparts) than they were among people with other educational attainment levels. Among men and women 75 years of age and older in all levels of educational attainment, RR estimates were similar and overlapping, ranging from 1.29 to 1.67.

Mortality RRs among people who smoked in the past (at the time of interview) were much lower than those among people who currently smoked (RRs among people who smoked in the past were ≤1.7); CIs overlapped for most estimates, leading to few differences by level of educational attainment, age group, and sex. Adults 35–54 years of age and 75 years of age and older who smoked in the past had

Table 6.3 Estimated relative risks for all-cause mortality among people, 35 years of age and older, who currently smoked and who formerly smoked, by gender, race and ethnicity, and age; NHIS Linked Mortality File, 1999–2014

Gender, race and ethnicity,[a] and age group	People who currently smoked vs. people who never smoked: RR (95% CI)	People who formerly smoked vs. people who never smoked: RR (95% CI)
Men		
Hispanic		
35–54	1.44 (1.24–1.68)	1.3 (1.1–1.54)
55–64	1.98 (1.57–2.5)	1.28 (1.02–1.61)
65–74	1.82 (1.43–2.31)	1.41 (1.17–1.69)
≥75	1.06 (0.79–1.41)	1.19 (1–1.42)
Non-Hispanic Black		
35–54	1.97 (1.68–2.31)	1.57 (1.28–1.93)
55–64	2.7 (2.22–3.29)	1.76 (1.43–2.17)
65–74	2.31 (1.93–2.77)	1.29 (1.09–1.53)
≥75	1.28 (1.02–1.62)	1.08 (0.93–1.27)
Non-Hispanic White		
35–54	3.28 (2.99–3.59)	1.49 (1.33–1.67)
55–64	3.42 (3.09–3.79)	1.51 (1.36–1.68)
65–74	2.81 (2.56–3.09)	1.58 (1.46–1.71)
≥75	1.57 (1.42–1.74)	1.18 (1.12–1.25)
Women		
Hispanic		
35–54	1.31 (1.07–1.61)	0.81 (0.61–1.07)
55–64	1.4 (1.06–1.87)	1.24 (0.96–1.62)
65–74	2.49 (1.93–3.2)	1.3 (1.05–1.61)
≥75	1.34 (0.95–1.9)	1.14 (0.95–1.36)
Non-Hispanic Black		
35–54	2.08 (1.8–2.41)	1.23 (0.99–1.55)
55–64	2.05 (1.72–2.45)	1.46 (1.2–1.77)
65–74	2.32 (1.95–2.76)	1.45 (1.24–1.69)
≥75	1.52 (1.24–1.86)	1.12 (0.99–1.26)
Non-Hispanic White		
35–54	3.19 (2.88–3.53)	1.37 (1.2–1.57)
55–64	3.6 (3.25–3.98)	1.7 (1.53–1.89)
65–74	2.65 (2.44–2.87)	1.55 (1.45–1.67)
≥75	1.55 (1.44–1.67)	1.23 (1.18–1.28)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **NHIS =** National Health Interview Survey; **RR =** relative risk.
[a]Sample sizes were too small to report data for other racial and ethnic groups.

lower mortality RR estimates (compared to people who never smoked) than the RR estimates among those 55–74 years of age. Compared to their never-smoking counterparts, mortality RR estimates for people with specific levels of educational attainment who smoked in the past did not differ significantly for men and women 35–54 years of age with less than an eighth-grade education; women 35–54 years of age with 9th- to 12th-grade education but no diploma; women 35–54 years of age with a high school degree or GED; and men 75 years of age and older with some college education but no degree. As stated previously, these non-significant findings may be due to small sample sizes.

Table 6.4 Estimated relative risks for all-cause mortality among people, 35 years of age and older, who currently smoked and who formerly smoked, by gender, level of educational attainment, and age group, NHIS Linked Mortality File, 1999–2014

Gender, level of educational attainment, and age group	People who currently smoked vs. people who never smoked: RR (95% CI)	People who formerly smoked vs. people who never smoked: RR (95% CI)
Men		
≤8th grade		
35–54	1.65 (1.33–2.04)	1.2 (0.92–1.57)
55–64	2.27 (1.79–2.89)	1.34 (1.04–1.73)
65–74	2.27 (1.89–2.72)	1.7 (1.45–2.00)
≥75	1.29 (1.09–1.52)	1.2 (1.09–1.33)
9th–12th grade, no diploma		
35–54	1.72 (1.44–2.05)	1.3 (1.04–1.63)
55–64	2.49 (2.00–3.12)	1.61 (1.27–2.02)
65–74	2.48 (2.03–3.04)	1.57 (1.31–1.88)
≥75	1.39 (1.13–1.71)	1.23 (1.08–1.41)
High school diploma or GED		
35–54	2.02 (1.79–2.28)	1.27 (1.08–1.48)
55–64	2.52 (2.17–2.91)	1.32 (1.13–1.54)
65–74	2.43 (2.11–2.81)	1.37 (1.21–1.54)
≥75	1.30 (1.10–1.55)	1.22 (1.12–1.34)
Some college, no degree		
35–54	2.25 (1.98–2.56)	1.29 (1.10–1.51)
55–64	3.07 (2.58–3.66)	1.47 (1.23–1.75)
65–74	2.09 (1.76–2.47)	1.31 (1.14–1.50)
≥75	1.50 (1.21–1.85)	1.09 (0.98–1.22)
≥College degree		
35–54	2.84 (2.38–3.40)	1.25 (1.02–1.53)
55–64	2.77 (2.26–3.38)	1.30 (1.09–1.55)
65–74	3.39 (2.77–4.14)	1.52 (1.32–1.76)
≥75	1.54 (1.17–2.02)	1.16 (1.05–1.29)
Women		
≤8th grade		
35–54	1.74 (1.36–2.24)	0.87 (0.55–1.38)
55–64	1.98 (1.55–2.53)	1.60 (1.24–2.07)
65–74	2.30 (1.92–2.76)	1.58 (1.34–1.87)
≥75	1.39 (1.17–1.65)	1.17 (1.07–1.29)
9th–12th grade, no diploma		
35–54	1.57 (1.31–1.88)	1.11 (0.84–1.47)
55–64	2.52 (2.09–3.04)	1.65 (1.32–2.05)
65–74	2.67 (2.31–3.09)	1.68 (1.46–1.93)
≥75	1.58 (1.37–1.83)	1.30 (1.18–1.43)
High school diploma or GED		
35–54	1.94 (1.71–2.19)	1.05 (0.88–1.27)

Table 6.4 Continued

Gender, level of educational attainment, and age group	People who currently smoked vs. people who never smoked: RR (95% CI)	People who formerly smoked vs. people who never smoked: RR (95% CI)
55–64	2.67 (2.32–3.06)	1.60 (1.37–1.85)
65–74	2.35 (2.08–2.66)	1.66 (1.50–1.83)
≥75	1.67 (1.48–1.87)	1.31 (1.23–1.40)
Some college, no degree		
35–54	2.63 (2.30–3.02)	1.18 (0.98–1.41)
55–64	2.82 (2.39–3.32)	1.47 (1.24–1.75)
65–74	2.54 (2.18–2.96)	1.37 (1.20–1.56)
≥75	1.58 (1.35–1.86)	1.28 (1.18–1.40)
≥College degree		
35–54	2.23 (1.78–2.80)	1.25 (1.00–1.57)
55–64	3.43 (2.72–4.34)	1.50 (1.21–1.87)
65–74	3.01 (2.38–3.80)	1.44 (1.20–1.72)
≥75	1.42 (1.12–1.81)	1.16 (1.03–1.30)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **GED =** General Educational Development; **NHIS =** National Health Interview Survey; **RR =** relative risk.

Geographic Region

Across all geographic regions, people 75 years of age and older who currently smoked at the time of their NHIS interview had the lowest RR for mortality compared with their counterparts never smoked (Table 6.5), which may be due to competing causes of mortality and temporal trends in smoking by birth cohort. For example, because older birth cohorts started smoking at earlier ages and had higher smoking prevalence than younger cohorts, more members of older birth cohorts may have died from smoking-attributable causes before reaching age 75 (USDHHS 2014). People 55–64 years of age who currently smoked had the highest RR for mortality, on average, led by men in the Northeast (RR = 3.30) and women in the Midwest (RR = 3.38), which were more than three times the RR for mortality compared with people who never smoked in their respective regions and age groups. RR estimates for people who smoked in the past were highest in the Midwest for men and women 35–74 years of age in the Midwest; men and women 65–74 years of age who smoked in the past had more than 1.7 times the risk for mortality compared with their never-smoking counterparts.

Urbanicity

Table 6.6 presents RR estimates for people who currently smoked and people who smoked in the past by urbanicity (at the time of their NHIS interview) compared to their never-smoking counterparts. In rural areas, women who currently smoked at the time of interview and were 35–54 years of age had higher RRs for mortality compared with women in the same age group who currently smoked in urban areas. There were no major differences in RR for mortality between people living in urban and rural places for other age and gender groups. Estimates followed similar patterns of highest RRs for men and women 55–65 years of age and lowest RRs for men and women 75 years of age and older. With respect to former smoking, the RR for mortality was highest (1.64) among women 55–64 years of age who lived in rural areas, although the magnitude of the RR for mortality was similar among other population groups studied based on overlapping CIs. The RR for mortality among women 35–54 years of age who smoked in the past and lived in either rural or urban areas was not statistically significant.

Smoking-Attributable Fractions in the United States, 2010–2018

To facilitate calculations of the SAF, the population-level prevalence estimates of current, former, and never smoking—pooled across the public use 2010–2018 NHIS data files—were stratified by age group, gender, race and ethnicity, educational attainment, and geographic region (Appendix Tables 6A.1–6A.3). Weights were pooled across years by dividing annual weights by 9 (equal to the number of NHIS survey years) following standard procedures. Pooled prevalence estimates by urbanicity were not obtained because of the absence of this information in 2010–2018 NHIS public-use files.

Table 6.5 Estimated relative risks for all-cause mortality among people, 35 years of age and older, who currently smoked and who formerly smoked, by gender, geographic region, and age group; NHIS Linked Mortality File, 1999–2014

Gender, geographic region, and age group	People who currently smoked vs. people who never smoked: RR (95% CI)	People who formerly smoked vs. people who never smoked: RR (95% CI)
Men		
Northeast		
35–54	2.92 (2.44–3.51)	1.33 (1.05–1.67)
55–64	3.30 (2.67–4.08)	1.42 (1.14–1.76)
65–74	2.35 (1.94–2.84)	1.43 (1.23–1.66)
≥75	1.44 (1.16–1.78)	1.22 (1.09–1.36)
Midwest		
35–54	3.07 (2.61–3.61)	1.68 (1.37–2.06)
55–64	2.94 (2.45–3.52)	1.51 (1.26–1.82)
65–74	2.76 (2.32–3.29)	1.73 (1.50–2.00)
≥75	1.51 (1.26–1.81)	1.22 (1.11–1.35)
South		
35–54	2.32 (2.08–2.59)	1.38 (1.20–1.58)
55–64	3.00 (2.63–3.41)	1.43 (1.25–1.64)
65–74	2.67 (2.35–3.02)	1.47 (1.32–1.63)
≥75	1.36 (1.17–1.58)	1.16 (1.07–1.27)
West		
35–54	2.14 (1.86–2.47)	1.21 (1.02–1.44)
55–64	2.84 (2.35–3.43)	1.43 (1.19–1.73)
65–74	2.70 (2.25–3.24)	1.41 (1.21–1.63)
≥75	1.44 (1.19–1.74)	1.25 (1.12–1.39)
Women		
Northeast		
35–54	2.76 (2.29–3.33)	1.21 (0.95–1.55)
55–64	2.67 (2.18–3.26)	1.42 (1.16–1.74)
65–74	2.49 (2.1–2.96)	1.57 (1.36–1.81)
≥75	1.71 (1.47–1.99)	1.30 (1.19–1.42)
Midwest		
35–54	2.31 (1.96–2.73)	1.22 (0.97–1.53)
55–64	3.38 (2.83–4.03)	1.68 (1.38–2.03)
65–74	2.70 (2.33–3.12)	1.70 (1.49–1.93)
≥75	1.49 (1.29–1.73)	1.14 (1.05–1.24)
South		
35–54	2.48 (2.21–2.78)	1.14 (0.96–1.35)
55–64	2.81 (2.47–3.19)	1.59 (1.39–1.83)
65–74	2.64 (2.36–2.95)	1.56 (1.42–1.73)
≥75	1.47 (1.30–1.66)	1.24 (1.16–1.33)

Table 6.5 Continued

Gender, geographic region, and age group	People who currently smoked vs. people who never smoked: RR (95% CI)	People who formerly smoked vs. people who never smoked: RR (95% CI)
West		
35–54	1.90 (1.62–2.24)	0.93 (0.75–1.15)
55–64	2.61 (2.14–3.17)	1.37 (1.11–1.68)
65–74	2.50 (2.11–2.97)	1.28 (1.10–1.48)
≥75	1.53 (1.30–1.80)	1.25 (1.14–1.36)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **NHIS =** National Health Interview Survey; **RR =** relative risk.

Table 6.6 Estimated relative risks for all-cause mortality among people, 35 years of age and older, who currently smoked and who formerly smoked, by gender, urbanicity, and age group; NHIS Linked Mortality File, 1999–2014

Gender, urbanicity, and age group	People who currently smoked vs. people who never smoked: RR (95% CI)	People who formerly smoked vs. people who never smoked: RR (95% CI)
Men		
Urban		
35–54	2.33 (2.12–2.55)	1.35 (1.2–1.51)
55–64	3.16 (2.8–3.56)	1.58 (1.4–1.79)
65–74	2.52 (2.25–2.83)	1.56 (1.43–1.72)
≥75	1.43 (1.26–1.63)	1.19 (1.11–1.27)
Rural		
35–54	2.52 (2.28–2.78)	1.32 (1.17–1.5)
55–64	2.9 (2.59–3.24)	1.36 (1.21–1.52)
65–74	2.73 (2.46–3.04)	1.47 (1.34–1.61)
≥75	1.43 (1.27–1.6)	1.19 (1.11–1.27)
Women		
Urban		
35–54	2.06 (1.86–2.27)	1.06 (0.93–1.21)
55–64	2.64 (2.35–2.96)	1.38 (1.22–1.56)
65–74	2.56 (2.31–2.84)	1.49 (1.37–1.63)
≥75	1.49 (1.35–1.65)	1.27 (1.2–1.34)
Rural		
35–54	2.56 (2.31–2.84)	1.07 (0.92–1.24)
55–64	3.08 (2.75–3.44)	1.64 (1.45–1.85)
65–74	2.58 (2.35–2.82)	1.53 (1.41–1.66)
≥75	1.62 (1.47–1.77)	1.21 (1.15–1.27)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **NHIS =** National Health Interview Survey; **RR =** relative risk.

Race and Ethnicity

Among men, an estimated 9–22% of all deaths of Hispanic, 12–39% of non-Hispanic White, and 7–39% of non-Hispanic Black men were attributed to smoking; the range varied by age group (Table 6.7). Among women, smoking was attributed to 1–13% of all deaths of Hispanic, 10–38% of non-Hispanic White, and 7–22% of non-Hispanic Black women. Among men, SAFs were highest among non-Hispanic White men who were 35–64 years of age (38–39%) and among non-Hispanic Black men who were 55–64 years of age (39%). Among women, SAFs were highest among non-Hispanic White women who were 35–64 years of age (35–38%) and lowest among Hispanic women who were 35–54 years of age and 75 years of age and older (<5%). For non-Hispanic Black and White people, SAFs peaked at 55–64 years of age before declining at older ages. For Hispanic people, SAFs peaked at 65–74 years of age.

Level of Educational Attainment

Table 6.8 shows SAFs by level of educational attainment. Among men, 12–16% of all deaths for those with an 8th-grade education or less were attributed to smoking, 15–44% for those with a 9th- to 12th-grade education but no diploma, 13–35% for those with a high school diploma or GED, 8–37% for those with some college education but no degree, and 9–17% for those with a college degree or above. Among women, 6–19% of all deaths for those with an 8th-grade education or less were attributed to smoking, 14–40% for those with a 9th- to 12th-grade education but no diploma, 12–33% for those with a high school diploma or GED, 12–30% for those with some college education but no degree, and 6–21% for those with a college degree or above. SAFs peaked at 55–64 years of age among men and women with more than an 8th-grade education but less than a college degree and among women with college degrees. In contrast, SAFs peaked at 65–74 years of age among men and women with an 8th-grade education or less and among men with a college degree or higher.

Geographic Region

Table 6.9 shows SAFs by geographic region. Among men, 12–34% of all deaths in the Northeast, 14–39% in the Midwest, 10–36% in the South, and 14–31% in the West were attributable to smoking. Among women, 12–27% of all deaths in the Northeast, 7–37% in the Midwest, 9–30% in the South, and 9–22% in the West were attributable to smoking.

Urbanicity

SAFs could not be calculated by urbanicity because the prevalence of smoking stratified by the intersection of urbanicity, gender, and age group was not available in the 2010–2018 NHIS public use data file.

Smoking-Attributable Mortality in the United States by Race and Ethnicity, 2010–2018

Tables 6.10 and 6.11 present the estimated number of deaths from all causes attributable to smoking among

Table 6.7 Smoking-attributable fractions for all-cause mortality by gender, age group, and race and ethnicity; NHIS Linked Mortality File, 1999–2014

Gender and age group	Hispanic: SAF (95% CI)[a]	Non-Hispanic Black: SAF (95% CI)[a]	Non-Hispanic White: SAF (95% CI)[a]
Men			
35–54	0.11 (0.05–0.17)	0.23 (0.16–0.30)	0.38 (0.34–0.42)
55–64	0.19 (0.08–0.29)	0.39 (0.30–0.47)	0.39 (0.34–0.43)
65–74	0.22 (0.11–0.32)	0.27 (0.17–0.36)	0.34 (0.29–0.38)
≥75	0.09 (-0.02–0.19)	0.07 (-0.03–0.17)	0.12 (0.09–0.16)
Women			
35–54	0.01 (-0.03–0.06)	0.16 (0.11–0.22)	0.35 (0.31–0.4)
55–64	0.07 (0.00–0.16)	0.22 (0.14–0.29)	0.38 (0.34–0.42)
65–74	0.13 (0.06–0.20)	0.20 (0.14–0.27)	0.27 (0.24–0.30)
≥75	0.04 (-0.01–0.09)	0.07 (0.01–0.12)	0.10 (0.08–0.12)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **NHIS =** National Health Interview Survey; **SAF =** smoking-attributable fraction.
[a]Sample sizes were too small to report data for other racial and ethnic groups.

Table 6.8 Smoking-attributable fractions for all-cause mortality by gender, age group, and level of educational attainment; NHIS Linked Mortality File, 1999–2014

Gender and age group	≤8th grade: SAF (95% CI)	9th–12th grade, no diploma: SAF (95% CI)	High school diploma or GED: SAF (95% CI)	Some college, no degree: SAF (95% CI)	≥College degree: SAF (95% CI)
Men					
35–54	0.16 (0.05–0.26)	0.27 (0.17–0.37)	0.27 (0.21–0.33)	0.26 (0.19–0.32)	0.16 (0.10–0.22)
55–64	0.29 (0.16–0.40)	0.44 (0.32–0.54)	0.35 (0.27–0.42)	0.37 (0.29–0.45)	0.18 (0.11–0.25)
65–74	0.37 (0.28–0.45)	0.38 (0.28–0.47)	0.30 (0.22–0.36)	0.24 (0.15–0.32)	0.27 (0.20–0.34)
≥75	0.12 (0.06–0.19)	0.15 (0.06–0.24)	0.13 (0.07–0.20)	0.08 (0.00–0.15)	0.09 (0.03–0.15)
Women					
35–54	0.07 (0.01–0.15)	0.17 (0.08–0.26)	0.21 (0.15–0.27)	0.27 (0.21–0.33)	0.11 (0.05–0.18)
55–64	0.18 (0.10–0.27)	0.40 (0.30–0.48)	0.33 (0.27–0.39)	0.30 (0.23–0.37)	0.21 (0.14–0.30)
65–74	0.19 (0.13–0.25)	0.34 (0.28–0.40)	0.27 (0.23–0.32)	0.23 (0.16–0.29)	0.19 (0.11–0.26)
≥75	0.06 (0.02–0.09)	0.14 (0.09–0.18)	0.12 (0.09–0.15)	0.12 (0.08–0.16)	0.06 (0.01–0.11)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **GED =** General Educational Development; **NHIS =** National Health Interview Survey; **SAF =** smoking-attributable fraction.

Table 6.9 Smoking-attributable fractions for all-cause mortality by gender, age, and geographic region; NHIS Linked Mortality File, 1999–2014

Gender and age	Northeast: SAF (95% CI)	Midwest: SAF (95% CI)	South: SAF (95% CI)	West: SAF (95% CI)
Men				
35–54	0.30 (0.22–0.38)	0.39 (0.32–0.46)	0.27 (0.22–0.32)	0.19 (0.13–0.26)
55–64	0.34 (0.24–0.43)	0.38 (0.29–0.45)	0.36 (0.30–0.41)	0.31 (0.22–0.39)
65–74	0.26 (0.17–0.34)	0.37 (0.30–0.44)	0.31 (0.26–0.37)	0.28 (0.19–0.35)
≥75	0.12 (0.05–0.19)	0.14 (0.07–0.20)	0.10 (0.05–0.16)	0.14 (0.07–0.21)
Women				
35–54	0.25 (0.17–0.33)	0.25 (0.17–0.33)	0.23 (0.18–0.28)	0.09 (0.04–0.15)
55–64	0.27 (0.18–0.35)	0.37 (0.29–0.44)	0.30 (0.25–0.36)	0.22 (0.14–0.30)
65–74	0.26 (0.19–0.32)	0.30 (0.24–0.36)	0.25 (0.21–0.29)	0.17 (0.11–0.24)
≥75	0.12 (0.08–0.16)	0.07 (0.03–0.11)	0.09 (0.06–0.12)	0.10 (0.06–0.14)

Source: NHIS 1999–2014, with National Death Index mortality follow-up restricted to a maximum of 10 years, ending December 31, 2015.
Notes: **CI =** confidence interval; **NHIS =** National Health Interview Survey; **SAF =** smoking-attributable fraction.

non-Hispanic Black, non-Hispanic White, and Hispanic adults who smoked and formerly smoked from 2010 to 2018 by gender, age group, and race and ethnicity. Estimates are presented after being rounded to the nearest 100 people.

To calculate the estimated total number of smoking-attributable deaths, SAFs were applied to the total number of deaths during 2010–2018 for selected populations from the National Vital Statistics System mortality data extracted from CDC Wonder among adults 35 years of age and older (CDC n.d.a). The average annual smoking-attributable mortality was calculated as the total number of smoking-attributable deaths divided by the number of years (n = 9) included in the analysis. The average annual smoking-attributable mortality rate (per 100,000 population) was calculated as the total number of smoking-attributable deaths divided by the total population size for selected population groups 35 years of age and older from the U.S. Census Bureau single-race population estimates extracted from CDC Wonder (CDC n.d.c).

Data for deaths are from the Multiple Cause of Death Files for 1999–2019, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program (CDC n.d.a). National mortality and population data by race and Hispanic origin, age group,

Table 6.10 Total deaths,[a] smoking-attributable mortality,[b] and average annual smoking-attributable mortality per 100,000 population[c] for all causes of death among people who currently smoked and who formerly smoked, by gender and age group; 2010–2018; United States[d]

Gender and age group	Total deaths, ≥35 years of age, 2010–2018	Total smoking-attributable mortality (95% CI)[e]	Average annual smoking-attributable mortality (95% CI)[e]	Total size of population, ≥35 years of age, 2010–2018[f]	Average annual smoking-attributable mortality per 100,000 population (95% CI)
Overall	22,111,312	4,259,400 (3,382,800–5,138,800)	473,300 (375,900–571,000)	1,425,151,570	298.9 (237.4–360.6)
Men					
35–54	1,317,110	427,600 (363,500–490,500)	47,500 (40,400–54,500)	345,774,158	123.7 (105.1–141.8)
55–64	1,830,894	685,500 (579,100–787,700)	76,200 (64,300–87,500)	162,756,751	421.2 (355.8–484.0)
65–74	2,346,088	750,600 (626,800–868,800)	83,400 (69,600–96,500)	104,212,216	720.2 (601.5–833.7)
≥75	5,513,569	630,000 (391,300–880,700)	70,000 (43,500–97,900)	68,891,174	914.5 (568.0–1,278.5)
Total	11,007,661	2,493,800 (1,960,800–3,027,800)	277,100 (217,900–336,400)	681,634,299	365.9 (287.7–444.2)
Women					
35–54	829,238	233,200 (194,600–272,400)	25,900 (21,600–30,300)	349,325,418	66.8 (55.7–78.0)
55–64	1,178,610	388,300 (328,200–447,700)	43,100 (36,500–49,700)	173,606,360	223.7 (189.0–257.9)
65–74	1,775,212	448,800 (380,100–519,800)	49,900 (42,200–57,800)	118,414,047	379.0 (321.0–439.0)
≥75	7,320,501	695,300 (519,200–871,100)	77,300 (57,700–96,800)	102,171,446	680.5 (508.2–852.6)
Total	11,103,651	1,765,600 (1,422,100–2,111,000)	196,200 (158,000–234,600)	743,517,271	237.5 (191.3–283.9)

Sources: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, unpublished data.

Note: **CI =** confidence interval.

[a]Total deaths from all causes from the National Vital Statistics System; mortality data during 2010–2018 obtained from CDC WONDER (CDC n.d.a) among non-Hispanic Black, non-Hispanic White, and Hispanic people 35 years of age and older.

[b]Estimated smoking-attributable mortality is based on relative risks presented in Table 6.3, on the prevalence of smoking from Appendix Table 6A.1, and on total deaths. Average annual smoking-attributable mortality was calculated as the total smoking attributable mortality divided by the number of years.

[c]Estimated average annual smoking-attributable mortality was calculated as the total smoking-attributable mortality divided by the total population size.

[d]Sample sizes were too small to report data for American Indian and Alaska Native people and Asian and Pacific Islander people; these population groups are excluded from this analysis. Therefore, the estimated smoking-attributable estimates presented for the overall total are generalizable only to non-Hispanic Black, non-Hispanic White, and Hispanic people 35 years of age and older.

[e]Estimate rounded to nearest 100 persons. Estimates may not add to totals due to rounding.

[f]Total population size from the U.S. Census Bureau's single-race population estimates, as extracted from CDC WONDER from 2010 to 2018 by state and single-year age among non-Hispanic Black, non-Hispanic White, and Hispanic adults 35 years of age and older (CDC n.d.c).

Table 6.11 Total deaths,[a] smoking-attributable mortality,[b] and average annual smoking-attributable mortality per 100,000 population[c] for all causes of death among people who currently smoked and who formerly smoked, by gender and race and ethnicity; 2010–2018; United States

Gender and race and ethnicity[d]	Total deaths	Total smoking-attributable mortality (95% CI)[e]	Average annual smoking-attributable mortality (95% CI)[e]	Total size of population, ≥35 years of age, 2010–2018[f]	Average annual smoking-attributable mortality per 100,000 population (95% CI)
Total					
Hispanic	1,381,786	136,100 (43,000–242,600)	15,100 (4,800–27,000)	196,648,587	69.2 (21.9–123.4)
Non-Hispanic Black	2,551,236	455,500 (279,700–643,500)	50,600 (31,100–71,500)	170,680,830	266.9 (163.9–377.0)
Non-Hispanic White	18,178,290	3,667,800 (3,085,600–4,252,700)	407,500 (342,800–472,500)	1,057,822,153	346.7 (291.7–402.0)
Total	22,111,312	4,259,400 (3,382,800–5,138,800)	473,300 (375,900–571,000)	1,425,151,570	298.9 (237.4–360.6)
Men					
Hispanic	735,455	102,300 (36,500–170,600)	11,400 (4,100–19,000)	96,472,456	106.0 (37.9–176.9)
Non-Hispanic Black	1,272,107	284,900 (184,300–397,000)	31,700 (20,500–44,100)	77,180,656	369.1 (238.8–514.3)
Non-Hispanic White	9,000,099	2,106,600 (1,758,400–2,460,200)	234,100 (195,400–273,400)	507,981,187	414.7 (346.2–484.3)
Total	11,007,661	2,493,800 (1,960,800–3,027,800)	277,100 (217,900–336,400)	681,634,299	365.9 (287.7–444.2)
Women					
Hispanic	646,331	33,800 (6,500–72,000)	3,800 (700–8,000)	100,176,131	33.7 (6.5–71.9)
Non-Hispanic Black	1,279,129	170,700 (95,400–246,500)	19,000 (10,600–27,400)	93,500,174	182.5 (102.0–263.7)
Non-Hispanic White	9,178,191	1,561,100 (1,327,100–1,792,500)	173,500 (147,500–199,200)	549,840,966	283.9 (241.4–326.0)
Total	11,103,651	1,765,600 (1,422,100–2,111,000)	196,200 (158,000–234,600)	743,517,271	237.5 (191.3–283.9)

Sources: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, unpublished data.

Note: **CI =** confidence interval.

[a]Total deaths from all causes from the National Vital Statistics System; mortality data during 2010–2018 obtained from CDC WONDER (CDC n.d.a) among non-Hispanic Black, non-Hispanic White, and Hispanic people 35 years and older.

[b]Estimated smoking-attributable mortality is based on relative risks from Table 6.3, on prevalence of smoking from Appendix Table 6A.1, and on total deaths. Average annual smoking-attributable mortality was calculated as the total smoking attributable mortality divided by the number of years.

[c]Estimated average annual smoking-attributable mortality was calculated as the total smoking-attributable mortality divided by the total population size.

[d]Sample sizes were too small to report data for other racial and ethnic population groups, and thus, they are excluded from the analysis.

[e]Estimate rounded to nearest 100 persons. Estimates may not add to totals due to rounding.

[f]Total population size from the U.S. Census Bureau's single-race population estimates, as extracted from CDC WONDER, from 2010 to 2018 by state and single-year age request among non-Hispanic Black, non-Hispanic White, and Hispanic adults 35 years of age and older (CDC n.d.c).

and gender were obtained from CDC Wonder. Death counts were restricted to select populations with non-missing data. For this analysis, deaths among American Indian and Alaska Native people, Asian American and Pacific Islander people, and people with unknown ethnicity were excluded because of small sample sizes that limit estimates of RR. Due to data issues that would complicate presentation of results, analyses of smoking-attributable deaths by urbanicity, geographic region, and level of educational attainment were not conducted.

From 2010 to 2018, at least 4,259,400 smoking-attributable deaths were estimated to have occurred. On average each year, at least 473,300 smoking-attributable deaths were estimated to have occurred (277,100 deaths among men and 196,200 among women) among non-Hispanic White, non-Hispanic Black, and Hispanic adults (Table 6.10). The average annual smoking-attributable death rate among non-Hispanic White, non-Hispanic Black, and Hispanic adults from 2010 to 2018 was an estimated 289.9 deaths per 100,000 population (365.9 deaths per 100,000 men and 237.5 deaths per 100,000 women). The estimated number of annual smoking-attributable deaths increased by age group for women, but for men, the estimated number peaked at 65–74 years of age before declining among those 75 years of age and older. However, the smoking-attributable death rate was highest among men and women 75 years of age and older: 914.5 deaths per 100,000 men and 680.5 deaths per 100,000 women.

Table 6.11 shows the estimated number of smoking-attributable deaths among Hispanic, non-Hispanic Black, and non-Hispanic White men and women. On average, an estimated 15,100 smoking-attributable deaths occurred each year among Hispanic adults (11,400 deaths among men and 3,800 deaths among women), 50,600 among non-Hispanic Black adults (31,700 deaths among men and 19,000 deaths among women), and 407,500 among non-Hispanic White adults (234,100 deaths among men and 173,500 deaths among women). Of all deaths that occurred among Hispanic men and women, 10% were attributed to smoking. In addition, 18% of all deaths for non-Hispanic Black men and women and 20% of all deaths for non-Hispanic White men and women were attributed to smoking.

The average annual smoking-attributable death rate from 2010 to 2018 was approximately 69.2 deaths per 100,000 Hispanic people (106.0 deaths per 100,000 Hispanic men and 33.7 deaths per 100,000 Hispanic women), 266.9 deaths per 100,000 Black people (369.1 deaths per 100,000 Black men and 182.5 deaths per 100,000 Black women), and 346.7 deaths per 100,000 White people (414.7 deaths per 100,000 White men and 283.9 deaths per 100,000 White women). From 2010 to 2018, men accounted for 75% of all smoking-attributable deaths in the Hispanic population, 63% of such deaths in the non-Hispanic Black population, and 57% of such deaths in the non-Hispanic White population.

The NHIS-NDI-LMF did not include sufficient data on American Indian and Alaska Native people and Asian American and Pacific Islander people to allow for longitudinal analysis of these population groups. Therefore, conclusions about mortality rates attributable to smoking for these populations cannot be made using these data. However, evidence from other sources, such as the Strong Heart Study and the Indian Health Service, shows that smoking is a large contributor to heart disease, stroke, and cancer mortality in American Indian and Alaska Native populations (Mowery et al. 2015; Zhang et al. 2015). Lung cancer is the leading causes of cancer deaths in Alaska Native people (Nash et al. 2022). Another study showed significant heterogeneity in tobacco-caused cancers among Asian American and Native Hawaiian and Other Pacific Islander people (Medina et al. 2021). Each of these groups are unique, and additional data sources are needed to assess mortality within each group.

The aggregate group of the Asian American and Native Hawaiian and Other Pacific Islander population has historically had the lowest prevalence of smoking (see Chapter 2). However, rates of smoking differ within specific groups, and aggregation of data masks disparities in cancer incidence and mortality rates for such groups as Vietnamese, Chinese, Filipino, Japanese, Native Hawaiian, and Samoan people. An evaluation of the prevalence of smoking by ethnic population group that used data from the NHIS and the National Survey on Drug Use and Health revealed disparities in smoking within the Asian American and Native Hawaiian and Other Pacific Islander population (Martell et al. 2016). This study showed that the prevalence of smoking is historically higher among Korean and Vietnamese American people than among Chinese and Indian American people. Furthermore, differences in the prevalence of smoking by ethnic population and gender have been observed. For example, Gorman and colleagues (2014) reported that Vietnamese men were significantly more likely to smoke than Chinese men in models adjusted for various acculturation measures, but this association was not observed among women.

Other analyses have shown high SAFs of cancer deaths among specific Asian American and Pacific Islander groups, such as Korean men who live in California and the aggregate category of Asian and Pacific Islander or Hawaiian men and women who live in Hawaii (Leistikow et al. 2006). Similarly, lower than average prevalence of smoking among Hispanic people may mask differences in smoking and in the SAF of deaths by ethnic origin. For example, Puerto Rican and Cuban American people are more likely to smoke than Mexican American people (Martell et al. 2016).

Limitations

Smoking status in the NHIS-NDI LMF is assessed at only baseline, and thus a particular respondent's smoking status recorded at the time of interview might not reflect that person's status at time of death. For example, it is possible that observed deaths occurred among people who had quit smoking but were recorded as currently smoking at the time of their NHIS interview. Such cases would lead to an underestimation of the true RRs of mortality associated with current smoking among specific population groups. Conversely, the RR of mortality associated with former smoking may partially reflect the risk of those who recently quit smoking because of smoking-related illness, potentially inflating the risk associated with being a person who used to smoke.

This analysis does not separate estimates of mortality risk for people who quit smoking recently from those who quit smoking longer ago. The analysis by Jeon and colleagues (2023) found that the RR of all-cause mortality due to smoking for people who had quit smoking for longer periods was negatively associated with the time since quitting in groups defined by race and ethnicity and educational attainment; mortality rates for people who quit smoking 15 or more years ago were similar to those who had never smoked, particularly among those who were younger than 65 years of age. To partially address this limitation, follow-up for each respondent in the NHIS-NDI LMF is restricted to 10 years (an approach called right censoring). Although this approach does not completely address the potential for misclassification of smoking status, other longitudinal data sources that could address this issue may not be as representative of the U.S. population as the NHIS. Prevalence of smoking is only one factor that influences RR of death. For example, socioeconomic indicators; alcohol use; dietary behaviors; biological factors, such as metabolic pathways, inflammation, and pathophysiological processes; and other risk behaviors may influence the risk of mortality (Thun et al. 2000; National Institutes of Health State-of-the-Science Panel 2006; Orsi et al. 2010; Du et al. 2011; Jin et al. 2013; Deng et al. 2016; Singh and Jemal 2017; Milajerdi et al. 2018).

Additionally, the current analysis does not account for smoking intensity among people who currently smoked or who formerly smoked at baseline. However, in a recent analysis by Jeon and colleagues (2023), which stratified people by smoking intensity (as measured by the number of cigarettes smoked per day), RRs generally increased with higher levels of smoking intensity across population groups defined by race and ethnicity and by educational attainment. Notwithstanding, disparities in cancer incidence by race and ethnicity and smoking intensity have been observed. Specifically, data from the Multiethnic Cohort Study showed that Native Hawaiian people and Black people have higher risks for lung cancer than do White, Japanese American, and Hispanic or Latino people who smoke similar numbers of cigarettes; disparities were more pronounced among those who smoked 10 cigarettes per day than among those who smoked 35 cigarettes per day (Stram et al. 2019).

Several aspects of the methodology may have resulted in underestimates of RR and, thus, smoking-attributable mortality. First, the stratified nature of this analysis reduces the number of observable deaths in each relevant age, gender, and demographic category. When evaluating some racial and ethnic populations, this can translate into small numbers of observations. Nonsignificant RR estimates reported in Tables 6.3–6.6 may reflect insufficient power to detect statistical significance and may not be an accurate assessment of risk of mortality associated with current or former smoking.

Second, the long latency period between onset of smoking and subsequent smoking-related morbidity and mortality further limits the number of observable incidents in the NHIS-NDI LMF. With longer follow-up periods, RRs associated with death tend to increase. As such, restricting the follow-up period to 10 years (right censoring) may have resulted in an underestimate of RRs. The tradeoffs associated with methods to limit different forms of bias, while unavoidable, are important to acknowledge.

Another limitation is that RR estimates for some population groups exhibit wide CIs, which translates into wide ranges in the calculation of SAFs (Tables 6.7–6.9). Because SAFs for each population group of interest reflect the underlying prevalence and RRs specific to that group, direct comparisons between different smoking-attributable mortality estimates are not always appropriate.

The estimates of smoking-attributable mortality presented in this chapter include deaths for non-Hispanic Black, non-Hispanic White, and Hispanic adults only. Thus, overall estimates presented likely represent underestimates of the total smoking-attributable mortality for the United States. As such, the findings reported in this chapter should be considered only a first estimate of the contribution of smoking to the increased morbidity and mortality burdens faced by specific population groups in the United States; comprehensive data are critical for more refined estimates.

Finally, the estimates reported here focused on only cigarette-smoking-attributable mortality. Use of other tobacco products, including cigars, pipes, and smokeless tobacco, either alone or in combination with cigarette smoking and other tobacco products also contributes to mortality risk (Nonnemaker et al. 2014). Patterns of use of other combustible tobacco and smokeless tobacco products vary by race and ethnicity, level of educational attainment, geographic region, and other sociodemographic factors and may influence tobacco-related mortality across the U.S. population (Hirschtick et al. 2021).

Deaths Due to Exposure to Secondhand Tobacco Smoke Among Infants and Nonsmoking Adults, by Race and Ethnicity

The 2014 Surgeon General's report included estimates from Max and colleagues (2012) of the number of deaths attributable to exposure to secondhand tobacco smoke among nonsmoking adults. The authors noted that 41,280 deaths among nonsmoking adults were attributable to exposure to secondhand tobacco smoke in 2006, including 33,950 deaths from coronary heart disease and 7,330 deaths from lung cancer. However, previous Surgeon General's reports did not included estimates of deaths due to exposure to secondhand tobacco smoke in the United States by race and ethnicity. Leveraging the methodology developed by Max and colleagues (2012), the present report estimates deaths among infants for 2020 and among nonsmoking adults 18 years of age and older for 2019, overall and by race and ethnicity.

Detailed documentation of the methodology, including epidemiological formulas, is presented in Max and colleagues (2012). For newborns, estimates of exposure to secondhand tobacco smoke by race and ethnicity were obtained from National Vital Statistics Reports for 2020, the most recent year available at the time of analysis (Osterman et al. 2022). In brief, exposure to secondhand tobacco smoke among newborns was determined by whether the mother smoked anytime during pregnancy, as reported on the U.S. Standard Certificate of Live Birth. RRs of death due to exposure to secondhand tobacco smoke for sudden infant death syndrome and prenatal conditions were based on data from Dietz and colleagues (2010).

For adults 18 years of age and older, estimates of exposure to secondhand tobacco smoke were obtained from the NHANES during 2017 to March 2020 and based on serum cotinine (0.05–10.0 ng/mL). NHANES participants with missing serum cotinine measurements were excluded from the analysis. Following the methodology used in the study by Tsai and colleagues (2021), people who currently smoked and those who used any nicotine-containing product, including nicotine replacement therapy, were excluded from the analysis. RRs of death from exposure to secondhand tobacco smoke for men and women were based on estimates from the 2006 Surgeon General's report (USDHHS 2006) for coronary heart disease and a 2005 California Environmental Protection Agency report for lung cancer (Max et al. 2012, citing California Environmental Protection Agency 2005). The estimates of the prevalence of former, never, and current cigarette smoking were obtained from the 2019–2020 NHIS. The total number of deaths among infants less than 1 year of age (in 2020) and adults 18 years of age and older (in 2019) were from NCHS's National Vital Statistics System, Multiple Causes of Death file, obtained from the CDC WONDER database.

Max and colleagues (2012) described the steps to estimate deaths among nonsmoking adults (people who never smoked and people who smoked in the past, combined), which were applied to produce the estimates for 2020. In short, deaths among nonsmoking adults were determined by (a) estimating the number of excess deaths attributable to current smoking; (b) subtracting these excess deaths attributable to active smoking from the total number of deaths among all people; and (c) apportioning the remaining deaths to people who did and did not smoke by applying the proportion of the population who did and did not smoke. The SAFs of deaths from exposure to secondhand tobacco smoke were estimated, then applied to total deaths among nonsmoking people who did not use nicotine-containing products in the previous 5 days for each condition category, by race and ethnicity.

Table 6.12 shows the percentage of newborn infants who were exposed to secondhand tobacco smoke in utero in 2020 and the percentage of nonsmoking men and women 18 years of age and older who were exposed to secondhand tobacco smoke from 2017 to March 2020, by race and ethnicity and for all races and ethnicities combined. Among all racial and ethnic groups, 5.5% of infants, 21.1% of men, and 19.3% of women were exposed to secondhand tobacco smoke. Among infants born in 2020, 1.4% of Hispanic, 4.5% of Black, and 8.1% of White infants were exposure to secondhand tobacco smoke in utero. Among women, exposure to secondhand tobacco smoke ranged from 14.5% among Hispanic women to 38.4% among Black women; 16.7% of White women and 24.4% of women of non-Hispanic Other races were exposed to secondhand tobacco smoke. Among men, exposure to secondhand tobacco smoke ranged from 18.2% for White men to 42.3% for Black men; 20.6% of Hispanic men and 24.7% of men of non-Hispanic Other race and ethnicity were exposed to secondhand tobacco smoke.

Overall, these estimates suggest a decline in exposure to secondhand tobacco smoke since 2006, which is consistent with findings presented in Chapter 2 of this report. Specifically, Max and colleagues (2012) noted that in 2006, 13.2% of infants and 39.1% of adults 20 years of age (the minimum adult age included for that study) and older were exposed to secondhand tobacco smoke.

As shown in Table 6.13, an estimated 19,600 deaths attributable to exposure to secondhand tobacco smoke

Table 6.12 Prevalence of exposure to maternal smoking among newborn infants in utero and of cotinine-measured exposure to secondhand tobacco smoke among nonsmoking adults, by race and ethnicity

Population group	Total (%)[a,b]	Non-Hispanic Black (%)[a]	Non-Hispanic White (%)[a]	Hispanic (%)[a]	Non-Hispanic Other Race (%)[a,c]
Male and female, 2020[d]					
Newborn infants	5.5	4.5	8.1	1.4	—[e]
Nonsmoking adults (≥18 years of age), 2017–2020[f]					
Men	21.1	42.3	18.2	20.6	24.7
Women	19.3	38.4	16.7	14.5	24.4

Sources: National Vital Statistics System, 2020 (newborns); NHANES public use data set, 2017–March 2020 (adults).
Note: **NHANES =** National Health and Nutrition Examination Survey.
[a]Sample sizes were too small to report data for other racial and ethnic groups. The term Hispanic denotes those from any race who identify as Hispanic. White and Black excludes those who identify as Hispanic.
[b]Includes people of multiple races and other categories not stated.
[c]Non-Hispanic Other Race includes Asian, Native Hawaiian and Pacific Islander, and American Indian and Alaska Native people and people reporting more than one race who also did not identify as Hispanic.
[d]Data on exposure to secondhand tobacco smoke among newborns are based on information about maternal smoking anytime during pregnancy, as reported on the U.S. Standard Certificate of Live Birth, which is published in Tables 13 and 15 of Osterman and colleagues (2022).
[e]Prevalence of exposure was unavailable. As such, the overall exposure (5.5%) among newborn infants was used in the calculation of secondhand-smoke-attributable deaths among this group.
[f]Data on exposure to secondhand tobacco smoke among nonsmoking adults, 18 years of age and older, are based on serum cotinine level of 0.05–0.10 ng/ml. People who reported currently smoking and those who used any nicotine-containing product, including nicotine replacement therapy, were excluded.

occurred among infants and nonsmoking adults in 2019 and 2020. Of these deaths, 70.7% (13,800) occurred among non-Hispanic White people, 19.1% (3,700) occurred among non-Hispanic Black people, 6.0% (1,200) occurred among Hispanic people, and 4.1% (800) occurred among non-Hispanic people of other races. In contrast, Max and colleagues (2012) found that in 2006, of the estimated 42,147 total deaths due to exposure to secondhand tobacco smoke, nonsmoking non-Hispanic White people accounted for 80% (33,746) of deaths, while non-Hispanic Black people accounted for 12.8% (5,410) of deaths, Hispanic people accounted for 4.1% (1,745) of deaths, and non-Hispanic, other racial and ethnic groups accounted for 3.0% (1,247) of deaths (Figure 6.1). Deaths among non-Hispanic Black, Hispanic, and other non-Hispanic racial groups accounted for a larger proportion of estimated deaths attributable to exposure to secondhand tobacco smoke in 2019 (adults) and 2020 (infants) (combined, 29.2%) compared with the proportion in 2006 (combined, 19.9%). Furthermore, among non-Hispanic White people, the estimated number of deaths attributable to exposure to secondhand tobacco smoke declined by nearly 60% from 2006 (n = 33,746) to 2019–2020 (n = 13,800). Smaller declines were observed among non-Hispanic Black people (by 31%; from 5,410 to about 3,700 deaths), Hispanic people (by 33%; from 1,745 to about 1,200 deaths) and non-Hispanic people from other races (by 35%; from 1,247 to about 800 deaths) during this period (Figure 6.1).

The rate of death (per 100,000 population) due to exposure to secondhand tobacco smoke in 2019 was calculated from the estimated number of deaths due to exposure to secondhand tobacco smoke (Table 6.14). The denominator included adults 18 years of age and older who did not smoke. The total population of adults, averaged across 2019 and 2020 from the U.S. Census Bureau single-race population estimate, was obtained from CDC WONDER (CDC n.d.d). For each racial and ethnic group presented in Table 6.14, the prevalence of cigarette smoking was estimated from the 2019–2020 NHIS. The number of nonsmoking adults was estimated by multiplying the total adult population by the prevalence of never and non-current cigarette smoking. The rate of death was calculated as the estimated number of deaths due to exposure to secondhand tobacco smoke divided by the estimated population of nonsmoking adults.

Among all nonsmoking adults 18 years of age and older in 2019, an estimated 19,300 deaths were due to exposure to secondhand tobacco smoke, which equates to an estimated 8.7 deaths per 100,000 population (10.6 deaths per 100,000 men and 6.9 deaths per 100,000 women) (Table 6.14). Differences were noted

Table 6.13 Estimated total number of deaths attributable to exposure to secondhand tobacco smoke among infants and nonsmoking adults, by cause, gender, and race and ethnicity, 2019 and 2020

Population group and condition	Non-Hispanic Black[a,b]	Non-Hispanic White[a,b]	Hispanic[a,b]	Non-Hispanic Other Race[a,b,c]	Total deaths, all races and ethnicities[a,b,d]
Infants (<1 year of age)[e]					
Male and female					
Sudden infant death syndrome	40	60	—[f]	—[f,g]	120
Prenatal conditions	50	90	—[f]	—[f,g]	170
Adults (age ≥18 years)[h]					
Men					
Coronary heart disease	1,600	6,400	640	360	9,000
Lung cancer	360	1,720	100	70	2,260
Women					
Coronary heart disease	1,340	4,160	360	280	6,140
Lung cancer	320	1,380	70	90	1,860
Total deaths (≤1 year of age and ≥18 years of age)[i]	**3,700**	**13,800**	**1,200**	**800**	**19,600**

Sources: Wendy Max, Hai-Yen Sung, and Tingting Yao, unpublished calculations using data from the National Center for Health Statistics, National Vital Statistics System Multiple Causes of Death file, 2019 and 2020; National Health and Nutrition Examination Survey public use data set, 2017–March 2020; and 2020 National Vital Statistics Report as cited by Osterman and colleagues (2022).

Note: **RR =** relative risk.

[a]Estimates were rounded to the nearest 10 people. Estimates may not add to totals due to rounding.

[b]Sample sizes were too small to report data for other racial and ethnic groups. The term *Hispanic* denotes those from any race who identify as Hispanic. White and Black excludes those who identify as Hispanic.

[c]Non-Hispanic Other Race includes Asian, Native Hawaiian and Pacific Islander, and American Indian and Alaska Native people and people reporting more than one race who also did not identify as Hispanic.

[d]Includes data otherwise suppressed in this table.

[e]Deaths attributable to exposure to secondhand tobacco smoke among infants younger than 1 year of age were calculated using total deaths in 2020 among male and female infants 1 year of age and younger, the prevalence of exposure to secondhand tobacco smoke as presented in Table 6.12, and the RR of death due to exposure to secondhand tobacco smoke as reported in Dietz and colleagues (2010).

[f]Data are suppressed in categories with fewer than 30 deaths but are included in totals.

[g]Deaths attributable to exposure to secondhand tobacco smoke among infants younger than 1 year of age were calculated using the estimated exposure prevalence in the total population (5.5%), as prevalence was unavailable.

[h]Deaths attributable to exposure to secondhand tobacco smoke among nonsmoking adults, 18 years of age and older, who did not smoke and did not use nicotine-containing products during the 5 days before their interview, were calculated using deaths in 2019, the prevalence of exposure to secondhand tobacco smoke as presented in Table 6.12, and the RR of death due to exposure to secondhand tobacco smoke as cited by (USDHHS 2006), (California Environmental Protection Agency 2005; Max et al. 2012).

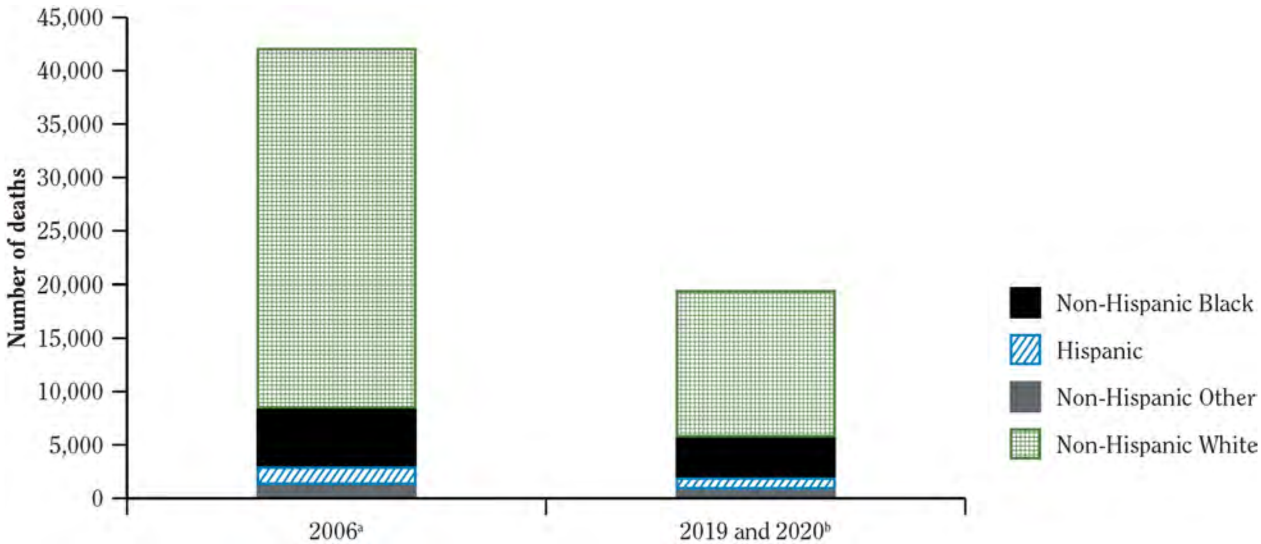
[i]Estimated total number of deaths rounded to nearest 100 persons. Estimates may not add to totals due to rounding.

by race and ethnicity. Although the greatest absolute number of deaths due to exposure to secondhand tobacco smoke occurred among White men and women, the highest population-specific death rates occurred among non-Hispanic Black men (16.4 deaths per 100,000 population) and non-Hispanic Black women (11.4 deaths per 100,000 population). The lowest rates of death due to exposure to secondhand tobacco smoke occurred among Hispanic adults: 3.9 deaths per 100,000 men and 2.1 deaths per 100,000 women.

Limitations

Similar to the analysis by Max and colleagues (2012), the current analysis is limited for several reasons. First, this analysis focused on deaths among nonsmoking people because it was challenging to separate the effects of exposure to secondhand tobacco smoke from the effects of active smoking and other tobacco product use on the health of people who use tobacco products. Nevertheless, there is no risk-free level of exposure to secondhand

Figure 6.1 Estimated number of deaths due to exposure to secondhand tobacco smoke among infants and nonsmoking adults, 2006 and 2019 and 2020



Source: Max and colleagues (2012) and Wendy Max, Hai-Yen Sung, and Tingting Yao, unpublished data.
[a]Data on deaths in 2006 among infants younger than 1 year of age and among adults, 20 years of age and older are from Max and colleagues (2012).
[b]Unpublished data on deaths among infants <1 year of age are from 2020, and unpublished data on deaths among nonsmoking adults, 18 years and older, are from 2019.

smoke, and such exposure harms health, including among people who smoke (USDHHS 2006; Max et al. 2012).

Second, although this analysis estimated deaths due to secondhand tobacco smoke exposure among infants, exposure to secondhand tobacco smoke was estimated only at birth based on the prevalence of self-reported maternal smoking while pregnant, as reported on the U.S. Standard Certificate of Live Birth. Thus, this proxy measure may underestimate total exposure to secondhand tobacco smoke among infants because of the potential for underreporting of maternal smoking behaviors at the time of birth or because this measure reflects only exposure in utero, as measured at the time of birth.

Third, the analysis is limited to conditions that are causally related to exposure to secondhand tobacco smoke for which there is a published estimate of the RR of death. Although the 2014 Surgeon General's report concluded that exposure to secondhand tobacco smoke is a cause of stroke (USDHHS 2014), stroke deaths were not included in this analysis due to the lack of a published pooled estimate of the RR of stroke death from exposure to secondhand tobacco smoke. Furthermore, asthma deaths are not included in this analysis because Surgeon General's reports have found suggestive but not sufficient evidence of a causal link between exposure to secondhand tobacco smoke and death from asthma (USDHHS 2014). Thus, these estimates may underestimate deaths attributable to exposure to secondhand tobacco smoke.

Fourth, although about 95% of examined adults, 18 years of age and older in the 2017 to March 2020 NHANES provided a blood specimen, about 12.5% of laboratory samples for all NHANES participants were not included in the analysis because the samples were missing a serum cotinine measurement (NCHS 2022). Additionally, similar to Max and colleagues (2012), variance was not estimated and thus no measures of precision are provided.

Fifth, the number of deaths attributable to exposure to secondhand tobacco smoke was estimated among nonsmoking adults (people who never smoked and people who smoked in the past, combined). Thus, some deaths among adults who smoked in the past and were exposed to secondhand tobacco smoke might be attributable to their previous smoking behaviors rather than to their exposure to secondhand tobacco smoke. However, because the RR of death for people who smoked in the past would be determined as the rate of death for people who smoked in the past who were exposed to secondhand tobacco smoke compared with people who smoked in the past who were not exposed to secondhand tobacco smoke, and because both of these groups were comprised of people who smoked at some point in their lives, the impact of smoking would likely dominate the comparison and the RR may be quite small.

Table 6.14 Estimated number of deaths attributable to exposure to secondhand tobacco smoke and rates of death per 100,000 population among nonsmoking adults, by race and ethnicity, 2019

Gender and race and ethnicity[a]	Estimated number of deaths, 2019[b,c]	Average size of population, ≥18 years of age, 2019–2020[d]	Estimated number of adults, ≥18 years of age, who were nonusers of cigarettes, 2019–2020[e]	Rate of death per 100,000 population[f]
Total				
All races and ethnicities	19,300	255,951,644	222,329,068	8.7
Non-Hispanic Black	3,600	31,289,104	26,636,101	13.7
Hispanic	1,200	42,248,634	38,562,863	3.0
Non-Hispanic Other Race[g]	800	21,710,078	19,159,187	4.2
Non-Hispanic White	13,700	160,703,829	137,950,738	9.9
Men				
All races and ethnicities	11,300	124,712,755	106,424,627	10.6
Non-Hispanic Black	2,000	14,677,479	12,066,473	16.4
Hispanic	700	21,219,096	18,690,629	3.9
Non-Hispanic Other Race[g]	400	10,280,429	8,692,020	5.0
Non-Hispanic White	8,100	78,535,751	66,950,393	12.1
Women				
All races and ethnicities	8,000	131,238,890	115,877,640	6.9
Non-Hispanic Black	1,700	16,611,625	14,539,723	11.4
Hispanic	400	21,029,538	19,841,306	2.1
Non-Hispanic Other Race[g]	400	11,429,650	10,498,865	3.6
Non-Hispanic White	5,500	82,168,078	70,997,574	7.8

Sources: Wendy Max, Hai-Yen Sung, and Tingting Yao, unpublished calculations; NHIS public use dataset, 2019–2020; National Vital Statistics System mortality data (2019–2020); and U.S. Census Bureau, single-race population totals, 2019–2020.

Note: **NHIS =** National Health Interview Survey.

[a]Sample sizes were too small to report data for other racial and ethnic groups. The term *Hispanic* denotes those from any race who identify as Hispanic. White and Black excludes those who identify as Hispanic.

[b]Total number of deaths attributable to exposure to secondhand tobacco smoke includes summed totals from coronary heart disease and lung cancer, by gender, as presented in Table 6.13.

[c]Estimated number of deaths rounded to the nearest 100 persons. Estimates may not sum to totals due to rounding.

[d]Total population size from the U.S. Census Bureau's single-race population estimates, as extracted from CDC WONDER, and was averaged across 2019 and 2020 among adults 18 years of age and older (CDC n.d.d).

[e]Number of nonsmoking adults was estimated from the prevalence of cigarette smoking from the 2019–2020 NHIS and total population size.

[f]Rate per 100,000 population was calculated as the estimated number of deaths attributable to exposure to secondhand tobacco smoke divided by the number of nonsmoking adults estimated from total population data.

[g]Non-Hispanic Other Race includes Asian, Native Hawaiian and Pacific Islander, and American Indian and Alaska Native people and people reporting more than one race who also did not identify as Hispanic.

Sixth, because RR estimates of death from exposure to secondhand tobacco smoke were not available for individual racial and ethnic population groups, the same RR estimates were used across all groups. Finally, as noted in the SAMMEC analysis described in this chapter, the small number of observed deaths in some racial and ethnic groups affected the ability to assess deaths for aggregate populations of Asian American people, Native Hawaiian and Pacific Islander people, American Indian and Alaska Native people, and people reporting multiple races, potentially masking racial and ethnic disparities in deaths due to exposure to secondhand tobacco smoke among these groups.

Summary of the Evidence

Despite continuing declines in the overall prevalence of smoking, cigarette smoking remains the leading cause of preventable death in the United States, exacting devastating tolls on the health of many U.S. population groups. Each year, on average, at least 473,300 people in the United States die from cigarette-smoking-attributable causes. Each year, on average, more than 400,000 non-Hispanic White, 50,000 non-Hispanic Black, and 15,000 Hispanic adults are estimated to die from diseases caused by smoking. There are large, absolute differences (i.e., magnitude of the difference) in the estimated number of smoking-attributable deaths among non-Hispanic White adults compared with non-Hispanic Black adults. However, smoking-attributable deaths represent a similar proportion of all deaths in these population groups (18% of all deaths for non-Hispanic Black adults and 20% of all deaths for non-Hispanic White adults). Furthermore, the proportion of all deaths attributable to smoking was about twice as high among non-Hispanic White and non-Hispanic Black adults as it was among Hispanic adults, among whom about 10% of all deaths were attributable to smoking during 2010–2018.

The 2014 Surgeon General's report provided estimates of smoking-attributable mortality for the United States for 2005–2009, based on prevalence data for 1965–2011, concluding that smoking caused an estimated 439,000 deaths per year and exposure to secondhand tobacco smoke caused more than 41,000 deaths per year—a combined total of more than 480,000 deaths (USDHHS 2014). The present report estimated that cigarette smoking causes at least 473,000 deaths per year and exposure to secondhand tobacco smoke causes more than 19,000 deaths per year—totaling more than 490,000 deaths per year. This suggests that, although progress has been made in reducing deaths due to exposure to secondhand tobacco smoke and despite population-level declines in the prevalence of smoking, the overall death toll from smoking has not yet declined substantially during the twenty-first century.

The relative difference in annual estimates of smoking-attributable deaths between the 2014 Surgeon General's report and the present report reflect population growth, particularly among older adults, during the period between the release of both reports. Although the prevalence of smoking among all U.S. adults has decreased, the prevalence of smoking has remained relatively stable among adults 65 years of age and older, an age group in which most smoking-related deaths occur (Jamal et al. 2015). Furthermore, the estimated number of smoking-attributable deaths presented in this report depends on the size, age, and demographic composition of the U.S. population. For example, the U.S. population is projected to increase to more than 435 million by 2050 and it will include increasing proportions of non-White racial and ethnic populations and people 65 years of age and older (Passel and Cohn 2008), which may change future comparisons of smoking-attributable mortality.

Also, although smoking cessation reduces the risk of mortality, many people who smoked in the past remain at higher risk of death compared with people who never smoked (Jha et al. 2013). As noted in the 2014 Surgeon General's report, cross-sectional estimates of smoking attributable mortality may not accurately reflect the risks of previous cohorts of people who smoke when the prevalence of smoking changes over time. When the prevalence of smoking declines over time (as reported in Chapter 2), the SAMMEC methodology tends to underestimate the number of deaths caused by smoking (USDHHS 2014). In either case, the present report finds that the toll of cigarette smoking and exposure to secondhand tobacco smoke remains high, claiming nearly half a million lives per year.

Overall declines in exposure to secondhand tobacco smoke from 2006 to 2019–2020 have resulted in more than 22,500 fewer deaths attributable to exposure to secondhand tobacco smoke among infants and nonsmoking adults—a drop of more than 50% since 2006 (Max et al. 2012). Although all racial and ethnic groups experienced substantial declines in the number of deaths attributable to exposure to secondhand tobacco smoke, non-Hispanic White people accounted for 88.2% of the decline in such deaths (compared to 7.4% for non-Hispanic Black people, 2.5% for Hispanic people, and 1.9% for non-Hispanic people of other races). Furthermore, although the absolute number of deaths attributable to exposure to secondhand tobacco smoke was higher among non-Hispanic White adults than it is among adults in other racial and ethnic groups (due to the relative size of the non-Hispanic White population group), the population-specific death rate among non-Hispanic Black adults per 100,000 population is 1.4, 4.5, and 3.3 times higher than that for non-Hispanic White and Hispanic adults, and non-Hispanic adults of other races, respectively. These findings align with disparities in secondhand tobacco smoke protections and exposure to secondhand tobacco smoke; for example, Asian, Hispanic, and non-Hispanic White people are more likely than non-Hispanic Black people to live in jurisdictions with smokefree laws (Gonzalez et al. 2013; Hafez et al. 2019), and African American populations are disproportionately exposed to secondhand tobacco smoke (see Chapter 2).

Jha and colleagues (2013) reported that men and women who never smoked were about twice as likely than people who currently smoke to live to 80 years of age, with people who smoke dying, on average, a decade earlier than people who do not smoke. Most smoking-attributable deaths occur when people are in their late 60s and 70s—ages that are not attainable for people who have died early due to competing causes. RRs are a function of the mortality from smoking and nonsmoking-related causes, such that some population groups with higher competing causes of death may have lower RRs from current smoking. For example, estimated RRs of death from smoking are lower in Black adults, 35–54 years of age, than they are in White adults from the same age group. This may be attributable, in part, to a rate of death from all causes that is substantially higher among Black people, 18–34 years of age, (141.5 deaths per 100,000) than it is among White people from the same age group (100.3 deaths per 100,000) (RR = 1.41, 95% CI, 1.39–1.44). This is driven particularly by the rate of death from homicide, which is higher among Black people in this age group (47.2 deaths per 100,000) than it is among White people in this age group (5.5 deaths per 100,000) (RR = 8.59; 95% CI, 8.22–8.97) (Cunningham et al. 2017).

Similar counterintuitive findings are observed by level of educational attainment. For example, despite having a higher prevalence of smoking, people with lower educational attainment have lower estimated RR of death from smoking than people with higher educational attainment, although confidence intervals overlapped (Table 6.4). This is consistent with recent findings by Jeon and colleagues (2023), which also suggest higher competing causes of death among certain population groups (e.g., people with lower educational attainment), along with differences in other factors such as smoking intensity and duration, may result in lower RRs of death when comparing people who smoke to people who never smoked. In contrast, the findings note that people with higher educational attainment have fewer comorbidities or competing causes of death, which likely then results in higher RRs when comparing people who smoke to people who never smoked.

Because data in this report are limited, conclusions cannot be made about smoking-attributable deaths among aggregate groups of American Indian and Alaska Native people or Asian American and Native Hawaiian and Other Pacific Islander people. Studies show that there is significant heterogeneity in tobacco use behaviors and tobacco-caused morbidity and mortality among these groups, and risk for smoking-related outcomes relative to the number of cigarettes smoked per day is not the same across all groups (Haiman et al. 2006; Bliss et al. 2008; Medina et al. 2021; Nash et al. 2022; NCI n.d.). For example, risk of lung cancer is higher among African American and Native Hawaiian people who smoke no more than 10 cigarettes per day and among African American people who smoke 11–20 cigarettes per day than it is among their counterparts who are White, Japanese American, and Latino (Haiman et al. 2006; Stram et al. 2019). Thus, each group is unique, and additional data sources are needed to assess within-group mortality.

Although smoking influences the incidence of many chronic diseases, whether an individual survives a disease is also a function of other important factors—such as comorbidities; other individual risk behaviors; access to healthcare; and social and structural determinants of health, which are known to differ dramatically across social groups (Agency for Healthcare Research and Quality 2021). Thus, although the differences in mortality found in this chapter are strongly influenced by underlying differences in the prevalence of smoking and RRs, numerous other factors contribute to premature mortality.

This report finds that the toll of cigarette smoking and exposure to secondhand tobacco smoke remains high, claiming nearly half a million lives per year. Estimates of smoking-attributable mortality for select U.S. population groups are useful for public health decision makers, as the estimates highlight disparities that have not been addressed. However, gaps in available data for different population groups and sociodemographic factors such as income and access to healthcare may result in the underrepresentation of some groups in surveys or research studies. As such, multiple measures across the tobacco use spectrum—including initiation, use, cessation, exposure to secondhand tobacco smoke, and disease incidence and mortality; as well as intersectional demographic factors, including race and ethnicity, SES, sexual orientation and gender identity, and access to healthcare—can best inform the allocation of resources to eliminate tobacco-related disease and death. Both targeted and broad-scale tobacco control interventions are needed to reduce smoking-related health disparities and tobacco-related death and disease across diverse populations.

Simulation Modeling of Smoking Disparities

Simulation models—also known as computational models—have been used to show the relationship between tobacco control policies and patterns of tobacco use and their downstream health outcomes (Mendez et al. 2013; Holford et al. 2014b; Feirman et al. 2016, 2017; Levy et al. 2016, 2017b). These models can complement the analyses of smoking-attributable morbidity and mortality by (1) combining information from different sources and (2) including cross-sectional and longitudinal surveys and policy and health evaluation studies to examine how the effects of tobacco use and tobacco control policies could unfold over time. Numerous tobacco simulation models were reviewed in the 2014 Surgeon General's report (USDHHS 2014) and by Feirman and colleagues (2016; 2017), but a limited number of tobacco models have considered explicitly groups that are disproportionately affected by tobacco-related health harms.

Chapter 12 of the NCI Tobacco Control Monograph 22 (NCI 2017a) discusses the SimSmoke disparity model—a modified version of the SimSmoke tobacco control simulation model—which was used to examine the potential effect of tobacco control policies on smoking and smoking-attributable deaths by SES in the United States. As illustrated in Chapter 2 of the current report, the prevalence of smoking is generally highest among people of lower SES—measured by poverty level and level of educational attainment—resulting in large disparities in the burden of tobacco-related disease and death by SES. Because levels of educational attainment are generally increasing in the U.S. population, the SimSmoke disparity model relies on income quintiles, which are a relative measure of SES and thus a more stable metric over time. Results of the SimSmoke disparity model are described next.

The SimSmoke model begins in 2006, when the prevalence of smoking among adults 18 years of age and older in the lowest income quintile was 30.2% for men and 22.7% for women. At that time, the prevalence of smoking among adults in the second lowest income quintile was 25.3% for men and 18.4% for women. The prevalence of smoking was higher in the lowest and second lowest income quintiles than it was in higher income quintiles. The model estimated that 119,526 people in the lowest income quintile and 95,986 people in the second lowest income quintile died prematurely from smoking in 2014 (NCI 2017a).

The SimSmoke disparity model showed that stronger tobacco control policies have the potential to reduce considerably the prevalence of smoking in lower income groups. The model simulated the specific effects of cigarette tax increases, smokefree policies, mass media antitobacco campaigns, marketing restrictions, health warnings, cessation treatment policies, and youth access policies for people in the two lowest income quintiles, taking into account moderating factors such as level of policy enforcement and intensity of publicity (NCI 2017a). The model simulated a status quo scenario by maintaining 2014 policy levels through 2064 and modeled the incremental effects of stronger policies implemented and maintained from 2015 through 2064 relative to the status quo. As shown in Table 6.15 (Parts A and B), raising the average cigarette tax by $3.00 per pack was projected to reduce the prevalence of smoking in the lowest quintile by 19.6% among men and by 19.5% among women, averting a total of 275,760 deaths from 2015 to 2064 (Table 6.16). For the second lowest quintile, the prevalence of smoking was similarly reduced, and 238,759 deaths were estimated to be averted over 50 years (NCI 2017a). All seven modeled policies were projected to reduce the prevalence of smoking and prevent smoking-attributable deaths in the lowest income quintile from 2015 to 2064, with the policy to raise the average cigarette tax to $3.00 per pack projected to have the largest effect (Table 6.15).

The SimSmoke disparity model also evaluated the effects of implementing a combination of the individual policies, including a cigarette tax increase ($1.00, $2.00, or $3.00 per pack); comprehensive, well-enforced smokefree air laws (smoking banned in worksites, bars, restaurants, and other public places); high-intensity mass media antitobacco campaigns; comprehensive, well-enforced marketing restrictions; strong health warnings (on cigarette packages); cessation treatment policies; and strong youth access enforcement (to prohibit minors from accessing tobacco products). In the combined policy scenario that specifically included a $3.00 tax increase per pack of cigarettes, the modified SimSmoke model projected that, from 2015 to 2064, (a) the prevalence of smoking for people in the lowest income quintile would fall by 42.8% among men and by 43.7% among women and (b) a total of 845,401 smoking-attributable deaths would be averted (Tables 6.15 and 6.16). For the second lowest income quintile, the model projected that this same policy combination would avert 676,821 smoking-attributable deaths among men and women from 2015 to 2064 (NCI 2017a).

Furthermore, two U.S. simulation models examined populations with comorbidities and higher-than-average prevalences of smoking, specifically adults with depression (Tam et al. 2020) and adults living with HIV (Reddy et al. 2017). According to data from the 2017 National Survey on Drug Use and Health, the prevalence of smoking among people with depression was greater than 23%, relative to about 15% among people without depression (Weinberger et al. 2020). Among people living with HIV, the prevalence of smoking was greater than 40% (Mdodo et al. 2015; Asfar et al. 2021).

Tam and colleagues (2020) evaluated smoking disparities by mental health status, focusing on adults with a common mental health condition: major depression. They showed that in the absence of intervention, people with depression would remain disproportionately affected by tobacco-related mortality from 2018 to 2060. This model estimated that during this period, 484,000 smoking-attributable deaths and 11.3 million life-years would be lost among adults with major depression (Tam et al. 2020). Reddy and colleagues (2017) simulated lung cancer mortality among people living with HIV and showed that

Table 6.15 Status quo policies and SimSmoke-recommended policies: prevalence of smoking and percentage change among men and women, 18–85 years of age, in the lowest income quintile (percentages)

A. Men

Policies and effects	2014	2015	2025	2045	2064
Status quo policies: Prevalence of smoking[a]	24.0	23.6	20.1	16.9	15.9
Percentage change in smoking prevalence with recommended policies vs. status quo[a]					
Independent policy effects:					
1. Tax increases					
a. By $1.00	0.0	–3.5	–4.9	–7.3	–8.2
b. By $2.00	0.0	–6.5	–8.9	–13.0	–14.5
c. By $3.00	0.0	–8.9	–12.1	–17.7	–19.6
2. Comprehensive, well-enforced smokefree laws	0.0	–1.9	–2.3	–2.6	–2.6
3. High-intensity mass media antitobacco campaigns	0.0	–2.5	–3.9	–4.4	–4.4
4. Comprehensive, well-enforced marketing bans	0.0	–3.4	–3.9	–4.8	–5.1
5. Strong health warnings	0.0	–3.5	–4.8	–5.5	–5.7
6. Cessation treatment policies	0.0	–1.1	–3.5	–4.0	–3.9
7. Strong enforcement of youth access laws	0.0	0.0	–1.1	–3.4	–4.7
Combined policy effects:					
a. 2–7 above, plus $1.00 tax increase	0.0	–18.0	–26.3	–32.6	–34.4
b. 2–7 above, plus $2.00 tax increase	0.0	–20.5	–29.5	–36.9	–39.0
c. 2–7 above, plus $3.00 tax increase	0.0	–22.6	–32.1	–40.4	–42.8

B. Women

Policies and effects	2014	2015	2025	2045	2064
Status quo policies: Prevalence of smoking[a]	18.5	18.3	16	14.1	13.3
Percentage change in smoking prevalence with recommended policies vs. status quo[a]					
Independent policy effects:					
1. Tax increases					
a. By $1.00	0.0	–3.6	–5.0	–7.3	–8.1
b. By $2.00	0.0	–6.5	–9.1	–13.0	–14.4
c. By $3.00	0.0	–9.0	–12.4	–17.6	–19.5
2. Comprehensive, well-enforced smokefree laws	0.0	–1.9	–2.3	–2.6	–2.8
3. High-intensity mass media antitobacco campaigns	0.0	–2.5	–4.1	–4.8	–4.9
4. Comprehensive, well-enforced marketing bans	0.0	–3.4	–4.0	–4.9	–5.2
5. Strong health warnings	0.0	–3.5	–5.0	–5.8	–6.1
6. Cessation treatment policies	0.9	–1.1	–3.9	–4.7	–4.8
7. Strong enforcement of youth access laws	0.0	0.0	–1.1	–3.1	–4.1
Combined policy effects:					
a. 2–7 above, plus $1.00 tax increase	0.0	–18.0	–27.4	–33.4	–35.5
b. 2–7 above, plus $2.00 tax increase	0.0	–20.5	–30.6	–37.7	–40.1
c. 2–7 above, plus $3.00 tax increase	0.0	–22.6	–33.3	–41.1	–43.7

Sources: NCI (2017a).

[a]The SimSmoke model was used for estimates about the prevalence of smoking under the status quo (2014 policy levels maintained through 2064) and the percentage change under each policy scenario (stronger policies implemented and maintained from 2015 to 2064 relative to the status quo scenario).

Table 6.16 Smoking-attributable deaths among men and women in the lowest income quintile, according to the U.S. SimSmoke model

Policies and effects	2014	2015	2025	2045	2064	2015–2064
Status quo policies[a]	119,526	119,151	111,280	74,671	62,207	4,382,226
Smoking-attributable deaths with the status quo policies minus smoking-attributable deaths with recommended policies[a]						
Independent policy effects:						
1. Tax increases						
a. By $1.00	—	—	1,166	2,436	3,797	111,743
b. By $2.00	—	—	2,120	4,399	6,786	201,721
c. By $3.00	—	—	2,915	6,015	9,201	275,760
2. Comprehensive, well-enforced smokefree laws	—	—	768	1,451	1,534	62,130
3. High-intensity mass media antitobacco campaigns	—	—	1,400	2,993	3,167	120,999
4. Comprehensive, well-enforced marketing bans	—	—	1,244	2,305	2,595	101,111
5. Strong health warnings	—	—	1,660	3,391	3,629	140,359
6. Cessation treatment policies	—	—	1,402	3,479	3,685	131,750
7. Strong youth access enforcement	—	—	—	204	1,055	12,310
Combined policy effects:						
a. 2–7 above, plus $1.00 tax increase	—	—	8,444	17,100	19,414	719,025
b. 2–7 above, plus $2.00 tax increase	—	—	9,223	18,606	21,545	788,461
c. 2–7 above, plus $3.00 tax increase	—	—	9,875	19,840	23,258	845,401

Sources: NCI (2017a).

[a]The SimSmoke model was used for estimates about the prevalence of smoking under the status quo (2014 policy levels maintained through 2064) and the percentage change under each policy scenario (stronger policies implemented and maintained from 2015 to 2064 relative to the status quo scenario).

patients who adhere to antiretroviral therapy were 6 to 13 times more likely to die from lung cancer than from AIDS-related causes.

Investigators with the Cancer Intervention and Surveillance Modeling Network (CISNET) consortium generated smoking initiation, cessation, and intensity parameters that can be used to simulate long-term smoking and related health outcomes. For example, Holford and colleagues (2016) used age-period-cohort statistical models to estimate smoking history patterns over the life course among African American and White people in the United States. They found that the probabilities of smoking initiation and cessation and the intensity of cigarette smoking are historically lower among African American people than among White people. This translates into longer smoking durations but lower levels of cumulative exposure in pack-years for African American people. These age-period-cohort analyses and the resulting parameters for modeling have been extended for additional racial population groups by Hispanic origin (Meza et al. 2019), by levels of educational attainment (Cao et al. 2018), and by family income in relation to the federal poverty line (Jeon et al. 2019).

Numerous simulation models have used estimates of smoking from CISNET to evaluate long-term health outcomes at the population level (Jeon et al. 2012; Moolgavkar et al. 2012; Vugrin et al. 2015; Apelberg et al. 2018). The smoking histories modeled by CISNET can be modified in an interactive web based Tobacco Control Policy Tool (TCPT) (CISNET 2021) to estimate the impact of various tobacco control policies (e.g., enacting smokefree air laws, increasing cigarette taxes, raising the minimum age of legal access to tobacco products, increasing the level of expenditures for tobacco control programs, and adding graphic health warnings to cigarette packaging) on projections of adult smoking prevalence, number of life-years gained, and number of deaths avoided in the United States (Tam et al. 2018).

Simulation Modeling of the Prevalence and Attributable Mortality of Menthol Cigarette Use

Research shows that menthol cigarette use contributes to increased rates of smoking initiation and is associated with reduced smoking cessation among the general population and notably among Black people (Giovino et al. 2004; Ahijevych and Ford 2010; Delnevo et al. 2011; Levy et al. 2011a, b; Rath et al. 2015; Villanti et al. 2017, 2019, 2021; D'Silva et al. 2018; Nonnemaker et al. 2019; Azagba et al. 2020; Cwalina et al. 2020; Mantey et al. 2021; Mills et al. 2021; Center for Tobacco Products 2022). Further, research shows that the tobacco industry has heavily marketed menthol cigarettes to Black people, who are more likely to smoke menthol cigarettes than are people from other racial and ethnic groups who smoke (Tobacco Products Scientific Advisory Committee 2011; Alexander et al. 2016; Mendez and Le 2021; Levy et al. 2023; U.S. Food and Drug Administration n.d.). Therefore, the availability of menthol cigarettes in the marketplace differentially affects Black people compared with people from other races. This is true even though the majority of people who smoke menthol cigarettes are White, because White people make up the largest racial group in the United States (U.S. Census Bureau 2022). Thus, although a smaller proportion of White people who smoke report smoking menthol cigarettes, the total number of people who smoke menthol cigarettes is largest for White people.

As of February 2024, nearly 200 cities and counties and two states (Massachusetts and California) have implemented restrictions on the sale of menthol cigarettes and other flavored tobacco products (Campaign for Tobacco Free Kids 2024). Chapter 7 discusses studies that evaluate the impact of those subnational policies.

In the absence of experimental studies or an actual prohibition on menthol cigarettes at the federal level, simulation modeling can project the potential effects of a federal prohibition under reasonable scenarios on tobacco use and tobacco-related health outcomes. Models developed by Levy and colleagues (2011b; 2023), Mendez (2011), Le and Mendez (2021), and Mendez and Le (2021) have assessed the impact of menthol cigarettes on the prevalence of smoking and smoking-attributable deaths among Black or African American people and the total U.S. population. The model by Levy and colleagues (2011b) estimated the effects of a menthol ban, and the model by Mendez (2011) assessed the effects of menthol cigarettes on the population by contrasting a world with and without menthol cigarettes. In projecting future prevalence estimates for menthol and nonmenthol cigarette smoking, both models considered differential initiation and cessation rates among those who start with or become established menthol cigarette users. The results of various simulation models and their updates are summarized in Table 6.17 and discussed in this section.

The SimSmoke model provided by Levy and colleagues (2011b) simulated the effect of a national-level menthol prohibition implemented in 2011 in three potential scenarios: (1) 10% of people who smoked menthol cigarettes permanently quit smoking, and 10% of those who would have initiated smoking with menthol cigarettes did not initiate smoking (10% change); (2) 20% of people who smoked menthol cigarettes quit, and 20.0% of those who would have initiated smoking with menthol cigarettes did not initiate (20% change); and (3) 30.0% of people who smoked menthol cigarettes quit, and 30.0% of those who would have initiated smoking with menthol cigarettes did not initiate (30% change). This model predicted that, in the absence of a federal menthol ban (i.e., the status quo), the prevalence of smoking would decline slowly and the proportion of remaining people who smoke menthol cigarettes would increase. However, in the presence of a prohibition on menthol cigarettes, the model projected greater reductions in the prevalence of smoking and fewer smoking-attributable deaths.

The SimSmoke model also showed that Black or African American people were projected to experience larger health gains from the menthol prohibition compared with the general population. Over a 40-year period (from 2010 through 2050), the 10% change scenario projected nearly a 5% relative reduction in the prevalence of smoking for the total population and a 9% relative reduction among Black or African American people (Levy et al. 2011b). Similarly, under the 20% and 30% change scenarios, the prevalence of smoking would decline by over 7% and nearly 10%, respectively, for all adults. However, these declines would be 17% and nearly 25%, respectively, among Black or African American people (Levy et al. 2011b).

FDA's Tobacco Products Scientific Advisory Committee (TPSAC) completed a review of the scientific evidence related to menthol cigarettes in 2011. Based on smoking models reviewed, TPSAC specified model parameters to compare smoking outcomes under two scenarios, with and without the availability of menthol cigarettes (Mendez 2011; Tobacco Products Scientific Advisory Committee 2011). The model projected that more than 327,500 premature (or excess) deaths would be attributable to the availability of menthol cigarettes over a 40-year period (2010 to 2050), of which, more than 66,500 would be among Black or African American people (Mendez 2011). Mendez (2011) also conducted sensitivity analyses of the model parameters specified by the TPSAC on results for the total number of premature (or excess) deaths overall and with varying menthol-specific parameters in the model; results are included in summary Table 6.17.

Table 6.17 Summary of simulation models estimating cumulative smoking-attributable deaths averted, if menthol cigarettes were banned, and premature (excess) deaths caused by menthol cigarettes: total population and Black or African American population, United States, 1980–2060

Model	1980–2018	2020	2030	2040	2050	2060
Levy and colleagues (2011b) model (cumulative smoking-attributable deaths averted if menthol cigarettes were banned, 2010–2050)						
Total population						
a. 10% reduction in initiation and increase in cessation	—	23,625	103,221	217,267	323,107	—
b. 20% reduction in initiation and increase in cessation	—	43,557	170,506	333,850	478,154	—
c. 30% reduction in initiation and increase in cessation	—	63,489	237,793	450,446	633,252	—
Black or African American population						—
a. 10% reduction in initiation and increase in cessation	—	9,500	36,032	67,212	91,744	—
b. 20% reduction in initiation and increase in cessation	—	18,112	65,514	119,676	164,465	—
c. 30% reduction in initiation and increase in cessation	—	26,724	95,000	172,180	237,317	—
Levy and colleagues (2023) model (smoking and vaping-attributable deaths averted if menthol cigarettes and cigars were banned, 2021–2060)						
Total population						
a. Baseline model	**—**	**—**	**—**	**—**	**—**	**654,221**
b. 10% reduction in overall smoking initiation rate	—	—	—	—	—	647,128
c. 10% increase in overall smoking initiation rate	—	—	—	—	—	661,201
d. 10% reduction in overall smoking cessation rate	—	—	—	—	—	702,353
e. 10% increase in overall smoking cessation rate	—	—	—	—	—	609,459
f. Menthol cessation rate = nonmenthol cessation rate	—	—	—	—	—	461,006
Issabakhsh and colleagues (2023) model (smoking and vaping-attributable deaths averted if menthol cigarettes were banned, 2021–2060)						
Black or African American population						
a. Baseline model	**—**	**—**	**—**	**—**	**—**	**255,895**
Mendez (2011) model (premature [excess] deaths caused by menthol cigarettes, 2010–2050)						
Total population						
a. TPSAC estimates (baseline values)	**—**	**17,182**	**67,817**	**164,590**	**327,565**	**—**
b. Low menthol experimentation	—	15,411	61,041	147,794	292,601	—
c. High menthol experimentation	—	20,723	81,367	198,181	397,489	—

Table 6.17 Continued

Model	1980–2018	2020	2030	2040	2050	2060
d. Low menthol cessation	—	18,495	74,138	178,061	346,122	—
e. High-menthol cessation	—	11,023	38,336	101,964	241,409	—
f. Low switch rate of menthol to nonmenthol	—	17,227	68,265	166,070	330,538	—
g. High switch rate of menthol to nonmenthol	—	17,138	67,397	163,252	324,972	—
h. Low yield from experimenting to smoking	—	2,127	10,220	21,810	30,346	—
i. High yield from experimenting to smoking	—	19,838	77,980	189,784	380,008	—
Black or African American population						—
a. TPSAC estimates (baseline values)	**—**	**4,716**	**16,381**	**35,250**	**66,524**	**—**
b. Low menthol prevalence (counterfactual)	—	2,691	10,244	23,218	44,771	—
Le and Mendez (2021) (premature (excess) deaths caused by menthol cigarettes, 1980-2018)						
Total population						
a. Updated TPSAC estimates (baseline values)	**377,528**	**—**	**—**	**—**	**—**	**—**
b. Low menthol experimentation	—	—	—	—	—	—
c. High menthol experimentation	—	—	—	—	—	—
d. Low menthol cessation	512,545	—	—	—	—	—
e. High-menthol cessation	240,936	—	—	—	—	—
f. Low switch rate of menthol to nonmenthol	386,884	—	—	—	—	—
g. High switch rate of menthol to nonmenthol	368,786	—	—	—	—	—
h. Low yield from experimenting to smoking	218,674	—	—	—	—	—
i. High yield from experimenting to smoking	529,035	—	—	—	—	—
Mendez and Le (2021) (premature (excess) deaths caused by menthol cigarettes, 1980-2018)						
Black or African American population						
a. Updated TPSAC estimates (baseline values)	**156,471**	**—**	**—**	**—**	**—**	**—**
b. Low menthol prevalence (counterfactual)	61,132	—	—	—	—	—

Sources: Levy and colleagues (2011b), including unpublished cumulative totals by year; Levy and colleagues (2023); Issabakhsh and colleagues (2023); Mendez (2011); Le and Mendez (2021); Mendez and Le (2021).

Notes: **TPSAC =** Tobacco Products Scientific Advisory Committee. Mendez (2011) conducted sensitivity analyses for the total number of premature excess deaths when varying (a) menthol smoking rates among people who smoke experimentally (b) menthol smoking cessation rates (c) switching rates from menthol to nonmenthol smoking and (d) the impact of menthol on smoking initiation among people who experiment with cigarettes compared with people who smoke cigarettes.

The SimSmoke (Levy et al. 2011b) and Mendez (2011) models yield relatively consistent estimates for the general population. Both models find that menthol cigarettes disproportionately harm Black people, although, the Mendez (2011) model yields estimates of cumulative menthol-attributable deaths among Black people that are lower than estimates in the SimSmoke model under various scenarios.

The two models have limitations when viewed as forecasts of the effects of potential regulatory actions on menthol. Mendez (2011) modeled a hypothetical world without menthol cigarettes to estimate the present and future harms attributable to menthol cigarettes, but that study did not evaluate a specific model of menthol regulation and its consequences. Levy and colleagues (2011b) explicitly modeled the potential future effects of a national-level prohibition on menthol cigarettes under various hypothetical scenarios but did not estimate which, if any, of the scenarios was most likely. In addition, Levy and colleagues (2011b) did not consider the potential impact of mass media campaigns or increased access to cessation services when implementing a menthol prohibition. Chapter 7 describes implementation evaluations and considerations in more detail.

The Mendez model (2011) and the SimSmoke model (Levy et al. 2011b) were originally developed using data from before 2010, when smoking patterns were relatively stable and cigarettes were the overwhelmingly dominant form of tobacco product use. Since then, evidence on the relationship between the use of menthol cigarettes and smoking initiation and cessation has expanded (Villanti et al. 2017); Chapter 2 of this report provides data on prevalence and trends in menthol cigarette smoking by race and ethnicity and age.

To provide more contemporary estimates to address these developments, Le and Mendez (2021) updated the model Mendez developed for TPSAC (Mendez 2011) to estimate the burden of menthol cigarettes in the United States from 1980 to 2018. Their analysis suggests that the prevalence of smoking in the United States was 2.6 percentage points higher in 2018 than it would have been if menthol cigarettes had not been available from 1980 onward (13.7% versus 11.1%). Furthermore, the availability of menthol cigarettes was estimated to result in smoking initiation among 10.1 million people from 1980 to 2018, and 3 million years of life lost (Le and Mendez 2021). This model also estimated that 378,000 premature deaths occurred from 1980 to 2018 as a result of menthol cigarettes (Table 6.17), or approximately 9,900 premature deaths per year (Le and Mendez 2021).

Mendez and Le (2021) also used the updated model to examine the impact of menthol cigarettes on African American people from 1980 to 2018. Results from this study estimated that from 1980 to 2018, menthol cigarettes were responsible for initiation of smoking among 1.5 million African American people, 1.5 million years of life lost, and nearly 157,000 premature deaths among African American people. This study noted that, compared with estimates of the total menthol-related harm among the general population (Le and Mendez 2021), African American people experienced a disproportionate share of menthol-related harm with respect to these measures (15%, 50%, and 41%, respectively), as African American people constituted about 12% of the U.S. population during the study period.

Simulation Modeling of the Effects of Menthol Cigarette Bans Accounting for Use of E Cigarettes

Some developments in the tobacco product marketplace are not incorporated in the aforementioned models. The SimSmoke model (Levy et al. 2011b) and the Mendez models (Mendez 2011; Le and Mendez 2021; Mendez and Le 2021) did not incorporate (a) the combined use of conventional cigarettes with smokeless tobacco, cigars, hookah, or e-cigarettes (polytobacco use), or (b) the exclusive use of noncigarette tobacco products. Polytobacco use and exclusive use of noncigarette tobacco products are prevalent tobacco use behaviors among youth (Wang et al. 2019; Gentzke et al. 2020; Cho et al. 2021; Tam 2021) and adults, although exclusive use of noncigarette tobacco products is less common among adults (Lee et al. 2014; USDHHS 2014; Sung et al. 2016; Kasza et al. 2017; Hirschtick et al. 2021).

To partially address this gap, Levy and colleagues (2023) updated their original model to simulate the future benefit of a complete prohibition on menthol cigarettes and menthol cigars on the U.S. population from 2021 to 2060. This model accounts for the use of e-cigarettes both among people who smoke and do not smoke cigarettes and explores potential transitions between cigarette smoking and e-cigarette use in reaction to a menthol prohibition. The authors used the Smoking and Vaping Model (SAVM), which simulates population health effects of cigarette and e-cigarette use for specific birth cohorts. Levy and colleagues (2023) extended the SAVM to evaluate the use of nonmenthol and menthol cigarettes separately among people who (a) never used cigarettes or e-cigarettes, (b) smoked menthol cigarettes, (c) smoked nonmenthol cigarettes, (d) exclusively used e-cigarettes, (e) formerly smoked (menthol or nonmenthol cigarettes) but currently used e-cigarettes, (f) formerly smoked (menthol or nonmenthol cigarettes), and (g) formerly used e-cigarettes.

Compared with the status quo scenario in which a menthol prohibition was not implemented, the menthol prohibition scenario with implementation of the prohibition in 2021 was estimated to incur a relative reduction in the overall prevalence of smoking (menthol and nonmenthol cigarettes) by 14.7% by 2026 and by 15.1% by 2060 (Levy et al. 2023). This overall decrease reflects a sharp 92.5% relative reduction in menthol smoking by 2026 and a 96.5% relative reduction by 2060, but a smaller 47.4% relative increase in nonmenthol smoking by 2026 and a 58.0% relative increase by 2060. The menthol prohibition scenario was projected to increase exclusive e-cigarette use (including de novo, exclusive e-cigarette use and e-cigarette use among people who formerly smoked) from 3.5% in 2021 to 5.7% in 2026 and to 7.4% in 2060, equating to a 26.5% relative increase (compared with the status quo scenario) by 2060. Overall, the model estimated that the menthol prohibition scenario would result in more than 654,000 premature deaths averted and more than 11,300,000 life-years lost averted by 2060 compared with the status quo scenario. The authors concluded that their findings “strongly support the implementation of a ban on menthol in cigarettes and cigars” (Levy et al. 2023, p. 1). By way of limitation, the authors note that the model did not distinguish dual use of e-cigarettes and cigarettes from exclusive use of cigarettes, instead counting those who dual use as smoking only. Evidence suggests that dual use of electronic and combustible tobacco products may result in worse respiratory symptoms and greater exposure to toxicants than use of either product alone (Goniewicz et al. 2018; Reddy et al. 2021). Further, Levy and colleagues (2023) noted that the transition scenarios explored were based on mean results from an elicitation that relied on expert opinion, which differed regarding the extent of switching to e-cigarettes.

Levy and colleagues (2023) did not explore the public health impact of a complete menthol prohibition in cigarettes and cigars on the prevalence of smoking, deaths, and life-years lost among Black or African American people. However, Issabakhsh and colleagues (2023), using the SAVM and methodology similar to that of Levy and colleagues (2023), estimated the potential public health impact of a federal prohibition on menthol cigarettes among non-Hispanic Black people. The authors modeled various transitions among non-Hispanic Black adults, as noted by expert elicitation, following a federal prohibition on menthol cigarettes including switching to nonmenthol cigarettes, using illicit menthol cigarettes, switching to e-cigarettes, and quitting smoking. Under the menthol prohibition scenario, the model projected, among non-Hispanic Black adults, the prevalence of (a) smoking menthol cigarettes would decline from 12.1% in 2021 to 0.7% in 2026 and to 0.2% in 2060 and (b) smoking nonmenthol cigarettes would increase from 2.2% in 2021 to 6.7% in 2026, followed by a decline to 3.6% in 2060. Compared with the status quo scenario, a menthol cigarette prohibition implemented in 2021 is projected to result in relative reductions in overall (menthol and nonmenthol) cigarette smoking among non-Hispanic Black adults of 35.7% in 2026 and 25.3% in 2060, but nonmenthol cigarette smoking and e-cigarette use were projected to increase over this period. Even so, the model projected that nearly 256,000 premature deaths and 4 million life-years lost would be averted among non-Hispanic Black adults under the menthol prohibition scenario relative to the status-quo scenario from 2021 to 2060 (Issabakhsh et al. 2023).

Compared to the results of the SAVM for the general population (relative to the status quo) as reported by Levy and colleagues (2023), the findings reported by Issabakhsh and colleagues (2023) for the SAVM for non-Hispanic Black people suggest that a menthol prohibition would result in several strong impacts (relative to the status quo) among non-Hispanic Black adults:

- Overall reduction in the prevalence of smoking: 25.3% through 2060 in the SAVM for non-Hispanic Black people versus 15.1% through 2060 in the SAVM for the general population;

- Reductions in cumulative averted deaths from 2021 to 2060: 18.5% in the SAVM for non-Hispanic Black people versus 4.6% in the SAVM for the general population; and

- Relative reductions in cumulative life-years lost from 2021 to 2060: 22.1% in the SAVM for non-Hispanic Black people vs. 7.9% in the SAVM for the general population.

Projections of averted deaths and life-years lost among non-Hispanic Black adults are approximately one-third of those projected by SAVM for the general population, despite the non-Hispanic Black population making up only 13.6% of the overall U.S. population in 2021. Thus, the authors note that a national menthol prohibition would result “simultaneously in considerable health gains and in reductions in health disparities between the non-Hispanic [B]lack and the rest of the US population” (Issabakhsh et al. 2023, p. 1). Findings were subject to the same limitations as those in the study by Levy and colleagues (2023); that is, dual use was not included in the model, and the effects of menthol prohibition on smoking and vaping initiation and cessation were based on expert elicitation. Furthermore, Issabakhsh and colleagues (2023) noted that the SAVM for non-Hispanic Black people did not distinguish between health outcomes among people who exclusively smoked menthol cigarettes and transitioned to cigar use as a result of the menthol prohibition.

Additional Considerations for Modeling Changes in the Flavored Tobacco Product Marketplace

Noncigarette tobacco products—such as little cigars, smokeless tobacco, and e-cigarettes—are available in menthol and other flavors (Buu et al. 2018; Russell et al. 2018; Schneller et al. 2018; Webb Hooper and Smiley 2018; Zare et al. 2018). These flavored tobacco products may (a) increase the likelihood of future cigarette smoking, (b) be used in conjunction with menthol and nonmenthol cigarettes (i.e., dual use), or (c) be used as substitutes for menthol cigarettes by people who are attempting to quit cigarettes or quit all tobacco products. Simulation models have explored scenarios involving multiple tobacco products (Kalkhoran and Glantz 2015; Cherng et al. 2016; Levy et al. 2017a, 2018, 2023; National Academies of Sciences, Engineering, and Medicine 2018; Warner and Mendez 2018; Brouwer et al. 2020; Mendez and Warner 2020; Niaura et al. 2020). However, none have specifically considered menthol flavoring in e-cigarettes, dual use of e-cigarettes and cigarettes, or differences in patterns of use by race and ethnicity or SES.

The magnitude of the effects of a federal prohibition on menthol cigarettes and flavored cigars would depend on (a) the proportion of people who use cigarettes who transition in whole or in part to other tobacco products and (b) whether such a flavor prohibition would be applied to other tobacco products. If a flavor prohibition was applied to cigarettes and cigars only, the impact of other menthol flavored tobacco products (e.g., e-cigarettes) remaining on the market on important outcomes—such as smoking cessation, complete tobacco product cessation, and tobacco product initiation—is unknown. It is also unclear if these effects would vary by race and ethnicity or SES. As of February 2024, two states (Massachusetts and California) prohibit the sale of all flavored tobacco products, including menthol cigarettes, cigars, and e-cigarettes (Campaign for Tobacco Free Kids 2024). Evaluations of the impacts of state-level flavor restrictions on the use trajectories and variations by race and ethnicity or SES can further elucidate the effects of such restrictions among various population groups.

Future Research Considerations for Simulation Modeling

Simulation models (a) make it possible to examine the potential role of various tobacco control policies in reducing rates of smoking among population groups that are at higher risk and (b) are well suited for evaluating complex social problems that may have unexpected consequences or that may vary with time. Future simulation models that evaluate the impact of specific policies on disparities in smoking could be designed to integrate the effects of noncigarette tobacco products with patterns of smoking. These models could consider whether individuals transition from cigarettes to cigars, smokeless tobacco, or heated tobacco products or vice versa; to dual use; or to complete cessation of all tobacco products.

Thus far, models of smoking in the United States that account for differences in the population by race and ethnicity and SES have been mostly compartmental (macro-level) models that examine trends in aggregate population groups, with a limited number of population categories. To account for diverse populations defined by race and ethnicity, SES, or other sociodemographic factors, as well as the specific patterns of tobacco use within these variables, individual-level models may be useful because they avoid what is known as the “state explosion” problem—that is, the need to dramatically increase the number of model compartments to correspond with the increased number of population characteristics (e.g., race and ethnicity or education) (Siebert et al. 2012).

Models that focus on behavior changes at the individual level—such as microsimulation, agent-based models, or social network models—could be used to show the impact of social stratification on outcomes for the prevalence of smoking (Chao et al. 2015). These types of models could be used to help assess underlying patterns of tobacco use and tobacco-related health disparities for people of lower SES, racial and ethnic groups, and other populations such as people with two or more health conditions at once. The models could also be used to help evaluate the impact of tobacco control policies and regulations on tobacco use patterns and tobacco-related health equity.

Although findings from simulation models are sensitive to the assumptions used and the overall availability, timeliness, and representativeness of the data put into the model, simulation models are increasingly recognized as important tools for evaluating the effects of tobacco use and tobacco control interventions across diverse populations (Ashley et al. 2014; Walton et al. 2015; Backinger et al. 2016). Thus, future models developed for this purpose should be designed with several research considerations in mind.

Data Gaps in Simulation Modeling

Data sources used as model inputs may not be representative of all study populations of interest. In particular, national data are often limited and provide insufficient sample sizes to (a) estimate morbidity and mortality among racial and ethnic groups; (b) investigate the intersection of these groups with sexual orientation, gender identity, level of educational attainment, and poverty status; (c) provide detailed data on tobacco use patterns, including use of noncigarette combustible tobacco products such as cigars; and (d) estimate the health effects of tobacco use (which are usually parameterized and incorporated into models as RRs) and policy effects for specific groups. For instance, historical models of smoking (Holford et al. 2014a,b, 2016; Levy et al. 2016) have relied heavily on RR estimates from the American Cancer Society's Cancer Prevention Study I and Study II. Data collected for these studies came mostly from White, college-educated samples (Rosenberg et al. 2012). These estimates have been updated to include data from five large prospective cohorts (Thun et al. 2013a,b; Carter et al. 2015) and more recent national surveys (Christensen et al. 2018; Choi et al. 2019; Inoue-Choi et al. 2019; Jeon et al. 2023). However, a lack of data on diverse groups remains. The RR estimates presented for different sociodemographic groups in this chapter are an important addition to the literature that can enable the development of further simulation models of smoking-related disparities. Additional data on health effects are critical to investigate the impact of cigarette and noncigarette tobacco products on populations disproportionately affected by tobacco harms.

Detailed data that go far beyond levels of the prevalence of smoking are also needed to determine tobacco use patterns for all relevant sociodemographic groups and other population groups that are disproportionately affected by tobacco use, such as people with mental health conditions. The average age at smoking initiation or smoking cessation or the level of smoking intensity may be lower or higher in specific population groups compared with the general population, as is the case for Black people and people without a college degree or above, respectively (Siahpush et al. 2010). For example, lesbian, gay, bisexual, and transgender people smoke at disproportionately high rates compared with the rest of the population (Lee et al. 2009) and represent an understudied group (Institute of Medicine 2011).

Although models for these population groups could draw from studies conducted at the state and local levels, models at the national level may be limited because nationally representative inputs from national health surveys have only begun to include questions about sexual orientation and gender identity relatively recently. For example, when the NHIS began asking about sexual orientation in 2013, only two other national-level surveys (the National Health and Nutrition Examination Survey and the National Survey of Family Growth) had included this measure (Dahlhamer et al. 2014). NHIS only began asking about gender identity in 2022 (NCHS 2023). Future national surveys should be sufficiently powered to collect detailed information about tobacco use in these and other understudied population groups. This information is needed to facilitate the development of simulation models that address tobacco-related health disparities.

State- and local-level data may provide more robust estimates for small population groups. To date, national-level data have not provided the estimates needed for different racial and ethnic groups, because non-White population groups collectively represented about 39% of the U.S. population as of 2020 (Jones et al. 2021). Sampling methods for national-level studies aim to generate nationally representative samples but may not consider the sample sizes needed to calculate robust estimates among specific population groups. The lack of data at the national level has repeatedly resulted in conclusions that the sample sizes are insufficient to examine outcomes for certain population groups. While pooling data from multiple years is one technique to increase sample size, statistical power, and precision, pooling may mask changes among population groups over time because it requires estimates to be interpreted as the average over the time period being pooled. As such, national surveillance data systems should seek to improve methods to collect more robust data on different population groups. It is also important to continue to examine alternative ways of collecting and analyzing data from diverse groups. Numerous models exist, particularly for American Indian and Alaska Native groups, where various researchers have used different datasets to understand regional differences in smoking and tobacco-caused cancers (Wiggins et al. 2008; Torre et al. 2016).

Population groups with two or more behavioral or physical health conditions at once present distinct modeling challenges. Data are important to understand how concurrent behaviors and conditions may interact with smoking to produce health outcomes that may either increase or reduce disparities for these populations. For instance, smoking prevalence and intensity have been shown to be higher among people with mental health conditions compared with people without mental health conditions (Lipari and Van Horn 2017). Models that simulate these populations should account for the potential interactions of smoking with other diseases such as HIV (Mdege et al. 2017) or mental health conditions (Hassmiller 2006; Prochaska et al. 2017; Reddy et al. 2017; Tam et al. 2020).

Policy Effects by Sociodemographic Group

Few simulation modeling studies have examined the impact of smoking on illness, healthcare costs, or lost earnings across diverse populations. Moreover, information about the specific effects of different tobacco control policies and regulations on smoking patterns for different sociodemographic or at-risk population groups is limited. In recent decades, evidence has been growing on the effectiveness of various tobacco control policies on disparities in smoking, discussed in detail in Chapter 7. Regardless, understanding is limited by (a) the scope of populations that are investigated; (b) the relative lack of focus on the outcomes of initiation and cessation, which are important to simulation modeling efforts; and (c) the need for additional analyses using more up-to-date, nationally representative data.

Federal agencies recognize that limited information is available about policy effects by sociodemographic group, and they encourage and invest in research funding in this area (NCI 2017b; CDC 2021, 2023a,b; National Institutes of Health n.d.). Future research could examine the impact of smoking on morbidity, disability, healthcare costs, years of potential life lost, and productivity losses among various population groups. Results from this research could enhance knowledge about the impact of tobacco control policies on these important populations. Simulation modelers can build on this work by integrating this information into their models as it becomes available.

Heterogeneous Groups

Models assessing heterogeneous populations should consider the potential for heterogeneity even within sociodemographic groups. For example, although aggregate Hispanic/Latino and Asian populations have a lower-than-average prevalence of smoking overall, heterogeneity may mask differences related to country of origin and level of acculturation. Both groups represent diverse populations whose overall health profiles mask inter-ethnic disparities. For example, the prevalence of smoking and frequency of smoking are significantly higher among Puerto Rican and Cuban American people than among Mexican American people (Blanco et al. 2014; Gorman et al. 2014). Differences by sex within and across ethnic groups also matter. For example, Vietnamese men are far more likely to smoke than Chinese men, but this pattern is not apparent in comparisons of Vietnamese and Chinese women (Gorman et al. 2014). In addition, longer duration of U.S. residence is associated with increased smoking within Asian and Hispanic immigrant populations. Although efforts should be made to identify inputs appropriate for each modeled population, efforts to simplify assumptions used in each model should be informed by existing literature about patterns of tobacco use because they vary across and within sociodemographic groups.

Changing Demographics

The overall composition of the U.S. population is changing. To obtain a more complete picture of the complex identities of the U.S. population, questions assessing Hispanic origin and each race group were improved in the 2020 U.S. Census. These improvements included having dedicated write-in response options, allowing respondents to provide additional details to the questions assessing Hispanic origin and race (Marks and Rios-Vargas 2021). These design improvements will likely lead to changes in national estimates of the prevalence of smoking as they resulted in differences in overall racial distributions as compared with the 2010 Census (Jensen et al. 2021). For instance, previous research showed that the rising proportion of Hispanic people in the U.S. population, a group with a lower-than-average prevalence of smoking, was a significant contributor to overall declines in the prevalence of smoking in the United States from 1980 to 2010 (Tam et al. 2014).

The aggregate group of Asian American people represent the fastest growing racial group in the United States (Hoeffel et al. 2012; Budiman and Ruiz 2021a). Although the prevalence of smoking is lower among Asian American people, as an aggregate group, than among White or Black people (Cornelius et al. 2022), past studies indicate that rates of smoking vary within aggregate populations (Li et al. 2013; Martell et al. 2016). Differences in the prevalence of smoking will depend on which Asian population groups are increasing in the United States, by gender, geographic region, level of educational attainment, and income. Chinese, Indian American, Filipino, Vietnamese, Korean, and Japanese people were the Asian groups that accounted for most of the Asian population in the United States in 2019 (Budiman and Ruiz 2021b). These groups have different smoking profiles and disease risk and also differ widely with respect to level of educational attainment, English proficiency, income, and recency of immigration, which could influence future prevalence of smoking among the aggregate population of Asian American people (Budiman and Ruiz 2021b).

Other changing demographics, including the aging of the overall population and greater racial and ethnic diversity in younger population groups (Rabe and Jensen 2023), are likely to influence statistics on tobacco use and how models incorporate these statistics to make future health projections. Developers of models that aim to represent the changing demographics of the U.S. population should, where possible, draw from data sources that will allow such representativeness, such as migration trend estimates.

Evolving Tobacco Landscape

As noted previously, most tobacco simulation models of smoking fail to consider simultaneous or polyuse of tobacco products (Lee et al. 2014; USDHHS 2014; Sung et al. 2016; Kasza et al. 2017; Hirschtick et al. 2021). Simulation models of smoking should incorporate data on noncigarette tobacco products such as e-cigarettes, cigars, smokeless tobacco, hookah, nicotine pouches, and heated tobacco products. Among youth, use of e-cigarettes in isolation and in combination with other tobacco products has become increasingly common, even as the use of combustible tobacco products among youth declines (Wang et al. 2019; Cho et al. 2021; Tam 2021). Additionally, adults use e-cigarettes concurrently with cigarettes more than other tobacco products (Mattingly et al. 2021). Patterns of polytobacco use vary by race and ethnicity, SES, and other sociodemographic factors, which poses a challenge for studies that aim to evaluate multiproduct use across multiple subpopulations.

Simulating the use of multiple tobacco products using the traditional compartmental or macro-level models may be challenging because having an increasing number of compartments for different categories of tobacco use increases the complexity and computational needs of macro-level models (Siebert et al. 2012). Individual-based models, such as agent-based and network-based models, can apply simple rules to individual behaviors and explore how social interactions and social segregation could influence polytobacco use, downstream population-level health outcomes, and tobacco-related disparities. Individual-based models are especially applicable for research that investigates neighborhood contexts and the transmission of tobacco use behaviors among adults and adolescents (Lakon et al. 2010; Luke et al. 2017). By integrating information about diversity in the study population and in the tobacco product marketplace, simulation models can assess the potential health consequences of various interventions, inform future decision making, and increase the likelihood that future public health aims will be met.

Summary of the Evidence and Implications

Simulation models can evaluate the effects of large-scale interventions on smoking-attributable morbidity and mortality and on disparities in tobacco use across various population groups. Few existing simulation models of smoking and of use of other tobacco products consider patterns of use by race, ethnicity, SES, or other demographic factors. Even fewer models explicitly measure disparities using recommended measures of health disparities (Harper and Lynch 2005) or evaluate whether disparities may change as smoking patterns evolve. Even so, the modeling research available to date demonstrates the usefulness of models in assessing patterns of smoking over time and projecting long-term health outcomes as they vary across populations. Future modeling efforts would benefit greatly from the following:

- Detailed data about historical patterns of smoking,
- Continued examination of the differential effects of tobacco control policies on specific sociodemographic groups,
- Consideration of the heterogeneity of racial and ethnic population groups within and across populations,
- Adjustments for shifts over time in the composition of populations, and
- Information about the use of various noncigarette tobacco products and the behaviors of specific sociodemographic groups in transitioning to those products or dual use of cigarette and noncigarette products.

Simulation models can be developed following best practices regarding model specification and structure such as those recommended by ISPOR (formerly the International Society for Pharmacoeconomics and Outcomes Research) and the Society for Medical Decision Making's Modeling Good Research Practices Task Force (Briggs et al. 2012; Caro et al. 2012; Eddy et al. 2012; Karnon et al. 2012; Pitman et al. 2012; Roberts et al. 2012; Siebert et al. 2012) to readily integrate new evidence as it emerges and explore a wide range of future health interventions that will alleviate the burden of tobacco use and its associated morbidity and mortality in populations at greater risk. The impact of modeling studies in this area could be enhanced by (a) adding recommended measures of health disparities into their analyses and (b) evaluating how interventions and changes in tobacco use behaviors could widen or narrow tobacco-related health disparities over time.

Conclusions

1. Smoking is the primary cause of lung and bronchus cancers—the leading cause of cancer death in the United States. Recent declines in the lung and bronchus cancer death rate have occurred among both men and women. Among men, the death rate for lung and bronchus cancer is highest among Black men, followed by White men, American Indian and Alaska Native men, Asian and Pacific Islander men,

and Hispanic men. Among women, the death rate for lung and bronchus cancer is highest among White women, followed by American Indian and Alaska Native women, Black women, Asian and Pacific Islander women, and Hispanic women.

2. Cigarette smoking is a primary cause of COPD and the primary risk factor for the worsening of COPD. The overall prevalence of COPD is highest among American Indian and Alaska Native adults and lowest among Asian adults. There is a clear socioeconomic gradient for COPD prevalence and mortality, with higher prevalence and mortality occurring among people with lower income and lower educational attainment.

3. Cigarette smoking and exposure to secondhand tobacco smoke have adverse effects on overall cardiovascular health and cause cardiovascular disease. Among men, the prevalence of cardiovascular disease in 2017–2020 was highest among non-Hispanic Black (11.3%) and non-Hispanic White (11.3%) men, followed by Hispanic men (8.7%) and non-Hispanic Asian men (6.9%). Among women, the prevalence of cardiovascular disease was highest among non-Hispanic Black women (11.1%), followed by non-Hispanic White (9.2%), Hispanic (8.4%), and non-Hispanic Asian (4.9%) women.

4. From 2010 to 2018, an estimated 4.26 million smoking-attributable deaths occurred among non-Hispanic Black, Hispanic, and non-Hispanic White adults in the United States. Among those groups, at least 473,000 cigarette smoking-attributable deaths are estimated to have occurred each year.

5. Smoking causes about 1 in 5 deaths among non-Hispanic White and non-Hispanic Black people and about 1 in 10 deaths among Hispanic people.

6. An estimated 19,600 deaths attributable to exposure to secondhand tobacco smoke occurred among nonsmoking people in the United States based on data from 2019 and 2020. Deaths attributable to exposure to secondhand tobacco smoke have declined considerably since 2006, but this is largely due to the declines in death observed among non-Hispanic White people. Declines occurred at lower rates during this period among non-Hispanic Black, Hispanic, and other non-Hispanic racial groups.

7. Simulation models can be useful tools to project the potential effects of large-scale interventions on smoking-attributable morbidity and mortality and on disparities in tobacco use across various populations. Future modeling efforts would benefit from (a) more detailed data on patterns of smoking and the use of noncigarette tobacco products; and (b) more robust data for racial and ethnic groups; minoritized sexual orientation and gender identity groups; urban and rural communities; and other focused populations.

8. Aggregation of data on tobacco product use, disease incidence, and mortality may mask disparities within population groups, such as within Asian American and Native Hawaiian and Other Pacific Islander groups. Disaggregation of data reporting and oversampling among disparate populations will foster greater understanding of tobacco-related health disparities.

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Chapter 6 Appendix

Appendix 6.1: Population-Level Estimates of the Prevalence of Smoking Statuses by Demographic Variables *533*

Appendix 6.1: Population-Level Estimates of the Prevalence of Smoking Statuses by Demographic Variables

Table 6A.1 Cigarette smoking status (weighted %) by gender, race and ethnicity, and age group; National Health Interview Survey (NHIS), 2010–2018

Gender, race and ethnicity, and age group	Current smoking (%)	Former smoking (%)	Never smoking (%)
Men			
Hispanic			
35–54	15.4	19.9	64.7
55–64	14.5	32.9	52.6
65–74	13.0	42.2	44.8
≥75	7.1	48.9	44.0
Non-Hispanic Black			
35–54	23.4	13.6	62.9
55–64	25.1	26.9	48.0
65–74	18.4	42.9	38.7
≥75	10.8	49.8	39.3
Non-Hispanic White			
35–54	22.2	24.0	53.8
55–64	19.3	34.1	46.6
65–74	12.1	49.5	38.4
≥75	5.8	57.6	36.7
Women			
Hispanic			
35–54	8.9	10.1	81.0
55–64	9.0	17.8	73.2
65–74	5.7	19.7	74.6
≥75	3.6	17.5	78.9
Non-Hispanic Black			
35–54	16.3	9.1	74.6
55–64	17.0	21.0	61.9
65–74	10.8	25.6	63.6
≥75	7.2	29.6	63.2
Non-Hispanic White			
35–54	21.5	21.4	57.1
55–64	16.1	28.5	55.4
65–74	10.9	35.1	54.1
≥75	5.8	35.1	59.1

Source: NHIS public use dataset, 2010–2018.

Table 6A.2 Cigarette smoking status (weighted %) by gender, level of educational attainment, and age group; National Health Interview Survey (NHIS), 2010–2018

Gender, level of educational attainment, and age group	Current smoking (%)	Former smoking (%)	Never smoking (%)
Men			
≤8th grade			
35–54	22.0	21.1	57.0
55–64	22.7	33.9	43.4
65–74	20.5	44.9	34.6
≥75	9.4	56.6	34.0
9th–12th grade, no diploma			
35–54	44.1	18.9	37.1
55–64	38.3	36.1	25.6
65–74	21.5	52.5	26.0
≥75	10.1	60.7	29.2
High school diploma or GED			
35–54	30.7	22.5	46.8
55–64	28.0	33.8	38.1
65–74	16.2	51.2	32.6
≥75	7.3	59.5	33.2
Some college, no degree			
35–54	22.0	25.5	52.5
55–64	20.4	36.6	43.0
65–74	14.0	51.4	34.6
≥75	6.1	57.6	36.2
≥College degree			
35–54	7.6	18.9	73.4
55–64	7.7	28.7	63.6
65–74	6.0	42.9	51.0
≥75	3.0	48.8	48.2
Women			
≤8th grade			
35–54	11.9	6.8	81.3
55–64	14.1	13.5	72.4
65–74	9.2	19.2	71.7
≥75	5.9	21.2	73.0
9th–12th grade, no diploma			
35–54	33.6	13.0	53.4
55–64	33.3	23.2	43.5
65–74	18.8	30.6	50.7
≥75	11.0	31.1	57.9
High school diploma or GED			
35–54	27.5	16.8	55.7

Table 6A.2 Continued

Gender, level of educational attainment, and age group	Current smoking (%)	Former smoking (%)	Never smoking (%)
55–64	20.7	25.5	53.8
65–74	12.2	32.4	55.4
≥75	5.9	32.0	62.2
Some college, no degree			
35–54	20.7	19.9	59.4
55–64	16.5	28.1	55.3
65–74	11.0	33.8	55.2
≥75	5.1	37.4	57.5
≥College degree			
35–54	7.2	16.2	76.6
55–64	6.0	25.3	68.7
65–74	4.7	31.0	64.3
≥75	3.1	33.8	63.0

Source: NHIS public use dataset, 2010–2018.
Note: **GED =** General Educational Development.

Table 6A.3 Cigarette smoking status (weighted %) by gender, geographic region, and age group; National Health Interview Survey (NHIS), 2010–2018

Gender, geographic region, and age group	Current smoking (%)	Former smoking (%)	Never smoking (%)
Men			
Northeast			
35–54	18.7	23.3	58.0
55–64	16.5	31.9	51.6
65–74	10.2	49.2	40.6
≥75	5.8	51.3	42.8
Midwest			
35–54	23.7	22.6	53.7
55–64	22.2	33.5	44.3
65–74	13.5	49.0	37.6
≥75	6.4	58.3	35.3
South			
35–54	22.6	20.2	57.3
55–64	20.8	32.4	46.8
65–74	13.9	48.4	37.7
≥75	7.1	55.7	37.2
West			
35–54	16.9	22.4	60.7
55–64	16.3	34.5	49.2
65–74	11.5	45.3	43.3
≥75	5.4	56.0	38.6
Women			
Northeast			
35–54	16.3	19.3	64.4
55–64	14.4	29.0	56.6
65–74	9.5	35.2	55.3
≥75	5.4	33.0	61.5
Midwest			
35–54	22.5	18.9	58.6
55–64	17.0	27.0	56.0
65–74	11.8	32.2	55.9
≥75	6.7	32.5	60.8
South			
35–54	18.7	15.3	66.0
55–64	16.3	23.9	59.9
65–74	10.4	29.3	60.3
≥75	5.5	31.9	62.6
West			
35–54	12.4	15.8	71.8

Table 6A.3 Continued

Gender, geographic region, and age group	Current smoking (%)	Former smoking (%)	Never smoking (%)
55–64	11.9	24.2	63.8
65–74	8.3	31.3	60.5
≥75	5.0	33.3	61.7

Source: NHIS public use dataset, 2010–2018.

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Introduction

A variety of approaches can be used to reduce tobacco-related health disparities in the United States. This chapter uses a socioecological perspective (consistent with Chapter 4) (McLeroy et al. 1988; National Cancer Institute [NCI] 2017b) to highlight opportunities to address such disparities on multiple levels, including (1) establishing policies at the federal, tribal, territorial, state, and local levels; (2) conducting mass media campaigns; (3) implementing interventions, policies, and practices in organizational and institutional settings; (4) applying interpersonal interventions; and (5) implementing individual interventions.

Many of the approaches discussed in this chapter build upon contributions from the NCI Tobacco Control Monograph 22, *A Socioecological Approach to Addressing Tobacco-Related Health Disparities* (NCI 2017b) (referred to hereafter as NCI Tobacco Control Monograph 22). Although many of these approaches historically have not focused specifically on addressing tobacco-related health disparities, their successful and equitable execution (i.e., such that resources are allocated to each person according to their needs in order to attain an equal outcome) could have a significant impact on reducing such disparities. Some of the approaches discussed in NCI Tobacco Control Monograph 22 and in this chapter are similar to provisions of the World Health Organization (WHO) Framework Convention on Tobacco Control (WHO 2003), the global tobacco control treaty to which the United States is a signatory but not currently a party.

This chapter does not summarize all possible approaches that could reduce tobacco-related health disparities. Tobacco control advocates and public health practitioners can also look to the WHO Framework Convention on Tobacco Control and other key policy documents and reports to identify additional existing and emerging strategies that could be implemented and evaluated to better understand their impact on addressing tobacco-related health disparities in U.S. communities. Furthermore, Chapter 8 discusses tobacco endgame proposals to advance tobacco-related health equity, as well as liberatory approaches designed to remove social, structural, political, and commercial barriers to tobacco-related health equity.

Overview

Efforts to reduce commercial tobacco use and its related disparities range from establishing federal policies to implementing individually based interventions. After an overview of the literature review methods and an orientation to community-engaged research, chapter sections are organized as follows:

- The first section focuses on tobacco control policies and practices that could reduce tobacco-related health disparities, including implementing smoke-free policies; regulating tobacco products, including reducing nicotine levels; eliminating flavored tobacco products; enacting policies to reduce the supply of and demand for tobacco, including regulating where retailers are located; and regulating tobacco pricing through taxation and other price-related strategies.

- The second section examines community-level programs that aim to reduce the prevalence of smoking, particularly among populations experiencing disparities. These include community-level resources for smoking cessation, specifically tobacco cessation quitlines, and activities to raise public awareness of the harms and health risks of tobacco product use and tobacco product emissions, particularly through media campaigns.

- The third section discusses institutional- and organizational-level policy approaches to reduce tobacco-related health disparities, including policies focused on tobacco use prevention and cessation among youth and young adults, as well as approaches involving healthcare systems (e.g., clinical settings, insurance plans) and worksites.

- The fourth section focuses on interpersonal-level interventions, such as smoking cessation interventions that involve a support person, to reduce tobacco-related health disparities.

- Finally, the fifth section highlights individual-level interventions to reduce tobacco-related health disparities.

Throughout this chapter, racial and ethnic groups; people who identify as lesbian, gay, bisexual, transgender, queer, or intersex (LGBTQI+); lower socioeconomic status (SES) groups; and other population groups with disproportionately high rates of tobacco use and incidence of tobacco-related morbidity and mortality are referred to as (a) priority populations or (b) groups disproportionately affected by tobacco-related health disparities.

Literature Review Methods

Academic literature platforms (including PubMed, Web of Science, MEDLINE, Scopus, Embase, Google Scholar) were searched for studies on interventions and approaches relevant to tobacco product use and tobacco control in general, on specific areas of intervention, and on the impact of such approaches on tobacco-related health disparities. Although time periods of searches varied (as described in Table 7.1), searches generally focused on literature published between 2015 and 2021 because NCI Tobacco Control Monograph 22 (NCI 2017b) synthesized the tobacco control literature on interventions through approximately 2014. This chapter also reviews earlier, seminal tobacco control research. Literature summarized in NCI Tobacco Control Monograph 22 is referenced where appropriate. Specific search strategies for each section are described in Table 7.1.

Table 7.1 Search strategies used for this chapter

Topic	Search strategy
Tobacco control policies	
Preemption	Time period: extending back to 2009 but focusing on literature published since 2012–December 31, 2021 Indexes: Google Scholar, PubMed Search terms: (preemption, tobacco) *Notes:* Articles obtained from this search were further scrutinized for their relevance in identifying examples of recent impacts of preemption on tobacco control and tobacco-related health disparities.
Smokefree air policies	Time period: 2010–December 31, 2021 Indexes: PubMed, Web of Science, and Embase Search terms: (“environmental smoke” OR “secondhand smoke”) OR (smokefree OR smoke-free) AND (regulat* OR polic* OR ban* OR restriction*). *Notes:* Articles obtained from this search were further scrutinized for their relevance to smokefree air policies in the United States, with a particular focus on implications for tobacco-related health disparities. Accordingly, this search informed the subsequent approach, specifically focusing on contextual factors related to the implementation of smokefree air policies (e.g., political factors, regional differences, race and ethnicity), places in need of further attention with regard to the implementation of smokefree air policies (e.g., casinos, multi-unit housing, vehicles), and smokefree air policies covering new tobacco products.
Tobacco product regulation and prohibiting the sale of flavored tobacco products	Updated search time period: 2018–December 31, 2021 Indexes: PubMed, Web of Science, MEDLINE, Embase, and Google Scholar Search terms: (tobacco OR cigar* OR nicotine) AND (regulat* OR ban OR banned OR restriction* OR prohib* OR flavor* OR flavor*) AND (“food and drug” OR “FDA”) Initial search time period: 2010–December 31, 2021 Indexes: PubMed, Web of Science, MEDLINE, Embase, and Google Scholar Search terms: (tobacco OR cigarette* OR smoking OR nicotine) AND (regulat* OR market* OR package* OR polic* OR ban* OR restriction* OR industry* OR flavor* OR flavor*) *Notes:* A narrower search using the revised search string was performed for articles published between 2018 and 2021. Articles obtained from this search were further scrutinized for their relevance to the regulation of tobacco products in the United States, with a particular focus on the implications for tobacco-related health disparities. Accordingly, this search informed the subsequent approach, which focused specifically on nicotine reductions, new tobacco products, and bans or sales restrictions on flavored tobacco products.

Table 7.1 Continued

Topic	Search strategy
Tobacco retail policies and practices: Place based	
Pharmacies	Time period: 2008–2020 Index: PubMed Search terms: (pharmacy AND (tobacco OR cigarette) AND (policy OR law OR ban OR end OR restriction OR regulation OR licens*) *Notes:* Studies were considered for inclusion if they assessed the impact of tobacco-free pharmacies (actual or simulated) on the retail environment (e.g., density reduction) or on adult tobacco use, with a particular focus on the implications for tobacco-related health disparities.
Restricting sales near schools	Time period: 2008–December 31, 2021 Index: PubMed Search terms: (school AND (tobacco OR cigarette) AND (retailer OR outlet OR store OR point-of-sale OR point of sale) AND (distance OR proximity OR location OR licens*) *Notes:* Studies were considered for inclusion if they examined compliance with a local policy, assessed the actual or simulated impact of the policy on the retail environment (e.g., density reduction), or assessed the policy impact on youth tobacco use, with a particular focus on the implications for tobacco-related health disparities.
Other tobacco reduction strategies among retailers	Time period: 2008–December 31, 2021 Index: PubMed Search terms: (tobacco OR cigarette) AND (retailer OR outlet OR store OR point-of-sale OR point of sale) AND (distance OR proximity OR location OR density) AND (policy OR law OR ban OR end OR restriction OR regulation OR licens*). *Notes:* Studies were considered for inclusion if they assessed the actual or simulated impact of the policy on the retail environment (e.g., density reduction), with a particular focus on the implications for tobacco-related health disparities.
Tobacco retail policies and practices: Product focused	
Tobacco pricing strategies	Time period: From inception date of each search engine (index) to December 31, 2021 Indexes: PubMed, EconLit, Web of Science, Google Scholar, and SSRN (formerly Social Science Research Network) Search terms: (cigarette, cigar, cigarillo, “smokeless tobacco,” and e-cigarette/electronic cigarette/electronic nicotine delivery system/ENDS) and the keywords “price/pricing” or “tax” *Notes:* Studies included in the review (a) examined the impact of tobacco pricing policies with a particular focus on implications for different population groups defined by socioeconomic status, age, gender, race and ethnicity, mental health disorder, and/or sexual orientation and (b) used rigorous quantitative methods to examine the actual behavioral changes attributable to changes in tobacco pricing policies. Studies were excluded if they were perspectives, commentaries, or something similar or if they examined only intermediate outcomes, such as attitudes, beliefs, knowledge, and perceptions.
Prohibiting the sale of flavored tobacco products	See above search strategy for tobacco product regulation and prohibiting the sale of flavored tobacco products
Community-level efforts and programs	
State-provided cessation resources	Time period: 2010–December 31, 2021 Indexes: PubMed, Web of Science, and Google Scholar Search terms: ((tobacco OR cigarette* OR smoking OR nicotine) AND (*phone)) OR (quitline*) *Notes:* Articles yielded from this search were further evaluated for relevance to quitline research in the United States, with a particular focus on implications for tobacco-related health disparities.

Table 7.1 Continued

Topic	Search strategy
Mass media campaigns	Time period: 2009–December 31, 2021 Index: PubMed Search terms: "mass media" [MeSH Terms] AND "United States" [MeSH Terms] AND smoking [MeSH Terms] AND (cessation, tobacco use [MeSH Terms]) OR "smoking prevention" [MeSH Terms]) AND campaign *Notes:* Studies were considered for inclusion if they discussed targeted media campaigns or assessed the efficacy of media campaigns focusing on high-risk population groups. Additional articles were identified through further searches using the reference sections from relevant articles and searching for publications evaluating the impact of known media campaigns.
Organizational-level programs and interventions	
School-based tobacco prevention programs	Time period: Inclusive up to December 31, 2021 Indexes: Google Search terms: see notes below. *Notes:* Selected literature was reviewed for relevancy to tobacco prevention and tobacco cessation curricula and programs in schools.
College-based settings	Time period: 2010–December 31, 2021 Indexes: PubMed, Web of Science, MEDLINE, Embase, and Google Scholar Search terms: "(tobacco OR cigarette* OR smoking) AND (college* OR university* OR campus OR young adult* OR college student*) AND (polic* OR ban* OR restriction* OR smoke-free OR smokefree OR tobacco-free OR cessation OR prevention OR program OR intervention)" *Notes:* Articles were considered for inclusion that (a) focused on U.S. colleges or universities and students and (b) provided results about the prevalence of campus tobacco control policies, changes in tobacco use behaviors in relation to campus tobacco control policy adoption or implementation, and/or behavioral outcomes from cessation interventions for young adults attending college. With regard to the latter, the search also included key articles that involved findings from intervention studies that focused on the general population of young adults in cases where substantial proportions of the young adults were also college students. In addition, the search included meta-analyses and systematic reviews that summarized historical data. Particular focus was given to studies with implications for addressing tobacco-related health disparities.
Healthcare systems interventions	Time period: January 2000–December 31, 2021 Indexes: PubMed, Ovid Search terms: PubMed search terms were ("health care" OR "healthcare" OR "hospital" OR "primary care" OR "ambulatory" OR "insur*" OR "pharmacy" OR "pharmacist" OR "dental" OR "dentist" OR "physician" OR "medical provider" OR "quitline") AND ("policy" OR "guideline*" OR "practice" OR "interven*" OR "treat" OR "treatment" OR "implement*" OR "clinic*" OR "advice" OR "advise" OR "assist*" OR "quit" OR "technol*" OR "health record" OR "system*" OR "pharmacol*" OR "medication" OR "medical" OR "coverage" OR "screen" OR "apply" OR "application") AND ("tobacco" OR "cigar" OR "cigarette" OR "nicotine" OR "pipe" OR "smokeless tob*" OR "snuff" OR "snus" OR "chewing tob*") AND ("health status" or "health disparity" or "disparity" OR "race" OR "racial" OR "ethnic*" OR "education" OR "income" OR "socioeconomic*" OR "SES" OR "Medicaid" OR "lesbian" OR "gay" OR "bisexual" OR "transgender" OR "queer" OR "sexual orientation" OR "gender" OR "minority" OR "blue collar" OR "working class" OR "disability" OR "low income"). The search string for the Ovid database, which did not identify any new articles, was (race or racial or ethnic* or education or income or socioeconomic* or SES or lesbian or gay or bisexual or transgender or LGBT or queer or sexual orientation or gender or minority or blue collar or working class or service or disability or low income or disadvantage) AND tobacco use or tobacco or nicotine AND addiction or dependence AND treatment or intervention or guideline*. *Notes:* Abstracts were reviewed, and the full-text article was retrieved if it described a tobacco cessation treatment intervention in a healthcare setting that addressed a disparate population. Reference lists from full-text articles were reviewed to identify any articles not captured in the search. Where several articles were summarized in a systematic review or meta-analysis article, the review findings are reported. Search terms in article titles or abstracts were related to healthcare organization policies or practices related to tobacco, and disparities or specific groups with disproportionate rates of tobacco.

Table 7.1 Continued

Topic	Search strategy
Worksite-based interventions	Time period: 2009—-December 31, 2021 Indexes: PubMed, Google Scholar Search terms: see notes below. *Notes:* Selected literature was reviewed for the following issues relevant to these themes: (1) health plan policies; (2) wage policies; (3) access to cessation resources; (4) financial incentives to encourage workers to quit tobacco use; (5) structural barriers to cessation treatment in the workplace; (6) employers and labor unions working together on tobacco-related initiatives to support employees; (7) comprehensive tobacco-free workplace policies; (8) psychosocial exposures, organizational factors, and occupational hazards in the workplace to reduce disparities in tobacco use; and (9) hiring policies based on tobacco use.
Interpersonal-level interventions	
Household smokefree air policies	Time period: January 1, 2008–December 31, 2021 Index: PubMed Search terms: smoke-free homes OR household smoking bans OR home smoking bans OR home smoking restrictions OR household smoking restrictions. *Notes:* Systematic reviews of interventions or evaluation research studies were examined in full, with a particular focus on the implications for tobacco-related health disparities.
Interventions engaging social support	Time period: January 2013 to December 31, 2021 Indexes: MEDLINE (via PubMed) and Embase Search terms: partner OR buddy OR social OR household OR family OR couple OR dyad OR pair OR interpersonal. The search terms were used in combination with the following topic-related terms in titles or abstracts: (tobacco OR cigarette OR smoking) AND (cessation OR treatment OR intervention OR program OR abstinence OR quit).
Individual-level interventions	Time period: 2008-December 31, 2021 Indexes: PubMed and Web of Science Search terms: racial or ethnic group; Black or African American, Hispanic or Latino, Asian; low SES or low-income; lesbian, gay, bisexual, or transgender (LBGT); or sexual or gender minority. These search terms were combined with the terms: tobacco, tobacco cessation, smoking cessation, smoking cessation intervention, tobacco cessation treatment, quitting smoking, smoking abstinence, and smoking RCT. *Notes:* This review focused on published studies of specific groups or those that compared cessation outcomes by population group. Inclusion criteria included adults who smoked, quasi-experimental or randomized controlled trials, single-arm interventions, and two kinds of cessation outcomes (self-reported or biochemically verified smoking abstinence).

Community-Engaged Research

Studies with community engagement components are included when available in this chapter's evidence reviews. Participatory action research, first described by social scientist Kurt Lewin in the 1940s (Lewin 1948; Adelman 1993), acknowledged and sought to address "social problems" by joining experimental scientific approaches with social action programs. Originating from these theoretical underpinnings, community-based participatory research (CBPR) represents a collection of approaches focused on understanding and acting to address social, structural, and environmental inequities through intentional collaborations with community members, organizational representatives, and researchers in all aspects and phases of research, including development, implementation, and translation (Israel et al. 2001).

CBPR approaches respect communities as units of identity, acknowledge and build upon community strengths and resources, foster opportunities for co-learning and capacity building, and respect and emphasize problems defined by communities (Israel et al. 2003). These approaches also ensure research and community partners mutually benefit, create and activate a sustainable process for developing and fostering community and research partnerships with the requirement of long-term commitment, and disseminate research findings to all stakeholders (Israel et al. 2003). Such approaches have been extended to the fields of social and organizational science, education, healthcare, and public health. Community-engaged research approaches, which include CBPR, give communities the flexibility to selectively engage in phases of interest, such as developing research questions, designing studies, and collecting data (National Institute of Environmental Health Sciences n.d.).

Community-engaged approaches have been utilized in public health and expanded to include assembling community–academic–practice partnerships to address social and structural inequities and reduce health disparities (Minkler et al. 2008; Hearod et al. 2019; Valdez et al. 2020). Initiatives that have meaningfully engaged communities show the importance of these collaboratives in realizing broader and sustained effects on health outcomes (Minkler et al. 2003; Freudenberg 2004; Nelson et al. 2008), including those related to preventing the initiation of commercial tobacco use and exposure to secondhand tobacco smoke and helping with tobacco cessation.

Tobacco Control Policies

Tobacco control policies across all levels of government (federal, tribal, territorial, state, and local) have the potential to significantly reduce tobacco-related health disparities if all populations are equitably protected by policies intended to reduce commercial tobacco use and exposure.[1] State and local governments have long exercised their authority to enact smokefree laws, impose tobacco taxes, restrict the sale and distribution of tobacco products, reduce the illicit trade of these products, and adopt other tobacco control policies, in addition to conducting programs to prevent tobacco use, running mass media campaigns, and providing access to aids for smoking cessation (Tobacco Control Legal Consortium 2009).

On June 22, 2009, the *Family Smoking Prevention and Tobacco Control Act* (Tobacco Control Act) (2009) was signed into law. This act amended the *Federal Food, Drug, and Cosmetic Act* of 1938 and gave the U.S. Food and Drug Administration (FDA) the primary federal authority to regulate the manufacturing, marketing, and distribution of tobacco products; enforce these regulations; support regulatory science; and educate the public about FDA's regulatory actions and about the harms of tobacco products. To carry out these activities, the *Tobacco Control Act* created FDA's Center for Tobacco Products, which is supported by user fees charged to domestic manufacturers and importers of certain types of tobacco products (FDA 2019, n.d.c).

The *Tobacco Control Act* did not authorize FDA to levy taxes on tobacco products, adopt smokefree regulations, raise the minimum legal sales age for tobacco products, or prohibit sales of any tobacco product by a specific category of retail store, including pharmacies. Importantly, this Act did not restrict—and, in fact, it affirmed—existing state, territorial, tribal, and local authority to enact a wide range of policies. These include smokefree policies, excise tax laws, and policies related to the sale and distribution of tobacco products, such as those that reduce tobacco retailer density or prohibit the sale of tobacco products (Tobacco Control Legal Consortium 2014a).

Despite robust evidence about the efficacy of many tobacco control interventions in reducing tobacco use in the general population, limited research analyzes their effects on reducing tobacco-related health disparities. This section focuses on preemption, smokefree policies, regulation of tobacco products, and place-based and product-focused strategies.

Preemption

Preemption occurs when the action of a lower level of government is blocked or overridden by the authority of a higher level of government. For example, under federal preemption, a federal law or regulation can constrain the legal authority of state and local governments. In turn, under state preemption, a state law or regulation restricts the authority of local governments (Kang et al. 2020; Pomeranz and Silver 2020). Preemptive laws and policies may seem neutral but can produce immediate and cumulative discriminatory effects that create and amplify tobacco-related health disparities (Centers for Disease Control and Prevention [CDC] 2012b; Carr et al. 2020; Yang and Berg 2022). The problem typically arises when a robust state or local tobacco control policy is blocked on grounds that it is prohibited by the authority of a weaker or less effective federal or state policy.

[1] *Policy* is a broad term that includes laws, regulations, rules, and organizational practices. In this chapter, references to governmental policies could encompass different mechanisms (e.g., laws or regulations) to achieve a specific goal. References to laws describe legislation enacted by a government.

Preemption is a major concern in the context of tobacco control, where state governments and, more frequently, local governments often lead in adopting effective measures to reduce tobacco use, tailoring their policies to address local conditions (U.S. Department of Health and Human Services [USDHHS] 2000, 2014; Crosbie and Schmidt 2020). By limiting the ability of communities to protect the health and safety of their residents, preemption can prevent local municipalities from implementing tobacco control policies that could reduce tobacco-related health disparities, the burden of tobacco-caused morbidity and mortality, and, in turn, healthcare expenditures.

Preemption can be express or implied. Express preemption arises when the law of a higher level of government explicitly precludes a lower level of government from acting (Public Health Law Center 2018c). If the law of a higher level of government neither explicitly prohibits, nor explicitly affirms the authority of a lower level of government to act, a court may find implied preemption in two circumstances. First, a court may find that the higher level of government intended to be the sole entity to regulate a field, known as field preemption. Second, a court may find that a law or regulation of a lower level of government conflicts with a law or regulation of the higher level of government in such a way that it is impossible to comply with the laws of both governments, which is known as conflict preemption (Public Health Law Center 2018c; Sykes and Vanatko 2019; Kang et al. 2020).

The tobacco industry has long argued for explicitly preemptive laws, which undermine, overturn, or prohibit state or local regulatory authority (Gorovitz et al. 1998; USDHHS 2000; Crosbie and Schmidt 2020). Tobacco industry documents have shown that by limiting local regulatory authority (and when possible state regulatory authority), tobacco companies can focus their resources on fewer legislative bodies and pursue weaker regulations (Siegel et al. 1997; Gorovitz et al. 1998; CDC 1999). When states and localities do adopt evidence-based tobacco control policies, tobacco companies have frequently filed lawsuits to keep them from being enforced on the grounds that they are preempted by federal and state laws (see Chapter 5).

Tobacco companies have argued that preemptive laws create more equitable and uniform business practices that are economically viable for the tobacco marketplace (Burris et al. 2018). Conversely, public health opposition to preemption in the tobacco control context is due to the observation that preemptive laws "can abrogate state or local authority to adopt innovative solutions to public health problems, eliminate the flexibility to respond to the needs of diverse communities, [and] undermine grassroots public health movements" (Pertschuk et al. 2013, p. 214; Mamudu et al. 2020). Thus, preemptive laws not only preclude state or local authority to act on a particular topic but also can affect collaborative efforts within a community to address broader issues. Preemption can hinder local efforts to educate and raise awareness, prevent exploration of policy solutions to best meet the needs of the community, limit opportunities to shift social norms, and impede the diffusion of strong public health laws (Crosbie and Schmidt 2020).

Many health inequities stem from adverse social determinants of health; political empowerment to change those conditions is necessary to reduce such inequities (WHO 2008; CDC n.d.a). The Institute of Medicine (IOM) (now the National Academy of Medicine) recommends that when regulating for the public's health, federal and state governments should set minimum standards but "allow states and localities to further protect the health and safety of their inhabitants" (IOM 2011, pp. 50–51). One of the national health objectives for the *Healthy People* campaigns, including *Healthy People 2030*, has been to eliminate policies in states and territories that preempt local tobacco control policies (Office of Disease Prevention and Health Promotion n.d.).

Federal Preemption: *Tobacco Control Act*

Several provisions of the Tobacco Control Act (2009) address preemption. The act expressly preempts state, territorial, and local requirements that are different from, or add to, any FDA requirements related to "tobacco product standards, premarket review, adulteration, misbranding, labeling, registration, good manufacturing standards, or modified risk tobacco products." However, a "preservation" clause specifies that nothing in the act should be construed to preempt any state, territorial, tribal or local measure other than those that are subject to the express preemption provision. The preservation clause effectively clarifies that preemption by the act cannot be implied; state and local measures are either expressly preempted by the act, or they are not preempted at all.

The Act also contains a "savings" clause that reaffirms that nothing in the express preemption provision limits state, territorial, tribal, and local authority to adopt and enforce requirements related to the sale, distribution, exposure to, access to, advertising and promotion of, or use of tobacco products by individuals of any age, among other actions. The preservation and savings clauses together protect state, territorial, tribal, and local authority to adopt and enforce certain tobacco control measures (Schroth 2020). Courts have looked to the language of the act's preservation and savings clauses when upholding the authority of local governments to restrict the sale of flavored tobacco products (*National Association of Tobacco Outlets, Inc. v. City of Providence, R.I.* 2013;

Independents Gas & Service Stations Associations Inc. v. City of Chicago 2015).

Taken together, these provisions serve to both preserve and limit state, territorial, tribal, and local authority, thereby allowing these governments to reduce the use of tobacco products and their consequent health effects, while furthering Congress' stated purpose of giving FDA exclusive authority over a few specific areas. Congress stated in the *Tobacco Control Act's* preamble that one of its purposes in enacting the law was to expand both federal and state authority to "address comprehensively the public health and societal problems caused by the use of tobacco products" (*Tobacco Control Act* 2009, p. 1777).

The act also expands the scope of state, territorial, and local authority concerning cigarette labeling and advertising. Specifically, the *Tobacco Control Act* eliminated a portion of the preemptive language in the *Federal Cigarette Labeling and Advertising Act* of 1965 and expressly granted state, territorial, and local governments the authority to ban or restrict the time, place, and manner (i.e., when, where, and how advertising may take place) of cigarette advertising or promotion—but not the content. However, the *Federal Cigarette Labeling and Advertising Act* continues to expressly preempt all other state and local measures related to cigarette advertising and promotion. The mere fact that a local cigarette advertising or cigarette promotion regulation is expressly protected from preemption by the preservation and savings clauses in the *Tobacco Control Act* will not necessarily protect the regulation from preemption under the *Federal Cigarette Labeling and Advertising Act*. Thus, a New York City requirement for cigarette retailers to display health warnings next to their registers or tobacco product displays was determined to be preempted, on grounds that it was not a restriction on the time, place, or manner of advertising and promoting cigarettes (*94th St. Grocery Corp. v. N.Y.C. Board of Health* 2012). In contrast, a municipal ban on cigarette coupons and multipack discounts was upheld on the grounds that it was a time, place, and manner restriction, and thus not subject to preemption by the *Federal Cigarette Labeling and Advertising Act* (*National Association of Tobacco Outlets, Inc. v. City of Providence, R.I.* 2013; *Independents Gas & Service Stations Associations Inc. v. City of Chicago* 2015).

State Preemption: Smokefree Laws and Youth Access to Tobacco Products

Preemption at the state level varies by state and topic. Although state laws can preempt a wide array of local tobacco control policies, much of the research that has documented tobacco industry efforts with respect to preemption has focused on smokefree laws and laws prohibiting youth access to tobacco products. For example, in the 1980s when local governments started to prohibit smoking in workplaces, restaurants, and bars, the tobacco industry responded by "implement[ing] a strategy of promoting preemptive state bills nationwide" (Gorovitz et al. 1998, p. 40).

By 2000, a total of 18 states had preempted local restrictions on smoking. Repealing preemptive state bills can be difficult (Crosbie and Schmidt 2020). By 2010, however, because of effective advocacy efforts and various legal actions, the number of states with such preemptive laws had fallen to 12, with states such as Illinois, Iowa, Nevada, New Jersey, Oregon, and South Carolina completely removing smokefree preemption through legislation or the courts (Centers for Disease Control and Prevention 2011a). Preemptive state laws have been "associated with fewer local ordinances restricting smoking [and] a reduced level of worker protection from secondhand smoke" (Mowery et al. 2012). A policy analysis published in 2016 found that 9 of 24 states that lacked comprehensive smokefree state laws also had no local smokefree laws; 8 of these 9 states preempted localities from passing smokefree laws (Tynan et al. 2016). These gaps in coverage contribute to disparities in protection from exposure to secondhand tobacco smoke (CDC 2012a). Disparities in protection can result in tobacco-related health disparities because even brief exposure to secondhand tobacco smoke can cause serious health problems (USDHHS 2006).

A policy analysis published in 2016 found that 9 of 24 states that lacked comprehensive smokefree state laws also had no local smokefree laws; 8 of these 9 states preempted localities from passing smokefree laws (Tynan et al. 2016). Among these states is Florida, where voters approved an amendment to the state's preemption law to prohibit smoking in workplaces and restaurants, but not in bars, beginning in 2003 (CDC n.d.g). Because of preexisting preemptive language in Florida's law, local communities have not been able to enact policies that would otherwise expand on the state law and prohibit smoking in bars in their communities (Tynan et al. 2016).

> *"When states enact substantive policy coupled with preemption, the law protects the population but does not allow for local variation to address additional community needs and freezes policy as reflective of the science and values at the time it was passed"* (Pomeranz 2020)

In the words of one former tobacco industry lobbyist, "the . . . tobacco companies' first priority has always been to preempt the field" (Crawford 1995, p. 202). Among other efforts, the industry heavily promoted preemptive state laws throughout the 1990s that prohibited local governments from passing ordinances to restrict youth access to tobacco products (Siegel et al. 1997). As of 2010, 22 states had preemptive youth access laws in effect (Centers for Disease Control and Prevention 2011a), an increase from 2000 (Crosbie and Schmidt 2020). As of December 31, 2021, 31 states had statutory language expressly preempting local governments from enacting smokefree, tobacco retail licensing, and/or youth access laws (CDC 2022).

Industry groups have a documented history of disseminating model legislation and engaging trade associations to encourage the passage of preemptive laws (Pomeranz et al. 2019; TSET Health Promotion Research Center, University of Oklahoma Health Sciences 2020). Strategies used to enact preemptive laws at the state level include, among other tactics, adding preemptive language to bills addressing unrelated topics, adding preemptive language late in the legislative process without the opportunity for public debate, and titling preemptive bills in a way that obscures their substance (Pomeranz and Silver 2020). In addition to recent efforts by corporations, trade organizations, and others to limit local public health authority to protect the public from serious illness, injury, and death (Pomeranz and Silver 2020; Network for Public Health Law and National Association of County and City Health Officials 2021), events in Pennsylvania, Hawaii, Florida, and Ohio suggest that the tobacco industry continues to pursue preemption of local tobacco control laws specifically (Crawford 1995). For example,

- In 2018, after the Philadelphia City Council introduced a measure to prohibit the sale of flavored cigars and cigarillos, the state legislature adopted a last-minute provision as part of the state budget preempting the city from adopting any new ordinance "regarding or affecting the sale of tobacco products" (Pennsylvania General Assembly 2018) by tobacco retailers licensed under state law (Briggs 2018).

- Similarly, in 2018, Hawaii enacted a provision, added at the last minute to a bill to fund kidney dialysis centers, that preempts "[a]ll local ordinances or regulations that regulate the sale of cigarettes, tobacco products, and electronic smoking devices" (Hawaii State Legislature 2018; PR Newswire 2018; Kang et al. 2020).

- In 2021, the Florida legislature amended its tobacco control statutes, explaining that the "establishment of the minimum age for purchasing or possessing, and the regulation for the marketing, sale, or delivery of, tobacco products is preempted to the state" (The Florida Senate 2021). Public health groups projected that Florida's 2021 preemptive law invalidated an estimated 192 local policies (American Lung Association 2021).

- In 2024, the Ohio legislature overrode the governor's veto of a bill that preempts local sales laws for flavored tobacco products. The governor told reporters that "it is a big win for Big Tobacco. They've lobbied this. They've been all over this" (Fahmy 2024).

These examples suggest that the tobacco industry will continue to seek to block local regulations, thereby limiting communities' ability to address tobacco-related health disparities.

Summary and Recommendations

State and local governments have been at the forefront of enacting tobacco control laws to reduce tobacco use and exposure to secondhand tobacco smoke. These efforts, when implemented equitably, can help address tobacco-related disparities, as will be discussed in subsequent sections. Innovations in tobacco control that effectively reduce the prevalence of tobacco use and exposure to secondhand tobacco smoke in a single jurisdiction can encourage other jurisdictions to follow suit and improve on the first jurisdiction's action, building momentum for change and opportunities for grassroots education and organizing. The tobacco industry recognizes this potential and has long focused on influencing states to remove local authority, as well as on using federal law to restrict state and local authority.

Preemption stops innovative policy efforts at the local and state levels because opportunities to adopt policies that can reduce tobacco-related health disparities are removed when a higher level of government preempts the actions of lower levels of government (Pertschuk et al. 2013). Community engagement—and power—are necessary to achieve and accelerate progress toward the goal of health equity (National Academy of Medicine n.d.). Preemption can lead to the exclusion of minoritized populations and people with lower incomes in shaping local laws that could protect their health and that of their children "by limiting their voice and involvement in policy considerations" (Yang and Berg 2022). Preemption at the state and federal levels can pose a significant obstacle both to enacting and to enforcing effective policy measures to address tobacco-related health disparities.

Although the 2009 *Tobacco Control Act* expressly preempts state, territorial, and local requirements in a narrow set of areas, the act explicitly and broadly preserves state, territorial, tribal, and local authority with respect to adopting and enforcing requirements concerning the use, sales, distribution, marketing, and taxation of all tobacco products. For example, generally, a local jurisdiction may enact a law prohibiting the sale of some or all tobacco products, restricting sales to specific types of retail stores such as tobacco-only retailers, or requiring a minimum price for tobacco products. Preventing and repealing express preemption laws is essential to advancing policies to prevent and reduce tobacco use and exposure to secondhand tobacco smoke, including among groups experiencing tobacco-related disparities. Using this strategy to reduce tobacco-related health disparities aligns with the *Healthy People 2030* tobacco use objective to eliminate policies in states and territories that preempt local tobacco control policies—an objective that reinforces the importance of preserving local authority to protect the public's health.

Preemption is often described in academic or complex legal terms, and its scope sometimes becomes evident only through litigation. Thus, it can be hard to fully explain or anticipate the limiting effects of a specific preemptive law. For these reasons, additional research is needed to evaluate the effects of preemption on tobacco-related health disparities and determine the best methods for communicating those impacts to affected communities and decision makers.

Smokefree Policies

There is no risk-free level of exposure to secondhand tobacco smoke (USDHHS 2006). Exposure to secondhand tobacco smoke causes a wide range of harmful effects, including stroke, coronary heart disease, lung cancer, and low birth weight, sudden infant death syndrome, impaired lung function, and lower respiratory disease in children (USDHHS 1986, 2006, 2014; Miller et al. 2007; Moritsugu 2007; IOM 2010; Tan and Glantz 2012; Chen et al. 2014; Glantz and Johnson 2014; Cao et al. 2015; Macacu et al. 2015; Hori et al. 2016). Exposure to secondhand tobacco smoke affects at least 20% of the U.S. population—with striking disparities across race and ethnicity and SES (Brody et al. 2021; Shastri et al. 2021) (see Chapter 2). Further, exposure to secondhand tobacco smoke causes tobacco-related diseases that resulted in approximately 19,500 deaths among adults in 2019 (see Chapter 6). This section discusses the evidence related to population-level smokefree policies in public places, workplaces, multi-unit housing, and vehicles. Smokefree rules adopted by individuals and households are discussed later in this chapter.

Comprehensive Smokefree Laws

After the publication of the 1964 Surgeon General's report, advocates brought national attention to the issue of exposure to secondhand tobacco smoke (Hyland et al. 2012). While some advocates focused on exposure to secondhand tobacco smoke in public places, flight attendants played a key role in highlighting occupational disparities in such exposure. Their occupation disproportionately exposed them to tobacco smoke on planes, resulting in respiratory illnesses and deaths, including from lung cancer (Holm and Davis 2004; Pan et al. 2005; Hyland et al. 2012). These efforts prompted multiple federal authorities to examine the evidence on the harms of exposure to secondhand tobacco smoke and led to the enactment of laws in the 1970s that prohibited smoking in some public places and a 1973 rule requiring airlines to provide separate smoking and nonsmoking seating areas on commercial flights (Holm and Davis 2004; Hyland et al. 2012). Following decades of advocacy efforts by flight attendants, laws enacted by the U.S. Congress banned smoking on flights lasting 2 hours or less in 1988, on flights lasting 6 hours or less in 1990, and on all domestic and international flights in 2000 (Holm and Davis 2004). It took so long to establish such airline smoking restrictions in part because tobacco companies considered them a serious threat to the continued social acceptability of smoking and worked for decades to stave off such restrictions (Lopipero and Bero 2006).

Continued educational and advocacy efforts spurred by the overwhelming evidence regarding the harms of exposure to secondhand tobacco smoke have resulted in the enactment of comprehensive smokefree laws over the past two decades by some state and local governments. These laws prohibit smoking in all indoor areas of workplaces and public places, including hospitality establishments such as restaurants and bars (Gingiss et al. 2009; International Agency for Research on Cancer [IARC] 2009; CDC 2012a; Tynan et al. 2016) (Figure 7.1).

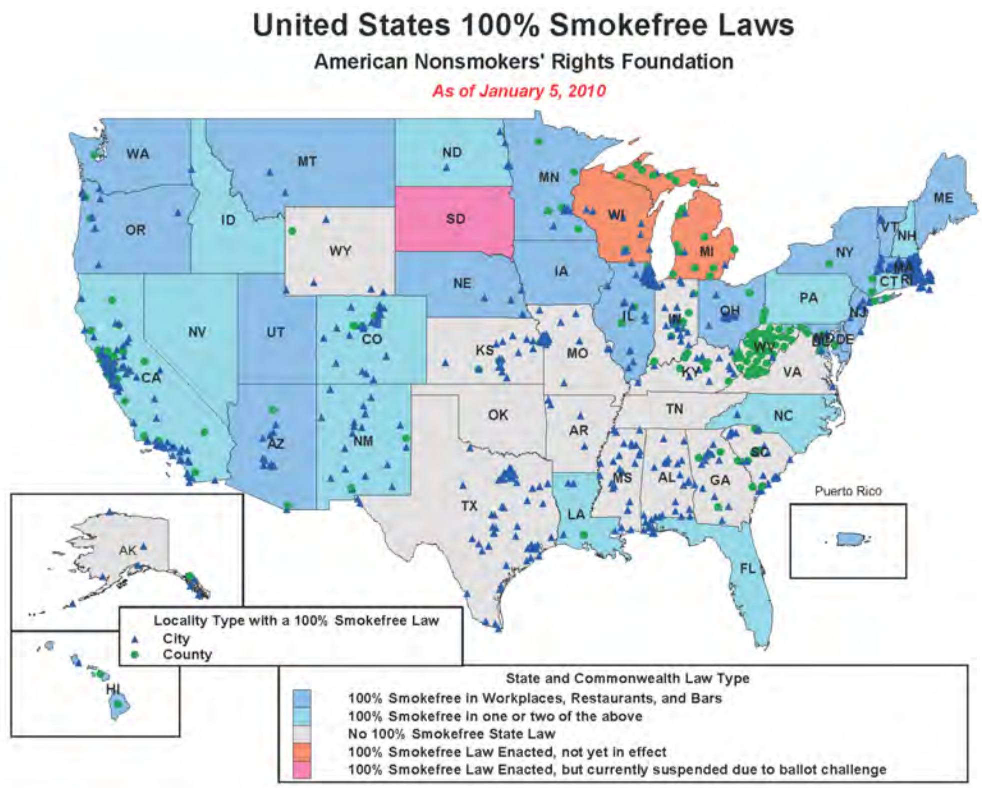
The implementation of comprehensive smokefree laws has been associated with decreased exposure to secondhand tobacco smoke (USDHHS 2006; IARC and WHO 2009; Hahn 2010; Homa et al. 2015; O'Donald et al. 2020). Moreover, robust evidence shows that the implementation of state- and community-level legislation mandating that indoor areas be smokefree changes social norms about the acceptability of smoking, prevents initiation of cigarette use, reduces cigarette consumption, increases quit attempts, reduces cardiovascular and respiratory diseases among people who do not smoke, and improves perinatal and child health (Tan and Glantz 2012; USDHHS 2014; Been et al. 2015; NCI and WHO 2016; Peelen et al. 2016; Tynan et al. 2016). Failure to fully and equitably adopt, implement, and enforce smokefree laws contributes to disparities in protection from exposure to secondhand tobacco smoke, including across racial and ethnic groups and among those of lower SES, which can increase existing health disparities (Bartosch and Pope 1999; Skeer et al. 2004; Tong et al. 2009; Ferketich et al. 2010; Gonzalez et al. 2013; Garrett et al. 2015; Huang et al. 2015; NCI 2017b; Hafez et al. 2019; Smith et al. 2020; Daley et al. 2021a).

Figure 7.1 Maps of 100% smokefree air laws, United States, 2000, 2005, 2010, and 2022

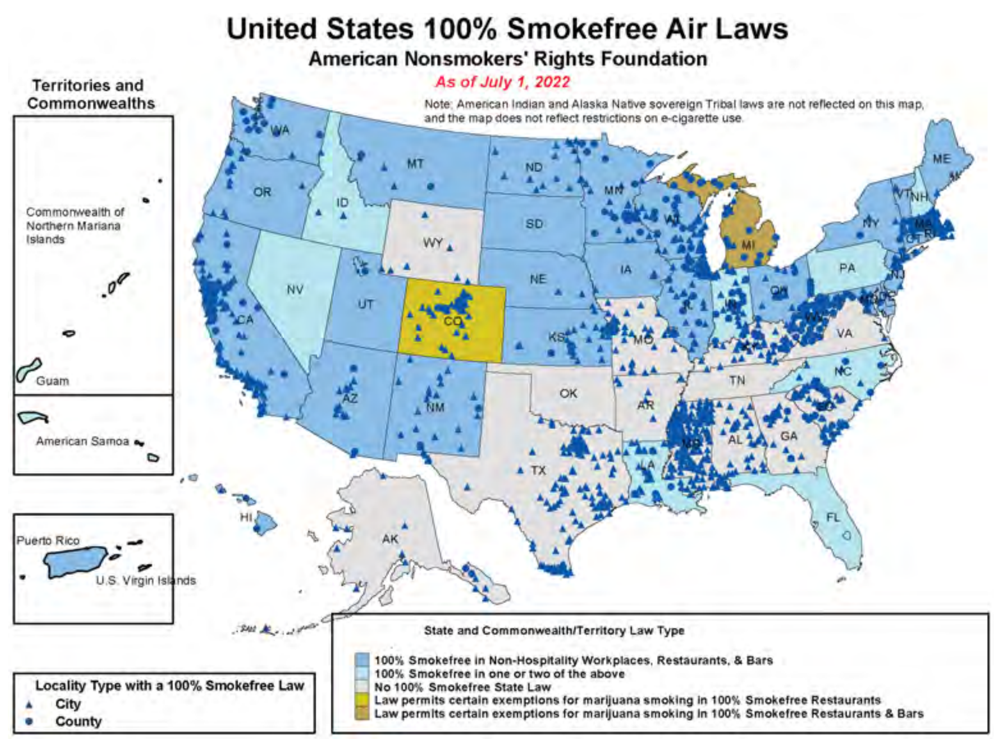
A. As of January 1, 2000

B. As of January 1, 2005

C. As of January 5, 2010



D. As of July 1, 2022



Source: American Nonsmokers' Rights Foundation (n.d.), with permission.

The tobacco industry continues to oppose comprehensive smokefree laws, often by arguing, despite strong evidence to the contrary, that smokefree laws harm businesses (NCI and WHO 2016). Rigorous empirical studies that used objective economic indicators, were conducted in multiple jurisdictions, and that used a variety of methodologies have found that smokefree laws do not have negative economic consequences for businesses, including restaurants and bars; a small positive effect was observed in some cases (USDHHS 2006; Hahn 2010; NCI and WHO 2016).

Smokefree laws have been a key contributor to declines in cigarette smoking in the United States (Hyland et al. 2009; Mills et al. 2009; Tauras et al. 2013; USDHHS 2014, 2020; Song et al. 2015; Hawkins et al. 2016; Dahne et al. 2020a). Overall, compliance with comprehensive smokefree laws is high and these laws have strong public support (NCI and WHO 2016). Comprehensive smokefree laws in the United States are also associated with an increased adoption of voluntary smokefree home rules by both people who smoke and people who do not smoke (Borland et al. 2006; Messer et al. 2008; Mills et al. 2009; Cheng et al. 2011, 2015; Guzman et al. 2012).

As of April 2022, 28 states, American Samoa, the Marshall Islands, Puerto Rico, the U.S. Virgin Islands, and Washington, D.C. had adopted comprehensive smokefree laws in workplaces, restaurants, and bars (American Nonsmokers' Rights Foundation 2022a, c; CDC n.d.i). Historically, most policies within or among states have been adopted at the local level (NCI 2000; USDHHS 2014). As of July 2022, 62.5% of the U.S. population was protected by local or state laws requiring that workplaces, restaurants, and bars all be smokefree (American Nonsmokers' Rights Foundation 2022b). This figure does not take into account the people who also are protected by comprehensive policies adopted by tribes, such as the *Cheyenne River Sioux Tribe Smoke-free Air Act of 2010* and the *Navajo Nation Air is Life Act of 2021* (Cheyenne River Sioux Tribe 2015; Navajo Nation Office of Legislative Services 2021; National Native Network n.d.) and others.

Comprehensive smokefree laws could benefit all people (Dinno and Glantz 2009; Hill et al. 2014; Tabuchi et al. 2018), yet many jurisdictions in the United States lack such laws. Within jurisdictions that do have such laws, enforcement varies. A systematic review of studies published from 1995 through 2013 examined the impact of population-level tobacco interventions and policies on disparities in tobacco-related outcomes (e.g., prevalence of smoking, exposure to secondhand tobacco smoke, cessation) between higher and lower SES groups (defined in the study as equity impact) in Australia, Canada, Europe, and the United States. The review concluded that 25 studies of voluntary, regional, or partial smokefree policies (i.e., policies that were not national in scope or that did not require all indoor areas to be smokefree) showed the potential of these policies to increase SES-related inequities. The review suggested that voluntary, regional, or partial smokefree policies are more likely to be equity-negative than to be comprehensive national smokefree laws. Of the 25 studies of voluntary, regional, or partial smokefree policies, 19 were equity-negative, 1 was equity-positive, 1 was neutral, and 4 were unclear. Of the 19 studies on comprehensive national smokefree laws, 6 were equity-negative, 2 were equity-positive, 9 were neutral, 1 was mixed, and 1 was unclear with regard to the impact on SES-related inequities (Brown et al. 2014). The authors suggested possible reasons for only two studies showing positive equity impacts with respect to other outcomes. These reasons include variation in time lags between policy implementation and smoking behavior changes resulting from changes to social norms among different SES groups and higher prevalence of smoking and exposure to secondhand tobacco smoke among lower SES groups before the policies were passed. More research is warranted to better understand the equity impacts of these policies across population groups.

A literature review of studies from 2000 through 2019 examined the role of comprehensive smokefree laws in reducing the prevalence of smoking (Hafez et al. 2019). With respect to disparities in tobacco use, the review found that smokefree laws are associated with a decline in smoking among adolescents, in general, as well as adolescents from higher SES families, that localities with a higher SES are more likely to pass comprehensive smokefree laws, and that Asian and Hispanic people were more likely than non-Hispanic African American people to live in jurisdictions with smokefree laws.

Based on their review, the authors recommended implementing comprehensive, rather than partial, smokefree laws throughout the United States to reduce smoking among population groups with a high smoking prevalence. This review also showed the importance of examining underlying assumptions related to the impact on health disparities of the presence or absence of policies intended to enhance or promote good health. The presence of a policy may reduce tobacco initiation and use among all population groups but may not necessarily reduce or eliminate inequities. Recognizing that a number of complex factors are associated with tobacco use, the authors note that comprehensive smokefree policies in public places and workplaces could further reduce tobacco-related health disparities if implemented with smokefree housing policies and with smoking cessation services, though further research is needed to assess the impact (Hafez et al. 2019).

Diffusion of Comprehensive Smokefree Laws

The passage of modern, comprehensive smokefree laws began in the 1990s at the local level. Most states that adopted such laws did so between 2000 and 2010 (CDC 2011b; USDHHS 2014; Milov 2019). After making progress in the early 2000s, adoption of smokefree laws stalled at the statewide level (Holmes et al. 2016; Tynan et al. 2016; American Nonsmokers' Rights Foundation 2022b). While comprehensive statewide laws extended throughout much of the Pacific, Midwest, and Northeast regions, statewide laws lagged in the South and Southeast, leaving any protection from exposure to indoor secondhand tobacco smoke in these regions dependent primarily on local smokefree laws adopted by communities that were not preempted from doing so (Figure 7.1).

Both the coverage and passage of smokefree laws have varied by sociodemographic characteristics, which differ by region and state (Huang et al. 2015) and can change over time (Deverell et al. 2006; Huang et al. 2015). Research has found that (a) localities with people of higher SES are more likely to pass comprehensive smokefree laws (Bartosch and Pope 1999; Skeer et al. 2004; Deverell et al. 2006; Ferketich et al. 2010; Huang et al. 2015); (b) smaller, rural communities are less likely to adopt smokefree laws compared with larger, urban areas (York et al. 2008; Hahn et al. 2009; Ferketich et al. 2010); and (c) the correlates of smokefree legislation that has both broad coverage and adequate strength involve having a larger proportion of workers who live and work in the same locality (Huang et al. 2015) or in a neighboring locality with a strong smokefree regulation (Skeer et al. 2004). The following section examines geographic variability in smokefree protections for racial and ethnic population groups.

Race, Ethnicity, and Geographic Variability

In the United States, urban areas have tended to have more smokefree policies and offer more protection from exposure to secondhand tobacco smoke than rural areas (Hafez et al. 2019). Regional and state-level studies of Massachusetts (Skeer et al. 2004), Texas (Gingiss et al. 2009; Huang et al. 2015), and Kentucky (Huang et al. 2015) indicate that localities with a higher proportion of people from minoritized racial and ethnic groups are more likely to pass smokefree legislation or to have legislation with stronger smokefree protections, which may be because much of the early comprehensive smokefree legislation was passed in urban metropolitan areas with concentrated minoritized racial and ethnic groups (Gingiss et al. 2009; Huang et al. 2015). For example, from 2000 through 2009, Asian and Hispanic people residing in metropolitan coastal cities in the United States were more likely to live in an area with a comprehensive smokefree law than their counterparts residing in other regions.

Even so, states in the South lack comprehensive statewide smokefree laws (Figure 7.1). The exact number of comprehensive smokefree laws adopted by American Indian and Alaska Native tribes is not known, but many tribes have enacted smokefree policies to protect their members from exposure to secondhand commercial tobacco smoke (O'Donald et al. 2020; Navajo Nation Office of the President and Vice President and Office of the Speaker 2021; National Native Network n.d.). As discussed in Chapter 6, not all racial and ethnic groups have experienced similar reductions in mortality attributable to exposure to secondhand tobacco smoke, even in states where there are comprehensive smokefree laws. Full implementation of smokefree protections across the United States and tribal lands could advance tobacco-related health equity. Monitoring progress in reducing disparities is a priority.

Smokefree Policies in Specific Settings

Smokefree policies have been extended to a variety of settings other than indoor public spaces, including hospitals (Williams et al. 2009), inpatient psychiatric facilities (Lawn and Pols 2005), corrections facilities (Kauffman et al. 2008), multi-unit housing (Pizacani et al. 2011), and public housing for lower income residents (Winickoff et al. 2010; *Federal Register* 2016a). Smokefree policies in these settings protect patients and residents, staff, and visitors from exposure to secondhand tobacco smoke and can reduce smoking, particularly when combined with cessation services (Kennedy et al. 2015; Vijayaraghavan et al. 2016).

Smokefree policies in hospitals and other medical facilities also contribute to community norms about the unacceptability of smoking (Hurt et al. 1989; Stillman et al. 1990). Policy interventions such as through accreditation requirements, state regulations, or local laws may require hospitals or psychiatric facilities to be smokefree. These facilities often expand their policies to make their entire campuses (indoors and outdoors) smokefree or tobacco-free.

As of January 2023, more than 4,100 hospitals and medical centers[2] have adopted campuswide smokefree

[2]A single estimate of the total number of hospitals and medical centers is not available. According to the Bureau of Labor Statistics (2020a), there were 13,944 hospitals in the third quarter of 2019. Also there are a total of 5,317 hospitals registered with Medicare (Centers for Medicare & Medicaid Services 2023). However, because of differences that can occur in counts when identifying a hospital site or hospital system, these numbers should not be used to calculate an overall proportion of hospitals that are smokefree.

policies (American Nonsmokers' Rights Foundation 2023a). This tally does not include two national managed care organizations (Cigna Corp., Kaiser Permanente); a nonprofit organization providing clinical care, education, and research (Mayo Clinic); and a Catholic nonprofit health system (SSM Health Care), which have adopted campus-wide smokefree policies extending to their respective facilities, campuses, and office buildings. However, an analysis of the 2016 National Mental Health Services Survey found that less than half of behavioral health treatment facilities (49% of mental health treatment facilities and 35% of substance use treatment facilities) reported having smokefree campuses (Marynak et al. 2018b). Historic disparities in accepted norms among providers about smoking among people with versus without behavioral health conditions may have contributed to the relatively low adoption rate of smokefree policies in behavioral health treatment facilities (Prochaska et al. 2017). Over time, however, the number of behavioral health facilities with smokefree policies has continued to rise along with awareness about disparities in tobacco use and smoking-related morbidity and mortality among people with behavioral health conditions (Prochaska et al. 2017). As of January 2023, more than 160 psychiatric facilities[3] have adopted smokefree policies for their buildings, and about half of these also have policies that apply to their entire campuses (American Nonsmokers' Rights Foundation 2023a). Additionally, as of July 1, 2023, 9 states had enacted laws or regulations requiring mental health facilities to have tobacco-free grounds and an additional 5 states had enacted partial prohibitions, while 10 states had enacted laws or regulations requiring tobacco-free grounds for substance use treatment facilities and an additional 4 states had enacted partial prohibitions (Public Health Law Center 2023b). Hospitals and medical and behavioral health facility settings tend to serve people who are disproportionately affected by tobacco use (Hafez et al. 2019). Extending smokefree laws and policies to entire campuses could contribute to reducing tobacco use and exposure to secondhand tobacco smoke among those experiencing tobacco-related health disparities.

Smokefree Casinos

Casinos are also important venues for smokefree policy efforts because workers and patrons in casinos are exposed to high levels of secondhand tobacco smoke (Babb et al. 2015). Historically, many casinos have allowed indoor smoking without restriction and some state and local laws have exempted casinos from smokefree policies. Studies of air quality in casinos and of biomarkers in casino workers and patrons show that smoking in casinos is a public health problem, as documented by dangerous levels of secondhand tobacco smoke in these venues and elevated levels of tobacco smoke biomarkers in the blood, urine, and saliva of casino employees and patrons who do not smoke (Babb et al. 2015). As noted in Chapter 2, tobacco use disparities exist among populations employed in the hospitality industry and in casinos.

Only a few studies have examined disparities in exposure to secondhand tobacco smoke among casino workers or patrons by their sociodemographic characteristics. One study of California residents who visited tribal-owned casinos showed that certain populations were more likely to have visited tribal casinos and were exposed to secondhand tobacco smoke because of the lack of comprehensive smokefree policies in tribal casinos (Timberlake et al. 2012). The populations in this study who were more likely to have visited a casino included people over the age of 50, non-Hispanic African American people, and Hispanic people (Timberlake et al. 2012). The evidence is well documented that people who spend extended amounts of time in environments where smoking occurs, such as casino employees, are at an increased health risk because of the high concentrations and cumulative effects of exposure to secondhand tobacco smoke (USDHHS 2006; Babb et al. 2015).

The tobacco industry routinely works through a "plurality of third-party voices," including those of business owners and concerned citizens, to argue that tobacco control laws, including smokefree laws, will harm other businesses—for instance, from revenue loss (Dearlove et al. 2002; Ulucanlar et al. 2016, p. 6). However, numerous economic studies have found that smokefree laws do not adversely impact business revenue (USDHHS 2006; Hahn 2010). One of the arguments, that opponents of smokefree casinos make, is that casino patrons still have a substantially higher prevalence of smoking than the population as a whole, suggesting that the effects that smokefree laws have on other types of hospitality businesses (such as a positive or neutral effect on revenue) do not apply to casinos. Observational studies have shown that only a small proportion of casino patrons actively smoke (Klepeis et al. 2012), and although active smoking rates in casinos vary across studies (Repace 2004, 2009, 2011; Pritsos et al. 2008; Jiang 2011; Timberlake et al. 2012; Brokenleg et al. 2014; Klepeis et al. 2016; Zhou et al. 2016), most casino patrons smoke at a rate similar to that of the general

[3]A single estimate of the total number of psychiatric facilities is not available. There are a total of 609 psychiatric facilities registered with Medicare (Centers for Medicare & Medicaid Services 2023). However, because of differences that can occur in counts when identifying a hospital site or hospital system, these numbers should not be used to calculate an overall proportion of psychiatric facilities that are smokefree.

public (Babb et al. 2015). Smokefree casinos are also popular with the general public. A recent cross-sectional survey of adults found that 75% of adults favored smokefree casinos, with similar favorability among respondents who visited casinos (75.1%), including those who visit casinos about once a year (74.1%), several times a year (75.3%), and at least once a month (74.2%) (Tynan et al. 2019).

A review of peer-reviewed studies on the impact of smokefree laws on casino revenue found conflicting results but largely suggested that smokefree laws have a minimal or nonsignificant impact on revenue. The studies also may not have accounted for potential cost savings, such as reduced employee healthcare costs, changes in employee productivity, decreased maintenance costs, or decreased fire and property insurance (Babb et al. 2015). As discussed in more detail by Babb and colleagues (2015) and Tauras and colleagues (2018), the impact of Delaware's smokefree law on casino revenue was examined in multiple publications that found conflicting results (Glantz and Alamar 2005; Mandel et al. 2005; Alamar and Glantz 2006; Pakko 2006, 2008). Mandel and colleagues (2005), and then additional analyses by Glantz and Alamar (2005) and Alamar and Glantz (2006), found that the state smokefree law did not significantly affect revenue, while Pakko (2006, 2008) found a decline in revenue. Another study that estimated the impact of Delaware's law on slot machines by Thalheimer and Ali (2008) found reduced demand for slot machines after the smokefree law took effect. However, two studies of Illinois' smokefree law found that the statewide smokefree law had no significant effects on Illinois casino attendance or revenues (Harris et al. 2012; Tauras et al. 2018).

Studies of community engagement with American Indian and Alaska Native people regarding smokefree policies have indicated the need for policy champions from within the community; extensive engagement with stakeholders, including tribal leaders and tribal members; and, in the case of casinos, the involvement of management and engagement with casino patrons and employees (Jiang et al. 2011; Brokenleg et al. 2014; Blanchard et al. 2015; Nez Henderson et al. 2016). This approach was taken by members of the Navajo Nation, who worked for 13 years on a strategy to build support for a smokefree environment on tribal land, resulting in the adoption of a policy in November 2021 that prohibits use of commercial tobacco, electronic cigarettes (e-cigarettes), and smokeless tobacco in all workplaces and public places on tribal land, including in tribal casinos (Navajo Nation Office of Legislative Services 2021; Navajo Nation Office of the President and Vice President and Office of the Speaker 2021).

As of April 2022, 21 states, as well as Puerto Rico and the U.S. Virgin Islands, had implemented laws requiring state-regulated gambling facilities to be 100% smokefree (even if no facilities existed at the time); these states covered approximately half (49.8%) of the U.S. population (American Nonsmokers' Rights Foundation 2022b). Many cities, such as New Orleans, have also implemented smokefree laws that apply to casinos and other gambling facilities (New Orleans Health Department 2015).

Allowing smoking in casinos continues to expose hundreds of thousands of employees in casinos and millions of casino visitors to the known health risks of secondhand tobacco smoke (Babb et al. 2015; Tynan et al. 2019). Employees at risk of exposure to secondhand tobacco smoke include not only dealers, but also other hospitality sector employees who work in casinos, including hotel, restaurant, and bar employees. Failure to protect employees in these settings risks exacerbating health disparities among casino and hospitality workers relative to workers who are protected by workplace smokefree policies. State, territorial, local, and tribal smokefree laws that apply to casinos would protect these employees as well as visitors from the health effects of secondhand tobacco smoke.

Smokefree Multi-Unit Housing Policies

People living in multi-unit housing are particularly susceptible to exposure to secondhand tobacco smoke. Tobacco smoke (consisting of gases, chemicals, and particulate matter) travels between living units through ventilation systems, cracks, and seams that naturally occur between units. It accumulates in units, including those inhabited by people who do not smoke or who have adopted smokefree rules for their units (King et al. 2013a; Homa et al. 2015; Driezen et al. 2020; Matt et al. 2020). Some population groups that experience tobacco-related health disparities also are disproportionately exposed to secondhand tobacco smoke because they live in multi-unit housing, which can further worsen disparities (see Chapter 4). Homes are the primary source of exposure to secondhand tobacco smoke for children (USDHHS 2006). Exposure to secondhand tobacco smoke in rental housing and in multi-unit housing is higher than in privately owned and single-family homes (Wilson et al. 2011; Homa et al. 2015; Farley et al. 2022).

At an institutional level, decisions about implementing smokefree policies in multi-unit housing have largely been left to the discretion of individual developers and property managers (Farley et al. 2015) except in jurisdictions where local ordinances prohibit smoking in multi-unit housing (American Nonsmokers' Rights Foundation 2004; Public Health Law Center 2021b). But most local smokefree ordinances do not apply to multi-unit housing. As of April 2022, a total of 74 municipalities nationwide had laws that required smokefree multi-unit housing—all 74 were located in California (American Nonsmokers' Rights Foundation 2022b, d).

Adopting smokefree multi-unit housing policies has been shown to reduce exposure to secondhand tobacco smoke among residents who do not smoke and can increase cessation intentions and attempts among residents who do smoke (Pizacani et al. 2012; Levy et al. 2015; MacNaughton et al. 2016; Hollar et al. 2017; Gentzke et al. 2018; Horn et al. 2021). The efficacy of smokefree policies in reducing exposure to secondhand tobacco smoke in multi-unit housing is largely dependent on how well the policies are implemented and enforced (Rokicki et al. 2016; Klassen et al. 2017; Anthony et al. 2019; Thorpe et al. 2020).

Providing cessation resources can aid implementation efforts of smokefree policies in multi-unit housing (U.S. Department of Housing and Urban Development [HUD] 2014); these policies may have a greater impact if exposure to secondhand tobacco smoke is eliminated in workplaces, public places, and other sources of exposure outside the home (Pizacani et al. 2012; Levy et al. 2015; Kingsbury and Reckinger 2016; Young et al. 2016; Anthony et al. 2019). These results suggest that smokefree multi-unit housing policies may be implemented more successfully if accompanied by communication strategies that ensure that residents understand the policies, the harm caused by exposure to secondhand tobacco smoke, and how smokefree policies reduce harm.

In January 2016, HUD mandated that all public housing agencies implement indoor smokefree policies within all their buildings by July 2018 (HUD 2016). Surveys of multi-unit housing residents living in urban and rural areas across the United States have found high levels of support for policies prohibiting smoking in public housing (Wilson et al. 2017; Wang et al. 2018a). In 2013, 91.3% of U.S. survey respondents with children who were living in multi-unit housing agreed that tenants have a right to live in a smokefree building (Wilson et al. 2017). Similarly, data from the 2016 Summer Styles web-based survey of U.S. adults revealed that 73.7% of adults surveyed favored smokefree public housing, including 69.6% of respondents living in multi-unit housing (Wang et al. 2018a). In that survey, 44.3% of respondents who currently smoked, 73.2% of respondents who had formerly smoked, and 80.4% of respondents who had never smoked were in favor of smokefree policies (Wang et al. 2018a). These findings suggest that most U.S. adults favor smokefree public housing.

The HUD rule does not cover other forms of publicly subsidized housing, such as the Housing Choice Vouchers Program, Section 8, mixed-finance developments, project-based rental assistance developments, or tribal housing. Many lower income residents who are not affected by the HUD rule remain exposed to secondhand tobacco smoke in their homes (Anastasiou et al. 2020). Owners and property management companies that oversee privately owned housing can voluntarily implement smokefree policies—and do so at higher rates for market-rate properties than for subsidized housing, despite strong preferences for smokefree policies among lower income residents of subsidized housing (Gentzke et al. 2018). A study by Patel and colleagues (2022) of adults 18–64 years of age found support for smokefree multi-unit housing policies among most people who identified as a member of a minoritized racial or ethnic group, especially those who identified as Hispanic. Support was strongest overall for those who thought that exposure to secondhand tobacco smoke was harmful. The authors noted that these findings demonstrate the promise of this intervention to reduce disparities among certain racial and ethnic groups as well as people with lower incomes.

Smokefree policies are more likely to be found in newer buildings, buildings that cater to higher income people, public housing buildings subject to the HUD rule, and buildings with few children (Stein et al. 2015; Snyder et al. 2016). Such findings indicate the need to further promote smokefree policies in lower income multi-unit housing not covered by the HUD rule and to consider how to better protect children in housing. Tribal communities can also adopt policies to prohibit commercial tobacco use in multi-unit or subsidized housing. Efforts may be more successful if they acknowledge and respect the use of sacred tobacco, focus communications on the fact that children in particular may benefit from smokefree policies (rather than focusing on drifting smoke, because tribal housing often consists of single-family homes), and obtain community-specific data to understand and communicate the scope of the issue (Public Health Law Center 2020).

The widespread adoption of smokefree public housing policies could protect populations that experience tobacco-related health disparities, such as people with lower incomes and people from certain racial and ethnic groups, and also protect people who continue to be exposed to secondhand tobacco smoke from their neighbors, despite making their own residential units smokefree (NCI 2017b). For example, although Hispanic residents in multi-unit housing reported being aware of and concerned about exposure to secondhand tobacco smoke, they experienced high levels of exposure to secondhand tobacco smoke, even when they had rules to make their own residential unit smokefree (Delgado-Rendón et al. 2017; Rendón et al. 2017).

Smokefree Laws for Personal Vehicles

In 2019, nearly one-quarter of U.S. middle and high school students reported being exposed to secondhand tobacco smoke in cars (Walton et al. 2020). Non-Hispanic Black and non-Hispanic White students had a higher prevalence of exposure to secondhand tobacco smoke in vehicles than other students (Walton et al. 2020). Although there is no risk-free level of exposure to secondhand tobacco smoke, studies have found that the gases and particulate matter in secondhand tobacco smoke in vehicles can reach high levels that are particularly harmful to children (Rees and Connolly 2006; Fortmann et al. 2010; Northrup et al. 2016; CDC n.d.j).

As of December 2022, nine states, Guam, the Northern Mariana Islands, and Puerto Rico had passed laws prohibiting smoking in personal vehicles when children or adolescents are present (CDC n.d.j). Smokefree vehicle laws have the potential to limit exposure to secondhand tobacco smoke among youth, foster tobacco-free norms, and support tobacco cessation, including among population groups that are more likely to experience tobacco-related health disparities. The evidence concerning the health impact of this strategy is mixed and evidence concerning the strategy's impact on disparities is limited. For example, an evaluation of a smokefree vehicle law in Scotland found an association between the law and reduced asthma-related hospital admissions among preschool children, but no impact was seen on older children (Mackay et al. 2021). A study of laws prohibiting smoking in vehicles in Canada found that the prevalence of exposure to secondhand tobacco smoke remained high, even among young children (Azagba et al. 2019). The authors of these studies noted that there is little enforcement of these laws, which could reduce their impact. In several jurisdictions, suspected violation of these laws may not serve as the basis for stopping a vehicle (Public Health Law Center 2017); this provision may help prevent selective enforcement among specific population groups (ChangeLab Solutions 2020). Another study found that voluntary smokefree car rules among adults in Maine increased after passage of a statewide smokefree vehicle law (Murphy-Hoefer et al. 2014). Most smoking restrictions in vehicles are established through voluntary household rules (Rees and Connolly 2006), as discussed later in this chapter.

Smokefree Policies and Other Tobacco Products and Cannabis

Although e-cigarettes do not generate sidestream aerosol between puffs, the exhaled aerosol from the person using e-cigarettes, known as secondhand e-cigarette aerosol, can expose people around them to nicotine, particulate matter, heavy metals, and carcinogenic chemicals such as formaldehyde and acetaldehyde (Ballbè et al. 2014; Czogala et al. 2014; Goniewicz et al. 2014; Kosmider et al. 2014; USDHHS 2016; Gray et al. 2020; Son et al. 2020; Eshraghian and Al-Delaimy 2021). Additionally, among people who do not use each respective product, people who are exposed to secondhand e-cigarette aerosol have been found to have levels of serum cotinine that are similar to those who are exposed to secondhand tobacco smoke from cigarettes (Flouris et al. 2013). Factors such as the number of people using e-cigarettes and the accumulation of aerosol constituents in the space where the products are used can impact levels of exposure, even though the secondhand emission levels per puff may be much lower than for cigarettes (Li et al. 2020).

More evidence (both cross-sectional and longitudinal) is needed to better understand the health effects of exposure to toxicants present in e-cigarette aerosol. Evidence available to date clearly indicates that bystanders are exposed to and can absorb the toxicants exhaled by people who use e-cigarettes (USDHHS 2016). Some devices also look like cigarettes, and e-cigarette aerosol is visually indistinguishable from cigarette smoke under some conditions (WHO 2014; USDHHS 2016). These factors may interfere with social norms that discourage cigarette use. Collectively, this evidence has already contributed to the enactment of legislation to protect people who do not use e-cigarettes from this exposure by expanding existing smokefree laws to include e-cigarettes and by including e-cigarettes from the outset in new smokefree laws.

Although historically, e-cigarettes have not been covered by most smokefree laws because those laws were often established before the introduction of these products, in the last decade, several localities, states, tribes, and territories have included e-cigarettes in their comprehensive smokefree laws. The wording of individual smokefree laws, as well as how other laws in the jurisdiction define "tobacco products" or "smoking" or identify specific product types, often determine whether smokefree laws regulate the use of e-cigarettes (and other devices used for inhalation of tobacco products, such as heated tobacco products) or if the laws must be amended to explicitly prohibit use of all electronic or combusted tobacco products (Hardin 2011; Lempert et al. 2016; Public Health Law Center 2018b, 2022b; Tobacco Control Legal Consortium and Public Health and Tobacco Policy Center 2018). As of April 2021, 17 states and Puerto Rico prohibit e-cigarette use as a part of a comprehensive smokefree law and 1,103 municipalities prohibit e-cigarette use in 100% smokefree venues (American Nonsmokers' Rights Foundation 2021; CDC n.d.h).

Another issue concerning smokefree laws is cannabis, which has been legalized by many states in the last decade, including for nonmedical use by adults 21 years of age and older. Secondhand cannabis smoke contains many of the same toxic and cancer-causing chemicals found in tobacco smoke, and some of those chemicals are found in higher amounts in secondhand cannabis smoke than in secondhand tobacco smoke (Moir et al. 2008; CDC n.d.d, n.d.e). More research is needed to understand the adverse health effects of exposure to secondhand cannabis smoke, including as compared to secondhand tobacco smoke (CDC n.d.f).

As states have legalized adult cannabis use, use in public places has generally been prohibited, including outdoors. Some states have begun to make certain exceptions for indoor cannabis use within their otherwise comprehensive smokefree laws. For example, Colorado allows for the use of cannabis in certain restaurants and Michigan allows for use in certain restaurants and bars, despite otherwise having comprehensive laws that prohibit tobacco use indoors (American Nonsmokers' Rights Foundation 2022c). Allowing cannabis use indoors and making exceptions to otherwise comprehensive smokefree laws will undermine the progress that has been made over decades to protect people who do not smoke, particularly those who are employed in jobs in the hospitality sector, from exposure to secondhand tobacco smoke and could lead to health disparities. As states and communities consider whether use of cannabis in public places should be permitted as a part of legalization, protecting all populations from exposure to secondhand tobacco smoke, including exposure to cannabis smoke, in all indoor settings should remain a priority.

Summary and Recommendations

There is robust evidence concerning the efficacy of smokefree laws and evidence documenting disparities in smokefree protections. Comprehensive smokefree laws for all indoor areas of public places and workplaces, including casinos, would be expected to reduce tobacco-related health disparities in exposure to secondhand tobacco smoke if they are adopted, implemented, and enforced fully and equitably. Smokefree laws have eliminated exposure to secondhand tobacco smoke in these settings among people who do not smoke and have successfully contributed to lowering the overall prevalence of smoking. These laws have also been shown to lower the prevalence of smoking among some population groups, such as adolescents (Hafez et al. 2019); people who are incarcerated (Kennedy et al. 2015); and people in addiction treatment centers, homeless shelters, and public housing (Vijayaraghavan et al. 2016), resulting in an absolute change in smoking activity and reductions in exposure to secondhand tobacco smoke and leading in turn to a substantial public health benefit. Continued efforts are needed to implement and examine the impact of smokefree policies on smoking prevalence among groups that are disproportionately affected by tobacco-related health disparities.

Similarly, smokefree policies for multi-unit housing also would be expected to reduce exposure to secondhand tobacco smoke if equitably adopted, implemented, and enforced. Public health and housing organizations have partnered to identify options for preventing exposure to secondhand tobacco smoke in multi-unit housing while also maintaining housing stability (Public Health Law Center 2023a). Policies such as HUD's rule mandating smokefree public housing properties are an important step toward reducing these disparities in exposure to secondhand tobacco smoke, but policies will have a greater equity impact if they reach more people (e.g., people living in lower income multi-unit housing not covered by the HUD rule) and if challenges with compliance are overcome.

The evidence is inadequate to infer that smokefree laws that prohibit smoking in personal vehicles when children or adolescents are present reduce disparities in exposure to secondhand tobacco smoke. However, this finding should not prevent tobacco control practitioners from working on interventions that encourage people to create their own rules prohibiting smoking in their cars.

Based on the evidence reviewed, the following interventions, particularly when combined, would be expected to further reduce exposure to secondhand tobacco smoke and reduce disparities in exposure to secondhand tobacco smoke and the prevalence of health effects attributable to secondhand tobacco smoke:

- Expansion and implementation of comprehensive smokefree air laws so that 100% of the U.S. population is covered;

- Comprehensive smokefree air laws that cover public places and places of employment and do not exempt gaming venues, such as casinos; and

- 100% smokefree air laws and policies in multi-unit housing, including all forms of subsidized housing.

When implementing these interventions, smokefree policies will be most protective if they cover all emissions (i.e., smoke, aerosol) from the full range of products, including e-cigarettes, cigars, waterpipe, and cannabis. It is important that policy protections are equitably enforced such that policies are implemented with fidelity and without discrimination against individuals, that their implementation is monitored and evaluated, and that continued steps be taken to identify population groups who are still exposed to secondhand tobacco smoke and to eliminate such exposure. Steps to advance equitable, nondiscriminatory enforcement of smokefree and other evidence-based tobacco prevention and control policies as described in Chapter 8, Box 8.1, may include

- Prioritizing enforcement efforts that focus on industry actors (e.g., manufacturers and retailers) and proprietors of restaurants, bars, and worksites, rather than individual consumers; and

- Ensuring that enforcement practices are proportional to the alleged violation and, if individuals are subject to enforcement action in addition to industry actors, leveraging restorative justice practices (including referral to optional tobacco cessation support services) (Tobacco Control Enforcement for Racial Equity 2021) and alternatives to punitive enforcement mechanisms.

It is important to continue to evaluate the impact of smokefree policies on disparities in tobacco use and tobacco-related disease.

Regulation of Tobacco Products

With the passage of the *Tobacco Control Act* in 2009, FDA was given immediate primary federal regulatory authority with respect to the manufacturing, marketing, and distribution of cigarettes, cigarette tobacco, “roll your own” tobacco, and smokeless tobacco, as well as authority over any other tobacco products that FDA regulations later “deemed” to be subject to the *Federal Food, Drug, and Cosmetic Act*. In 2016, FDA issued a final rule exercising this “deeming” authority to extend to any product made or derived from tobacco that is intended for human consumption, including any component, part, or accessory (*Federal Register* 2016b; FDA 2016). In April 2022, through the *Consolidated Appropriations Act* (2022), Congress expanded FDA’s authority to include tobacco products containing nicotine from any source, including synthetic nicotine. As of August 2023, FDA’s deeming authority as it applies to premium cigars is the subject of litigation after the District Court of the District of Columbia vacated a portion of the deeming rule related to this product (*Cigar Association of America. v. U.S. Food & Drug Administration* 2023).

The *Tobacco Control Act* permits FDA to create a regulatory framework for scientifically informed decisions on a variety of issues, including but not limited to the three topics discussed in this section:

- Levels of nicotine in tobacco products;

- Introduction of new tobacco products in the U.S. marketplace; and

- Elimination of flavors in tobacco products.

When exercising its authority with respect to these three topics, FDA is required to consider whether its action is appropriate for the protection of public health. This requires an assessment of risks and benefits to the population as a whole, including people who use and do not use tobacco products. FDA must also assess the likely impact of the action on initiation and cessation of tobacco use. Assessing an action’s impact on tobacco-related health disparities is not explicitly mentioned in the *Tobacco Control Act*. Given known disparities in tobacco use, an action’s impact on tobacco-related disparities could be considered within the assessment of population-level risks and benefits.

There may be other regulatory opportunities to address tobacco-related health disparities beyond the three areas highlighted in this section, such as those described in NCI Tobacco Control Monograph 22 (NCI 2017b). For example, FDA issued a final rule in March 2020 requiring large pictorial and textual health warnings on cigarette packages and advertisements, after an earlier health warning rule was overturned by a federal appellate court in 2012 due to a tobacco industry lawsuit (*Federal Register* 2020). This latest rule, which has not yet been implemented because it is also being challenged in the courts by the tobacco industry, could address disparities in understanding of the risks associated with the use of cigarettes among those who do and do not smoke (*Federal Register* 2020). Because the pictorial warning requirement offers more robust access to health information, particularly among people who smoke, and because the messages’ reach may extend into the interpersonal networks of people who smoke, this final rule has the potential to help reduce disparities in both understanding related to the harms of smoking and intention to quit (IOM 2006; Thrasher et al. 2012; Cantrell et al. 2013; NCI 2017b; Ramanadhan et al. 2017).

Levels of Nicotine in Tobacco Products

In March 2018, FDA issued an advance notice of proposed rulemaking that specifically requested data and other information to inform a potential tobacco product standard to reduce nicotine levels in cigarettes to make them minimally addictive or nonaddictive, for the protection of public health (*Federal Register* 2018). FDA can establish nicotine levels for tobacco products, although it is prohibited by the *Tobacco Control Act* from reducing nicotine yields in tobacco products to zero.

Nicotine is powerfully addictive and plays a dominant role in sustaining tobacco use (USDHHS 2014; Apelberg et al. 2018). Reducing the nicotine levels in cigarettes to make them minimally addictive or nonaddictive would help prevent those who experiment with cigarettes from becoming dependent on nicotine, help prevent them from transitioning to regular use, and thus help protect them from tobacco-related death and disease (USDHHS 2014; *Federal Register* 2018). This strategy, especially when combined with education, behavioral support for quitting, and access to cessation medications, could also result in increased rates of intentions to quit, attempts to quit, and smoking cessation (Benowitz et al. 2015; Hatsukami et al. 2015; Apelberg et al. 2018), including among adolescents (Cassidy et al. 2018). The growing literature on the potential impacts of reduced-nicotine cigarettes, as described next, indicates that reducing nicotine levels in cigarettes to minimally addictive or nonaddictive levels will benefit public health.

A 2018 study modeled the potential population-level effects of a policy setting a maximum level of nicotine in cigarettes to make them minimally addictive and found that this strategy could lead to a substantial reduction in tobacco-related mortality (Apelberg et al. 2018). Specifically, this study estimated that an additional 5 million adults who smoke would quit smoking within a year after implementation of such a policy, and that the prevalence of smoking among adults would drop from 7.9% in the baseline scenario to 1.4% by the year 2060. It estimated that if the policy had been adopted in 2020, by 2060, it would have prevented 16 million people who otherwise would have initiated smoking from starting to smoke. In addition, the study estimated that the adoption of this policy in 2020 would prevent 2.8 million tobacco-related deaths by 2060 and 8.5 million deaths by 2100 (Apelberg et al. 2018).

This modeling study assumed that the policy would apply to combusted tobacco products that likely would be used as substitutes for cigarettes (such as "roll your own" tobacco, pipe tobacco, and nonpremium cigars), but would not apply to other tobacco products (such as premium cigars, water pipe or hookah, e-cigarettes, and smokeless tobacco). Further, it assumed that, based on prior studies, the policy was unlikely to result in a substantial increased demand for cigarettes with higher nicotine levels from illicit sources (Apelberg et al. 2018). Some studies surveyed people who smoked and found the possibility of illicit trade if nicotine levels in cigarettes were reduced to minimally addictive or nonaddictive levels (Hall et al. 2019b; Popova et al. 2019), and have outlined the potential benefits of education and enforcement tools available to federal, state, territorial, tribal, and local governments, such as encrypted tax stamps, a track and trace system, and licensing requirements for distributors (Hall et al. 2019b; Ribisl et al. 2019). A 2018 paper from FDA analyzing potential responses to FDA tobacco product standards, including a reduced-nicotine product standard for cigarettes, concluded that the development of illicit markets likely would be minimized due to several factors, including higher manufacturing costs, lower profits, and the threat of enforcement action and criminal prosecution associated with producing and selling illegal products (FDA 2018c).

As discussed, a product standard that reduces nicotine levels in cigarettes to minimally addictive or nonaddictive levels (reduced-nicotine-content cigarettes) is expected to have a strong effect on preventing smoking initiation and reducing cigarette consumption among people who currently smoke. A randomized, double-blind clinical trial conducted among people who smoked cigarettes intermittently (nondaily) found that adults who were randomized to very-low-nicotine-content cigarettes reduced their daily cigarette consumption by an average of 51% (an average decrease of 1.6 cigarettes per day from baseline), while adults randomized to normal-nicotine-content cigarettes had no significant change in number of cigarettes consumed per day (Shiffman et al. 2018). These treatment differences were not moderated by gender or by race and ethnicity. Other clinical trials that assessed the impact of using reduced-nicotine-content-cigarettes have shown a reduction in the number of cigarettes smoked per day among people who are Black or African American, who have mental health conditions (such as elevated depressive symptoms or affective disorders), who are of lower SES, who are women, who have opioid dependence, and who are pregnant (Table 7.2) (Tidey et al. 2018, 2022; Higgins et al. 2020; Krebs et al. 2021).

The effects of reduced-nicotine-content cigarettes among populations with multiple forms of disadvantage have also been explored. In a secondary analysis of three randomized clinical trials (RCTs), Higgins and colleagues (2021) investigated whether reduced-nicotine content cigarettes could benefit people experiencing intersectional disparities (described as "cumulative vulnerabilities" in the study, including but not limited to rural residence, substance use disorder, disability status, and poverty). The authors "saw little evidence that cumulative vulnerabilities moderate response to reduced-nicotine-content cigarettes, suggesting that a policy reducing nicotine content

Table 7.2 Studies of impact of policies reducing nicotine to minimally addictive or non-addictive levels on tobacco-related health disparities

Study	Design, population, and location	Primary outcome(s)	Results
Donny et al. (2015)	• Seven-group, double-blind, randomized clinical trial conducted at 10 sites between June 2013 and July 2014 • Participants were recruited through flyers, direct mailings, television and radio announcements, and other advertisements • A total of 840 participants, 18 years of age or older who smoked ≥5 cigarettes per day and were not currently interested in quitting smoking; 780 participants completed the study • Participants were randomly assigned to smoke cigarettes for 6 weeks, using either their usual brands of cigarettes (n = 118) or one of six types of investigational cigarettes of different nicotine content; cigarettes were provided free • Nicotine content of tobacco in the investigational cigarettes varied: – 15.8 mg/g (n = 119) – 5.2 mg/g (n = 122) – 2.4 mg/g (n = 119) – 1.3 mg/g (n = 119) – 0.4 mg/g (n = 119) – 0.4 mg/g high tar (n = 123)	• The primary outcome was the number of CPD at Week 6 and was assessed through an interactive voice-response system • Other measures assessed: FTND, WISDM, MNWS, CES-D, QSU, TNE, cotinine, and NNAL	• During Week 6, the average number of CPD was lower for participants randomly assigned to cigarettes containing 2.4, 1.3, or 0.4 mg/g (16.5, 16.3, and 14.9 CPD, respectively) than it was for participants randomly assigned to their usual brands of cigarettes (22.2 CPD) or to cigarettes containing 15.8 mg/g (21.3 CPD); $p < 0.001$) • Participants assigned to smoke cigarettes with 5.2 mg/g of nicotine smoked an average of 20.8 cigarettes per day, which did not differ significantly from the average number of CPD among those who smoked control cigarettes (15.8 mg/g) • Compared with control cigarettes, cigarettes with lower nicotine content reduced exposure to and dependence on nicotine, as well as reduced craving during abstinence from smoking, without significantly increasing the expired CO level or total puff volume, suggesting minimal compensation • Adverse events were generally mild and similar among groups

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Shiffman et al. (2018)	• Randomized, double-blind clinical trial • Intent-to-treat analyses • June 2015–July 2017 • Participants were recruited through the media, smoked cigarettes intermittently or non-daily, and were not planning to quit smoking in the next 3 months • A total of 238 participants were randomized to two groups based on the level of nicotine content in cigarettes: – VLNC cigarettes: 0.07 mg nicotine delivery (n = 118) – NNC cigarettes: 0.8 mg nicotine delivery (n = 120) • Baseline data were collected during a 2-week period in which participants smoked their own brands of cigarettes • Outcomes were assessed biweekly, and cigarette butts were collected at Weeks 1–2, 3–4, 5–6, 7–8, and 9–10 • One study site: Pittsburgh, PA	• Compared changes in cigarette consumption—as measured by the number of CPD and number of days smoked—between baseline and the final 2 weeks of the trial (Weeks 9–10) • Three convergent methods assessed the number of CPD: – Retroactive reports entered in calendar format – Counts of cigarette butts returned – Reports called into an interactive voice response system by participants each time they smoked • Outcomes assessed by race and ethnicity and gender	• Loss to observation after randomization was similar in the two treatment arms • In the intent-to-treat analyses, the VLNC group reduced consumption by 1.51 CPD more than the NNC group and reduced the number of days smoked by 17% more than the NNC group • Mean changes in number of CPD: – VLNC cigarettes: -1.6 CPD – NNC cigarettes: -0.05 CPD • Effects of VLNC cigarettes did not vary by gender or by race and ethnicity • Number of CPD in the VLNC group declined steeply during the first 4 weeks (by 1.18 cigarettes per day) then leveled off; although the number of CPD differed between VLNC and NNC groups from Week 5 to Week 10, there were no group differences in CPD change over time from Week 5 to Week 10 • Results suggest that a policy mandating the use of VLNC cigarettes might reduce consumption without leading to quitting among people who smoke intermittently, as reductions in the number of CPD leveled off after 4 weeks
Denlinger-Apte et al. (2019)	• Secondary analysis of randomized clinical trial conducted by Hatsukami and colleagues (2018) to compare treatment effects of VLNC cigarettes and NNC cigarettes by menthol use status • Adults who smoked and had no intention to quit smoking in the next 30 days • After 2-week baseline phase, participants were randomly assigned for a 20-week condition to receive: – VLNC cigarettes: nicotine = 0.4 mg/g (n = 503) – NNC cigarettes: nicotine = 15.5 mg/g (n = 249) • Participants received menthol or nonmenthol cigarettes, based on their preference: – VLNC: menthol (n = 231) and nonmenthol (n = 272) – NNC: menthol (n = 115) and nonmenthol (n = 134) • Ten sites in the United States	• Mean total number of CPD (study plus non-study cigarettes) at Week 20 • CO-verified abstinence at Week 20 (CO ≤5 ppm; for the intent-to-treat analysis missing samples were imputed as non-abstinent [CO >5 ppm], whereas the per-protocol analysis included only participants with CO samples at Week 20) • Any cigarette-free days during the 20-week trial (yes or no) • Mean number of cigarette-free days during the 20-week trial	• Compared with those who smoked nonmenthol cigarettes at baseline (n = 406; all p <0.05), participants who smoked menthol cigarettes (n = 346) reported smoking fewer numbers of CPD (14.9 vs. 19.2) and having lower levels of TNE (52.8 vs. 71.6 nmol/mg) and CO (17.7 vs. 20.5 ppm) • At Week 20, significant interactions indicated that those who smoked menthol cigarettes (a) had smaller treatment effects than those who smoked nonmenthol cigarettes for number of CPD (-6.4 vs. -9.3), TNE (ratio of geometric means = 0.22 vs. 0.10), and CEMA (ratio = 0.56 vs. 0.37) (all p<0.05) and (b) trended toward a smaller treatment effect for CO (-4.5 vs. -7.3 ppm, p = 0.06) • ORs for abstinence at Week 20 were significantly lower for people in the menthol VLNC group than for those in the nonmenthol VLNC group (intent-to-treat OR = 1.88 vs. 9.11, p = 0.02 for the interaction)

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Shiffman et al. (2019)	• 12-week double-blind randomized clinical trial • Participants were adults, 18 years of age or older, who were recruited via a variety of media, reported smoking nondaily for at least 1 year or at any rate for at least 3 years, and were not seeking to quit smoking in the next 3 months • People who smoked intermittently were randomized to two groups: – VLNC cigarettes: 0.07 mg nicotine delivery (n = 118) – NNC cigarettes: 0.8 mg nicotine delivery (n = 120) • Multiple measures of dependence (FTND, NDSS, WISDM, and HONC) were assessed at baseline and 2, 6, and 10 weeks after randomization • Pittsburgh, PA	• A principal component factor score captured common variance among the measures that were used to assess dependence • Three convergent methods assessed the number of CPD	• People who smoked intermittently and switched to VLNC cigarettes reduced their dependence on nicotine on all measures, except WISDM Secondary Dependence Motives and HONC • The reductions in dependence appear to be secondary to effects on cigarette consumption and do not appear to be an independent predictor or cause of reduced cigarette consumption
Tidey et al. (2019)	• Randomized, double-blind trial • Data collected from November 2014 to September 2017: – 2-week baseline period – 6-week intervention period – 1-week abstinence period • Intent-to-treat analyses • Adults, 18–70 years of age, who had serious mental illness (schizophrenia, schizoaffective disorder, or bipolar disorder), smoked ≥10 cigarettes per day, and were not seeking treatment for smoking or thinking about quitting • A total of 58 participants were randomized to two conditions: – VLNC: nicotine = 0.4 mg/g (n = 30) – NNC: nicotine = 15.8 mg/g (n = 28) • Providence, Rhode Island	• Primary outcome was total number of CPD (study plus non-study cigarettes) at Week 6, as measured by interactive voice response and timeline follow-back interviews • Other behavioral and physiological measures: breath CO, TNE, and NNAL • Questionnaires and assessments of psychiatric symptoms: FTCD, QSU, MNWS, modified CES, PANAS, PANSS, SANS, CES-D, Calgary Depression Scale for Schizophrenia, BPRS, AIMS, Simpson-Angus Scale, and BARS	• In total, 87% (n = 26) of participants in the VLNC group and 89% (n = 25) of those in the NNC group completed interactive voice responses through Week 6; 80% (n = 24) of participants in the VLNC group and 89% (n = 25) of those in the NNC group completed responses at the Week 6 in-person session • Adjusted regression analyses indicated that participants in the VLNC condition smoked fewer total cigarettes per day (mean difference: -4.23 CPD, $p = 0.047$) and fewer study cigarettes per day (mean difference: -9.96 CPD, $p<0.001$) at Week 6 than did participants in the NNC condition • CO levels ($p <0.05$) and QSU scores ($p <0.05$) were lower among participants in the VLNC group than they were among participants in the NNC group • Participants in the VLNC group reported lower satisfaction, psychological reward, enjoyment, and a reduction in cravings than did participants in the NNC group • No significant differences were observed between conditions at Week 6 for TNE, NNAL, FTCD, MNWS, and PANAS scores and for most measures of psychiatric symptoms, with exception of the Simson-Angus scale, for which scores were lower for the VLNC group than they were for the NNC group • During the abstinence period, the median lapse to first cigarette was 2 days in the VLNC group and 1.5 days in the NNC group, but this difference was not statistically significant

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Higgins et al. (2020)	• Describes three randomized clinical trials performed at the University of Vermont, Brown University, and Johns Hopkins University from October 2016 to September 2019 • A total of 775 participants who smoked cigarettes daily, had psychiatric disorders, or experienced socioeconomic disadvantage, including: – People with affective disorders, exemplifying people who smoke with mental illness (n = 258) – People with opioid use disorder, exemplifying people who smoke with substance use disorders (n = 260) – Women with a high school education or less, exemplifying women who smoke and experience socioeconomic disadvantage (n = 257) • Participants were randomized to receive 12 weeks of exposure to study cigarettes: – VLNC cigarettes: nicotine = 0.4 mg/g (n = 286) – LNC cigarettes: nicotine = 2.4 mg/g (n = 235) – Control cigarettes: nicotine = 15.8 mg/g (n = 286)	• Examined whether VLNC cigarettes decreased smoking rates and severity of nicotine dependence • The primary outcome was between-group differences in mean total number of CPD (study and non-study cigarettes) during Week 12 • Secondary outcomes included number of CPD for study and nonstudy cigarettes and severity of nicotine dependence across weeks analyzed using analysis of covariance, random coefficients growth modeling, or repeated measures analysis of variance	• Participants randomized to the VLNC group had decreased mean (SEM) total number of CPD during Week 12 across populations (Cohen $d = 0.61$; $p < 0.001$) • At Week 12, mean (SEM) number of CPD decreased to 17.96 (0.98) in the VLNC group and to 19.53 (1.07) in the LNC group, both of which differed significantly from the mean in the control group, which was 25.08 (1.08) • Compared with participants in the control group, the number of CPD decreased significantly among participants in the VLNC group (adjusted mean difference = -7.54 [95% CI, -9.51 to -5.57]) and those in the LNC group (adjusted mean difference = -5.33 [95% CI, -7.41 to -3.26]); the change was not significant between the VLNC and LNC groups • Across the populations groups studied (those with affective disorders, opioid use disorder, and women with socioeconomic disadvantage), the number of nonstudy CPD was greater at lower nicotine doses (0.4 mg/g and 2.4 mg/g) than at the highest nicotine dose (15.8 mg/g) • Among people who smoked in the VLNC group, those with opioid use disorder smoked more and evidenced a steeper decreasing trend across weeks (weekly change = -4.42 [95% CI, -5.38 to -3.46] × study week) than did people with affective disorders (weekly change = -0.90 [95% CI, -1.81 to 0.01] × study week) or women with socioeconomic disadvantage (weekly change = -2.02 [95% CI, -2.99 to -1.04] × study week)

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Carroll et al. (2021)	• Secondary analysis of a randomized clinical trial (n = 1,250) • Examined optimal approaches to nicotine reduction—which depended on the education level, gender, or race of people who smoked—and whether the optimal approach differentially benefited people who smoked based on their education level, gender, or race • Analysis compared immediate and gradual reductions in nicotine from 15.5 to 0.4 mg/g • People in the control group provided cigarettes with 15.5 mg/g nicotine	• Outcomes included number of CPD and CO, TNE, NNAL, PheT, and CEMA • Data were analyzed as the area under the curve	• Regardless of education level, gender, and race, CPD, CO, TNE, NNAL, PheT, and CEMA were lower in people in the immediate nicotine reduction group than in those in the gradual nicotine reduction group • Regardless of education level, gender, and race, outcomes were lower for those in the immediate nicotine reduction group than among those in the control group; however, the magnitude of the effect for TNE varied by race • The geometric mean of the area under the curve of TNE was 49% lower in Black participants and 61% lower in White participants in the immediate nicotine reduction group than it was among their counterparts in the control group ($p = 0.047$) • Immediately reducing nicotine in cigarettes has the potential to benefit people who smoke regardless of education level, gender, and race
Higgins et al. (2021)	• Secondary analysis of three 12-week randomized clinical trials examining research cigarettes with different levels of nicotine content (0.4, 2.4, 15.8 mg/g) (Higgins et al. 2020) • Investigate the role of cumulative vulnerabilities in moderating responses to nicotine levels • Analysis examined whether the risk of smoking increases in a summative manner corresponding with the number of co-occurring vulnerabilities (cumulative vulnerability) • Participants (n = 775) were categorized as having low (0–1), moderate (2–3), or high (4–7) cumulative vulnerabilities • Vulnerabilities included rural residence, current substance use disorder, current affective disorder, low level of educational attainment, poverty, unemployment, and physical disability	• The primary outcome was total number of CPD during Week 12 • Secondary outcomes included number of CPD across weeks, toxin exposure, and severity of dependence and craving or withdrawal (17 dependent measures)	• Total number of CPD during Week 12 increased as the cumulative number of vulnerabilities increased ($p = 0.004$) but decreased as the level of nicotine content decreased ($p<0.001$) • There was no significant interaction between cumulative vulnerability and nicotine dose on CPD ($p = 0.67$) • Policies that reduce nicotine content in cigarettes to minimally addictive levels could benefit people in highly disparate groups who smoke, including those residing in rural areas or in other regions with overrepresentation of co-occurring vulnerabilities

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Krebs et al. (2021)	• 33-week, two-arm, double-blind randomized trial • Examined outcomes in response to the gradual tapering of nicotine among people who smoked over an extended period • Participants were adults who smoked cigarettes daily (≥5 cigarettes per day), had less than a college degree, and had no plans to quit within the next 6 months • Participants (n = 245) were randomized to two groups: – RNC study cigarettes with nicotine content tapered every 3 weeks to final VLNC cigarettes (0.2 mg of nicotine per cigarette) for 6 weeks (n = 122) – UNC study cigarettes (11.6 mg of nicotine per cigarette) (n = 123) • Hershey, Pennsylvania, and Washington, DC	• Outcomes included acceptability of study cigarettes, as measured by attrition (primary outcome); compliance; reduction in cigarette dependence and tobacco biomarkers; and post-intervention cessation	• Attrition was higher in the RNC group (43%; n = 52) than it was in the UNC group (15%; n = 19) (adjusted hazard ratio = 3.4; 95% CI, 1.99–5.81) • At the end of the randomization period (ninth visit of the intervention), 174 participants remained in the study: 70 in the RNC group and 104 in the UNC group: – Cotinine levels were 50% lower among participants in the RNC group (mean group difference = -137 ng/mL; 95% CI: -172 to -102) than they were among participants in the UNC group – Participants in the RNC group smoked fewer cigarettes per day (-4.1; 95% CI: -6.44 to -1.75) and had lower levels of exhaled CO (-4.0 ppm; 95% CI: -7.7 to -0.4) than participants in the UNC group – Among 62 participants in the RNC group who were assessed for biochemical compliance when smoking VLNC cigarettes, 47% (n = 29) were compliant, 34% (n = 21) were partially complaint, and 19% (n=12) were noncompliant – At the ninth visit, 44% (n = 31) of participants in the RNC group chose to continue to receive VLNC cigarettes, 24% (n = 17) returned to smoking their own brands of cigarettes, and 31% (n=22) chose to make a quit attempt: ○ Among those who chose a quit attempt, 27% (n = 6) were quit at the 3-month follow-up ○ Participants in the RNC group were more likely to quit if they were determined to be compliant in the use of VLNC cigarettes • Differential dropout and noncompliance with the study protocol may suggest that some people who smoke may have difficulty transitioning to low-nicotine-content cigarettes

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Foulds et al. (2022)	• Randomized controlled parallel group trial • Examined the potential effects of reducing the nicotine content in cigarettes to very low levels among people who smoked and had affective disorders • Participants included adults who smoked, had a current (n = 118) or lifetime (n = 70) anxiety or unipolar mood disorder, and were not planning to quit smoking in the next 6 months • After two baseline periods, 188 adults were randomized to two study groups: – UNC research cigarettes (11.6 mg of nicotine per cigarette) (n = 94) – RNC research cigarettes (n = 94) where, during a five-step phase over 18 weeks, the nicotine content per cigarette was progressively reduced to 0.2 mg of nicotine per cigarette • After randomization, 143 respondents (69 in the RNC group and 74 in the UNC group) entered the treatment choice phase where they were offered the choice of receiving assistance to quit smoking, continuing to receive free research cigarettes, or resuming smoking their own brands of cigarettes during a 12-week follow-up period • Penn State University, Hershey, Pennsylvania; and Massachusetts General Hospital, Boston, Massachusetts	• The pre-registered primary outcome was plasma cotinine (metabolite of nicotine) • Study also measured group mean differences in: – Other biomarkers of nicotine and toxicant exposure (exhaled CO, NNAL, GSSP:GSH ratio, 8-isoprostanes, and hydroxypyrene) – Smoking behavior (number of CPD) – Dependence measures (FTCD, PSCDI, HONC, MNWS, and QSU scales) – Severity of psychiatric symptoms (Kessler K6, OASIS, QIDS, PSS, and CES-D) – Health status indicators (blood pressure, heart rate, weight, waist:hip ratio, FEV1, and CCQ)	• Compared with participants in the UNC group at the last randomization phase visit, those in the RNC group had significantly lower: – Plasma cotinine (difference between groups = -175.7 ng/ml; 95% CI, -218.3 to -133.1) – NNAL (difference between groups = -0.54; 95% CI, -1.02 to -0.06) – Exhaled CO (difference between groups = -7.86 ppm; 95% CI, -12.06 to -3.66) – Number of CPD (difference between groups = -4.543; 95% CI, -7.43 to -1.64) – Cigarette dependence, as measured by the FTCD, PSCDI, and HONC scores • No between-group differences were found on a range of other biomarkers (e.g., 8-isoprostanes) or health indicators (e.g., blood pressure) or on five psychiatric questionnaires, including the Kessler K6 measure of psychological distress • At the end of the subsequent 12-week treatment choice phase, those randomized to the RNC group were more likely to have quit smoking, based on initial intent-to-treat sample (n = 188; 18.1% RNC vs. 4.3% UNC; p = 0.004)

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Higgins et al. (2022a)	• Secondary analysis of three 12-week randomized clinical trials examining research cigarettes with different levels of nicotine content (0.4, 2.4, and 15.8 mg/g) (Higgins et al. 2020) • Analysis examined whether the relative reinforcing effects of smoking increase with greater cumulative vulnerability and whether cumulative vulnerability moderates responses to reduced levels of nicotine content in cigarettes. • Participants (n = 775) were categorized as having low (0–1), moderate (2–3), or high (4–7) cumulative vulnerability • Vulnerabilities included rural residence, opioid use disorder, affective disorder, low level of educational attainment, poverty, unemployment, and physical disability	• A CPT was used to assess the relative reinforcing effects of participants' usual brand of cigarettes at baseline and study cigarettes during the 12-week trial • The CPT is a behavioral-economic task wherein participants estimate the likely demand for smoking over 24 hours under escalating cigarette price • Demand is characterized by two factors: amplitude (demand volume at zero or minimal price) and persistence (demand sensitivity to price)	• Greater cumulative vulnerability was associated with greater demand amplitude ($p < 0.0001$) and persistence ($p = 0.0003$) for usual-brand cigarettes • Demand amplitude for study cigarettes increased with increasing cumulative vulnerability ($p < 0.001$) and decreased with decreasing levels of nicotine content ($p < 0.001$) • There was evidence of moderation on demand persistence in which larger reductions at the 0.4 mg/g compared with 15.8 mg/g doses were observed among participants with low compared to moderate or high cumulative vulnerability ($p = 0.04$); the relative reinforcing effects of smoking clearly increased with greater cumulative vulnerability • Reducing levels of nicotine content could reduce demand amplitude across cumulative vulnerability levels but reductions in demand persistence may be more limited among those with greater cumulative vulnerability
Lin et al. (2022)	• Two parallel randomized controlled trials • Examined the gradual reduction of nicotine content in cigarettes (from 11.6 to 0.2 mg of nicotine per cigarette in the VLNC condition) versus 11.6 mg of nicotine per cigarette in the UNC condition) over an 18-week period among people who smoked cigarettes and had low socioeconomic status and mental health conditions • Investigated the treatment effects of gradually reducing levels of nicotine from commercial to VLNC research cigarettes on reducing smoking exposure between people who smoke menthol and nonmenthol cigarettes • United States	• Number of CPD, cotinine, and expired CO • Adherence to VLNC research cigarettes; compared the odds of being adherent with using only VLNC research cigarettes by menthol preference of participants	• Compared with UNC cigarettes, VLNC cigarettes were associated with significant reductions in cotinine, number of CPD, expired CO levels, nicotine dependence, and symptomology • The pooled OR of being adherent with using only VLNC study cigarettes in the gradual nicotine reduction arm for people who smoked nonmenthol versus menthol cigarettes was 2.6 (95 % CI,1.0–6.4; $p = 0.04$) • When nicotine is lowered to non-addictive levels, results indicate an independent effect of menthol on the need to sustain nicotine intake in people who smoke cigarettes

Table 7.2 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Morgan et al. (2022)	• Secondary analysis of three 12-week randomized clinical trials examining research cigarettes with different levels of nicotine content (0.4, 2.4, and 15.8 mg/g) (Higgins et al. 2020) • Focused exclusively on adherence among adults from disparate populations who were assigned to use VLNC cigarettes (0.4 mg/g) (n = 286): – Women of reproductive age who were socioeconomically disadvantaged (n = 93) – Adults with opioid use disorder who were enrolled in opioid-assisted treatment (n = 92) – Adults with affective disorders (n = 101) • Goal was to identify characteristics of people who would require additional assistance if a nicotine reduction policy were implemented	• Logistic and linear regressions modeled predictors of two measures of adherence at the Week-6 and Week-12 assessments: (1) changes in cotinine relative to baseline); and (2) full adherence (yes/no), considered as a 90% reduction in cotinine relative to baseline • Predictors included satisfaction with study cigarettes, craving, severity of nicotine dependence, withdrawal, population group, baseline symptoms of affective disorders, and sociodemographic characteristics	• Severity of nicotine dependence was negatively associated with both adherence measures at Week 6 ($p < 0.01$) • Increased satisfaction with study cigarettes and age were positively associated with both adherence measures at Weeks 6 and 12 ($p < 0.01$) • Adults receiving opioid maintenance treatment exhibited reduced adherence and were less likely to reach full adherence at Week 12 compared with women who were socioeconomically disadvantaged ($p = 0.02$)
Reed et al. (2022)	• Secondary analysis of a 6-week randomized controlled trial examining the effects of VLNC cigarettes in adults with serious mental illness from November 2014 to November 2017 (Tidey et al. 2019) • Examined the prevalence and predictors of non-adherence among trial participants with serious mental illness • Adults with serious mental illness who smoked daily and were not trying to quit (n = 58) were randomized to receive VLNC cigarettes (0.4 mg/g; n = 30) or NNC cigarettes (15.8 mg/g; n = 28) • Providence, Rhode Island	• Assessed predictors of biologically assessed non-adherence in participants assigned to the VLNC group • Predictors included subjective responses to questions about VLNC cigarettes measured by the CES (subscales: satisfaction, psychological reward, enjoyment of respiratory tract sensations, craving reductions, and aversion), baseline nicotine dependence and dependence motives, and severity of psychiatric symptoms • Series of linear models regressing non-adherence metrics onto covariates (gender and menthol preference) and focal predictors	• Nearly all participants (96%) were estimated to be less-than-completely adherent to VLNC cigarettes • Lower enjoyment ratings of respiratory tract sensations of VLNC cigarettes predicted a greater degree of non-adherence (beta = -0.40; 95% CI, -0.71 to -0.10; standard error = 0.14)

Notes: **AIMS** = Abnormal Involuntary Movements Scale; **BARS** = Barnes Akathisia Rating Scale; **BPRS** = Brief Psychiatric Rating Scale; **CCQ** = Clinical COPD Questionnaire; **CEMA** = N-Acetyl-S-(2-cyanoethyl)-L-cysteine (a urinary metabolite of acrylonitrile); **CES** = Cigarette Evaluation Scale; **CES-D** = Center for Epidemiological Studies-Depression Scale; **CI** = confidence interval; **CO** = carbon monoxide; **CPD** = cigarettes smoked per day; **CPT** = cigarette purchase task; **FEV1** = forced expiratory volume in 1 second; **FTCD** = Fagerstrom Test of Cigarette Dependence; **FTND** = Fagerstrom Test of Nicotine Dependence; **g** = gram; **GSSP:GSH** = ratio of glutathione to oxidized glutathione; **HONC** = Hooked on Nicotine Checklist; **LNC** = low-nicotine-content; **mg** = milligram; **mL** = milliliter **MNWS** = Minnesota Nicotine Withdrawal Scale; **NDSS** = Nicotine Dependence Syndrome Scale; **ng** = nanogram; **nmol** = nanomole; **NNAL** = 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol; **NNC** = normal-nicotine-content; **OASIS** = Overall Anxiety Severity and Impairment Scale; **OR** = odds ratio; **PANAS** = Positive and Negative Affective Schedule; **PANSS** = Positive and Negative Syndrome Scale; **PheT** = phenanthrene tetraol; **ppm** = parts per million; **PSCDI** = Penn State Cigarette Dependence Index; **PSS** = Perceived Stress Scale; **QIDS** = Quick Inventory of Depressive Symptomatology; **QSU** = Questionnaire on Smoking Urges-short form; **RNC** = reduced-nicotine-content; **SANS** = Scale for Assessment of Negative Symptoms; **SEM** = standard error of the mean; **TNE** = total nicotine equivalents; **UNC** = usual-nicotine-content; **VLNC** = very-low-nicotine-content; **WISDM** = Wisconsin Inventory of Smoking Dependence Motives.

in cigarettes to minimally addictive levels could benefit even highly vulnerable smokers" (Higgins et al. 2021, p. 1). In a subsequent secondary analysis of the same parent trials, Higgins and colleagues (2022a) found some evidence that a nicotine content reduction policy could result in more smoking persistence, but not more cigarettes smoked per day, among those with greater versus lower levels of cumulative vulnerability.

A scoping review identified and synthesized 18 original research studies published between January 2000 and October 20, 2021, about a very-low-nicotine-content cigarette product standard related to various population groups experiencing tobacco-related disparities, including people experiencing mental illness, substance use disorders, unemployment, or with low incomes; and people who identify as LGBTQI+ (Puljevic et al. 2023). The authors found that a very-low-nicotine-content cigarette product standard would likely be accepted by people from the population groups included in the review and would likely reduce smoking among those population groups, especially if supported by cessation treatment, such as nicotine replacement therapy (NRT). The authors noted that these findings are consistent with their previous review of 26 evidence syntheses, wherein they concluded that a very-low-nicotine-content cigarette product standard would likely notably reduce cigarette smoking among people experiencing mental illness, people experiencing socioeconomic disadvantage, pregnant women, women of childbearing age, and First Nations people (Puljevic et al. 2022, 2023). The authors cautioned that, although the studies in the scoping review showed that use of very-low-nicotine-content cigarettes reduced smoking, cigarette cravings, nicotine withdrawal, and nicotine dependence among the population groups studied, none of the studies examined the effectiveness of such a standard in promoting smoking cessation beyond 12 weeks (Puljevic et al. 2023). Additionally, the majority of the studies focused on people experiencing mental illness or substance use disorders, and the authors noted that only one of the studies reviewed included people who identify as LGBTQI+ (Denlinger-Apte et al. 2021) or people who experienced unemployment (Higgins et al. 2021). Furthermore, none of the studies reviewed included people living with HIV or experiencing homelessness or incarceration, although these populations were expressly included in the literature search (e.g., Puljevic et al. 2023).

A narrative review of studies conducted between 2010 and 2021 identified few studies investigating the effects of very-low-nicotine-content cigarettes in minoritized racial and ethnic groups, people who are socioeconomically disadvantaged, people who smoke menthol cigarettes, and pregnant women; no studies were found that investigated these effects among minoritized sexual orientation and gender identity groups, veteran or military populations, or people in underserved rural environments (Tidey et al. 2022). Additionally, few of the studies in the narrative review investigated the impact of these products on quit attempts because smoking cessation has not been a goal of most clinical trials to date. However, the authors noted that increases in abstinence were observed in studies focused on "vulnerable participants" and in studies that were not focused on "vulnerable populations" (Tidey et al. 2022).

The few studies that have examined the impact of reduced-nicotine-content cigarettes on smoking cessation are nonetheless promising. A randomized controlled parallel group trial found that, compared with usual-nicotine-content cigarettes, reduced-nicotine-content cigarettes increased smoking cessation among people with mood and/or anxiety disorders who were not planning to quit in the next 6 months, without worsening mental health (Foulds et al. 2022). Specifically, participants were randomly assigned to usual or reduced-nicotine-content cigarettes where the nicotine content was reduced over 18 weeks, then were offered the choice to either receive assistance to quit smoking, free research cigarettes, or to resume using their own cigarette brand during a 12-week follow-up period. After the 12-week treatment choice phase, those randomized to the reduced-nicotine-content cigarette group were significantly more likely to have quit smoking.

A similar double-blind randomized controlled trial examining the impact of reduced nicotine content on smoking-related outcomes among adults 18–65 years of age with lower SES found that reduced-nicotine-content cigarettes were associated with higher rates of quit attempts and successful quitting at 1 month and 3 months post-intervention compared with usual-nicotine-content cigarettes (Krebs et al. 2021). At 1 month post-intervention, the quit rate among participants in the reduced-nicotine-content cigarette group who chose to quit was 36% compared with 18% in the control group, and at 3 months, the quit rate was 27% and 18%, respectively.

Separately, in a trial of 775 men and women 18–70 years of age with affective disorders or opioid dependence and women 18–44 years of age with 12 or fewer years of education, those assigned to very-low-nicotine-content (0.4 mg/g) or low-nicotine-content (2.4 mg/g) cigarettes had lower dependence and reported more abstinent days and quit attempts compared to those assigned to regular cigarettes (15.8 mg/g); few differences were observed between the very-low-nicotine-content and low-nicotine-content groups (Higgins et al. 2020). The extent to which the use of reduced-nicotine-content cigarettes leads to cessation among population groups experiencing tobacco-related disparities that were not included in these studies is not known (Puljevic et al. 2022).

Compared with complete cessation, reduced cigarette consumption alone still results in elevated health risks (USDHHS 2020). Furthermore, a secondary analysis of an RCT found that, although reduced-nicotine-content cigarettes led to reductions in the number of cigarettes smoked per day and reduced exposure to nicotine regardless of race, education, and gender, the magnitude of effect on nicotine exposure (measured by total nicotine equivalents) was lower for Black versus White adults (Carroll et al. 2021). This could be due to the continued availability of high-nicotine-content cigarettes during the trial, which would not be the case if a product standard were implemented for all cigarettes. It also could be due to differences by race and ethnicity in exposure to carcinogens like 4-(methylnitrosamino)-1-(3)pyridyl-1-butanol (NNAL) among people who smoke at the same frequency, especially among people who smoke at lower frequencies (Benowitz et al. 2011; Murphy et al. 2018). For example, a review of analyses of the Multiethnic Cohort Study found that African American people had significantly higher levels of NNAL than White people, and Japanese American people had the lowest levels (Murphy et al. 2018). Such differences in exposure could be due in part to differences in smoking behaviors, including the type of cigarette smoked (e.g., menthol vs. nonmenthol) and the depth of inhalation (Benowitz et al. 2011). Because Black people who reduce their cigarette consumption may not reduce their risk of exposure to carcinogens as much as people of other races who similarly reduce their consumption, they may be one population group for which additional support is warranted to achieve successful smoking cessation. Other studies have concluded that because people from other population groups (e.g., adults receiving opioid maintenance treatment or people with serious mental illness) experiencing tobacco-related disparities had difficulty adhering to very-low-nicotine-content cigarettes when normal-nicotine-content cigarettes were available, they may also benefit from additional cessation support when implementing a reduced-nicotine-content product standard (Morgan et al. 2022; Reed et al. 2022).

Many people who experience tobacco-related disparities smoke menthol cigarettes (see Chapter 2, Table 2.6). People who smoke menthol cigarettes may be less responsive to a reduced-nicotine-content product standard if menthol-flavored reduced-nicotine-content cigarettes are available (Donny and White 2022; Lin et al. 2022; Tidey et al. 2022). For example, RCT participants who were randomized to the very-low-nicotine-content cigarette arm and who received menthol cigarettes (based on their usual flavor preference) for 20 weeks had (a) smaller reductions in smoking and toxicant exposure than those randomized to receive very-low-nicotine-content nonmenthol (based on usual flavor preference) cigarettes and (b) did not have increased odds of abstinence at the end of the trial unlike the very-low-nicotine-content nonmenthol cigarette recipients (Denlinger-Apte et al. 2019).

In addition, Lin and colleagues (2022) conducted two parallel RCTs of gradually reduced levels of nicotine content in cigarettes versus usual-nicotine-content cigarettes over 18 weeks in (1) people with lower SES who smoke cigarettes and (2) people with mental health conditions who smoke. Participants were assigned to menthol-flavored study cigarettes based on their usual flavor preference. Very-low-nicotine-content cigarettes were associated with reductions in cotinine, cigarettes smoked per day, expired carbon monoxide levels, and nicotine dependence symptoms. Associations did not differ between menthol and nonmenthol cigarettes. However, in the trial involving people with lower SES, people who smoked very-low-nicotine-content menthol cigarettes had a lower cotinine reduction than those who smoked very-low-nicotine-content nonmenthol cigarettes. Additionally, the pooled odds ratio of being adherent with using only very-low-nicotine-content study cigarettes for people who smoked nonmenthol versus menthol cigarettes was 2.6 (95% confidence interval [CI], 1.0–6.4), indicating higher adherence to very-low-nicotine-content study cigarettes for people who smoked non-menthol cigarettes. The authors concluded that there was “an independent effect of menthol on the need to sustain nicotine intake” among people with nicotine dependence who smoke menthol cigarettes (Lin et al. 2022, p. 131).

As discussed later in this chapter, in April 2022, FDA announced a proposed product standard prohibiting menthol as a characterizing flavor in cigarettes (FDA 2022a). A policy to reduce nicotine content in cigarettes to minimally addictive or nonaddictive levels is expected to have a strong effect on preventing smoking initiation and reducing cigarette consumption among people who currently smoke, including among many population groups experiencing tobacco-related disparities. It is expected that this policy could be even more impactful if adopted and implemented in concert with complementary efforts such as restrictions on flavored tobacco products, particularly menthol products (see Chapter 8).

Education campaigns may help to maximize the public health benefit of a policy that reduces nicotine content in cigarettes to minimally addictive or nonaddictive levels by providing consumers with information about the policy and its rationale, as well as cessation resources, prior to or during implementation (Benowitz et al. 2015; Popova et al. 2019; Villanti et al. 2019a). Education campaigns could also help address misperceptions that reduced-nicotine-content cigarettes are less harmful (Denlinger-Apte et al. 2017). This may be particularly important with respect to the efficacy of this type of policy among members of minoritized racial and ethnic groups who smoke (Villanti et al. 2019a). Studies have shown that some people who smoke misperceive lower-nicotine cigarettes as less harmful than higher-nicotine cigarettes, and that this misperception is more common among Black and other non-White people who smoke as compared with White people who smoke (Denlinger-Apte et al. 2017; Byron et al. 2018; Mercincavage et al. 2019; Villanti et al. 2019a).

There is public support for federal policies to reduce nicotine levels in cigarettes in the United States and in other countries (Fix et al. 2011; Connolly et al. 2012; Pearson et al. 2013; Ali et al. 2019; Smith et al. 2021b). Although some variability exists with respect to which population groups most strongly support this type of policy, possibly owing to study design, four studies show that overall support throughout the United States has ranged from 48% (Pearson et al. 2013) to 81% (Ali et al. 2019). Three of these four studies assessed support by demographic characteristics. The studies indicated greater support among non-Hispanic African American people (Pearson et al. 2013) and Hispanic people (Connolly et al. 2012) than among White people (Ali et al. 2019). Two of the studies found similar levels of support regardless of smoking status (Pearson et al. 2013; Ali et al. 2019).

In summary, reducing the level of nicotine in cigarettes to make them minimally addictive or nonaddictive is expected to prevent and reduce tobacco use, resulting in substantial reductions in tobacco-related death and disease and in healthcare expenditures (USDHHS 2014; *Federal Register* 2018). The evidence discussed earlier suggests that this policy would reduce cigarette consumption among many population groups experiencing tobacco-related disparities and that there is support for this policy among non-Hispanic Black people and Hispanic people regardless of smoking status. Evaluation of any reduced-nicotine product standard will be important to monitor progress on reducing tobacco product use and health disparities.

New Tobacco Products

As discussed earlier, under the *Tobacco Control Act*, FDA's decisions to authorize new tobacco products to enter the U.S. market require an assessment of whether the manufacturer's application demonstrates that doing so would be appropriate for the protection of public health, considering the risks and benefits to the population as a whole and taking into account the likely impact on initiation and cessation (*Family Smoking Prevention and Tobacco Control Act* 2009, 21 U.S.C. § 387j(c)(4)).

There are numerous complex and interactive factors that, regardless of the potential for reduced toxicity, may influence whether the presence of new products in the tobacco market increases or decreases overall harm (USDHHS 2016, 2020), including among people who experience tobacco-related health disparities. Most studies to date have focused on the potential impact on the general population, rather than the potential relationship to health disparities. Beyond research related to the products themselves, research is also needed to understand how modified risk claims (i.e., claims of reduced harm or reduced exposure to harmful chemicals) affect initiation, use, and cessation (McKelvey et al. 2020; Ahuja et al. 2021; Berg et al. 2021a, b) among people experiencing disparities.

Countries have taken a range of regulatory approaches regarding newer products such as e-cigarettes (Kennedy et al. 2017; WHO 2021) and heated tobacco products (Campaign for Tobacco-Free Kids 2020; WHO Study Group on Tobacco Product Regulation 2021). FDA has authorized the marketing of certain e-cigarettes and heated tobacco products in the United States, and these products are subject to the same FDA regulations that apply to all tobacco products, such as the prohibition on their sale to people under 21 years of age (FDA n.d.b). Many states, territories, tribes, and local governments have updated their tobacco control laws so that they explicitly apply to these products, although approaches vary (Public Health Law Center 2018b, 2022b). For example, some states have included these products in their statutes that impose a tax on cigars or smokeless tobacco products, and other states have set up a separate taxing structure (e.g., a specific tax on the amount of consumable liquid used in e-cigarettes) (Chaloupka and Tauras 2020). There is a lack of evaluation data concerning the impact of these policies for newer tobacco products on tobacco-related disparities specifically.

Population groups that are likely to experience tobacco-related disparities with respect to combustible or smokeless tobacco may also experience disparities in exposure to marketing for and use of new products as well as in dual use of new products and cigarettes (see Chapters 2 and 5). However, there is little information about the regulatory approaches for e-cigarettes, heated tobacco products, and other new products that could reduce—or inadvertently exacerbate—tobacco-related health disparities.

Dual use of e-cigarettes and combusted tobacco products is a public health concern that presents important considerations for regulators. On the basis of data from the 2017, 2018, and 2020 Behavioral Risk Factor Surveillance Survey, e-cigarette use increased more for some groups of adults than for others. For example, e-cigarette use increased more among (1) adults who formerly smoked cigarettes than among adults who never or currently smoke cigarettes; (2) adults who use smokeless tobacco than those who do not use it; (3) adults who used other substances (including cannabis and alcohol) than those who do not use these substances; and (4) adults who have depression than adults without depression (Boakye et al. 2022). While some people might be using e-cigarettes in an attempt to transition away from combustible tobacco product use, the increase in adult e-cigarette use may also be related to multiproduct use (Chen-Sankey and Bover-Manderski 2022). According to data from the 2021 National Health Interview Survey (NHIS), 4.5% of U.S. adults currently used e-cigarettes (Cornelius et al. 2023a), of whom 30.3% had never smoked cigarettes and 29.4% currently used cigarettes, also known as dual use (CDC 2023). E-cigarette use among those who had never smoked was more common among younger versus older adults, while dual use was more common among older versus younger adults. Dual use of electronic and combustible tobacco products may result in worse respiratory symptoms and greater exposure to toxicants than cigarette smoking alone or e-cigarette use alone (Goniewicz et al. 2018; Reddy et al. 2021). Continued monitoring of the impact of e-cigarettes and dual use on tobacco-related disparities is warranted.

Data from the Population Assessment of Tobacco and Health (PATH) Study found that shifting from smoking cigarettes exclusively to using e-cigarettes exclusively between 2013–2014 and 2014–2015 was less likely among non-Hispanic Black and Hispanic people (compared with non-Hispanic White people) and less likely among people of lower SES (compared with those of higher SES) (Harlow et al. 2019). The study also found that Black people, Hispanic people, and people of lower SES were more likely to hold the unsubstantiated belief that e-cigarettes are more harmful than cigarettes. Two studies based on data from the PATH Study, the NHIS, and the Tobacco Use Supplement to the Current Population Survey (TUS-CPS) that were collected between 2014 and 2016 showed a greater likelihood of dual use of e-cigarettes and cigarettes among people with lower educational attainment (compared to those who have completed one or more years of college) and lower incomes (compared to those with household incomes greater than 200% of the federal poverty level). The evidence was mixed regarding dual use among people of different races and ethnicities (Friedman and Horn 2019; Hirschtick et al. 2021).

Several studies mentioned here present data that were collected before the rise in prevalence of pod- or cartridge-based e-cigarettes and similar-looking disposable e-cigarettes. More research is needed to better understand the regulatory approaches for e-cigarettes, heated tobacco products, and new tobacco products that may enter the market with the potential to reduce or inadvertently exacerbate tobacco-related health disparities in smoking initiation, quitting, and disease outcomes.

The evidence base continues to grow about newer products and their relationship to disparities in tobacco use and health outcomes. In the meantime, given the known harms of combusted tobacco products (USDHHS 2014), the known disparities in their use (USDHHS 1998; Park-Lee et al. 2022; Cornelius et al. 2023b) (see Chapter 2), the known harms of dual use of combusted tobacco products and e-cigarettes (Goniewicz et al. 2018; Owusu et al. 2019; Reddy et al. 2021; Smith et al. 2021a), and the known benefits of utilization of evidence-based cessation treatments (USDHHS 2020), it is important to prioritize regulatory efforts that eliminate the use of combusted tobacco products at the population level. Simultaneous efforts are warranted to advance access to and use of evidence-based tobacco cessation treatment, particularly for people experiencing health disparities.

Elimination of Flavors in Tobacco Products

The *Tobacco Control Act* prohibited cigarettes with characterizing flavors other than tobacco or menthol. (See Chapter 3 of the current report for a summary of the science of flavors in tobacco products and how inclusion of flavors may contribute to tobacco-related health disparities). As discussed earlier in this chapter, FDA has the authority to establish product standards, including those that prohibit characterizing flavors or flavor additives in tobacco products, such as menthol in cigarettes. Territorial, tribal, state, and local sales restrictions on flavored products are discussed later in this chapter. In May 2022, FDA announced two proposed tobacco product standards: one proposed rule prohibiting menthol as a characterizing flavor in cigarettes and another proposed rule prohibiting all characterizing flavors (other than tobacco) in cigars (FDA 2022a).

In addition, manufacturers must obtain FDA authorization to market new tobacco products, including e-cigarettes, and FDA makes determinations based on the public health standard discussed previously. This requirement also applies to flavored e-cigarettes and flavored e-cigarette liquids. Because of their popularity among youth, FDA announced, in February 2020, intent to prioritize its enforcement activities to remove from the market any flavored, cartridge-based, e-cigarette product (other than tobacco- or menthol-flavored products) unless and until FDA authorized that product for sale (FDA 2020). All new tobacco products on the market without FDA authorization are being illegally marketed. Therefore, FDA can, and has, pursued enforcement action at any time against illegally marketed products (FDA 2020, 2023). As of April 2023, the only e-cigarette products that have received marketing authorization from FDA have been tobacco flavored (FDA n.d.b). Thus, although some flavored e-cigarettes remain on the market, it is not yet known whether FDA will determine that it is appropriate for the protection of public health for any flavored e-cigarettes to be on the market.

Since 2014, e-cigarettes are the tobacco product youth most commonly use (Cooper et al. 2022). There are disparities in use among different youth population groups (Park-Lee et al. 2022). For example, in 2022, a higher prevalence of e-cigarette use was observed among White high school students (16.9%; 95% CI, 14.6–19.5) than among Black (11.1%; 95% CI, 8.3–14.7), Hispanic (12.2%; 95% CI, 10.7–14.0), American Indian or Alaska Native (14.6%; 95% CI, 9.4–22.0) and Multiracial (14.3%; 95% CI, 11.0–18.3) high school students; however, confidence intervals overlapped for some population groups, so these differences may not be statistically significant (Park-Lee et al. 2022). Eighty-five percent of youth who currently use e-cigarettes report using flavored products (Cooper et al. 2022).

Nearly all people who smoke begin smoking before 25 years of age (USDHHS 2012). If someone does not use tobacco products regularly by 25 years of age, it is highly unlikely that they will start (USDHHS 2012). Previous Surgeon General's reports and Chapter 3 of this report document that flavored tobacco products mask the harshness of tobacco; flavors are particularly appealing to young people and promote initiation and sustain tobacco use among young people; menthol enhances the effects of nicotine on the brain and can make products more addictive; and menthol reduces the likelihood of cessation, particularly among Black people (Tobacco Products Scientific Advisory Committee 2011; USDHHS 2012, 2014, 2020; Brody et al. 2013; Palmatier et al. 2013; IOM 2015; Audrain-McGovern et al. 2016, 2019; WHO 2016b; Henderson et al. 2017; Villanti et al. 2019b, 2021; Weinberger et al. 2019; Rose et al. 2020b; Brouwer et al. 2022; FDA 2022c). In addition to menthol, factors contributing to the reduced likelihood of cessation among Black people could include less access to cessation treatments, as well as social determinants that may make it harder to quit (Nollen et al. 2019).

Despite overall decreases in smoking prevalence and menthol smoking prevalence, the proportion of people who smoke who use menthol cigarettes has increased, particularly among population groups that experience tobacco-related disparities (Seaman et al. 2022). Given both the existence of disparities in tobacco product use and the evidence related to the role of menthol and other flavors with respect to tobacco use initiation and progression to regular use, flavors play a key role in tobacco product use.

Because flavored tobacco products are commonly used by young people and certain population groups—who also initiate tobacco use primarily as youth or young adults—eliminating flavors in tobacco products is expected to lead to a reduction in tobacco product use and tobacco-related health disparities (FDA 2013; Villanti et al. 2016; Huang et al. 2017a; Kowitt et al. 2017; Zare et al. 2018; Goldenson et al. 2019; Chen-Sankey et al. 2021). Studies show that policies that prohibit the sale of flavored tobacco products reduce tobacco use. For example, the *Tobacco Control Act's* prohibition on cigarettes with characterizing flavors other than menthol or tobacco was associated with a 17% reduction in the prevalence of cigarette smoking among youth and a 58% decrease in number of cigarettes smoked by youth (Courtemanche et al. 2017). Additionally, in a modeling study of the *Tobacco Control Act's* flavor prohibition, Rossheim and colleagues (2020) reported a reduction in the predicted probability of cigarette smoking among youth and young adults in 2017 compared to the model-predicted probability of cigarette smoking in the absence of the flavor prohibition. However, the *Tobacco Control Act's* effect on youth tobacco use likely was diminished by the continued availability of menthol cigarettes and other flavored noncigarette tobacco products, such as little cigars and cigarillos (Courtemanche et al. 2017; Rossheim et al. 2020).

Evaluations have shown that state and local restrictions on the sale of flavored products reduced the sale of such products, as well as the sale of unflavored products in some cases; reduced the odds of youth trying flavored tobacco products and the odds of youth ever using tobacco products; and reduced current use of tobacco products among youth (Farley and Johns 2017; Rogers et al. 2017, 2020; Kingsley et al. 2019, 2022; Pearlman et al. 2019; Gammon et al. 2021; Asare et al. 2022; Satchell et al. 2022; FDA 2022c). In two Minnesota communities, flavor policies were associated with decreases in the sales of each tobacco product category, including cigarettes, cigars, smokeless tobacco, and e-cigarettes, as well as smaller increases in the prevalence of youth tobacco use from 2014 to 2019 as compared with the rest of the state (Olson et al. 2022a,b). Four of the policies that were evaluated by these state and local evaluation studies prohibited the sale of menthol cigarettes in addition to other flavored tobacco products (Yang et al. 2020; Gammon et al. 2021; Asare et al. 2022; Kingsley et al. 2022; Olson et al. 2022a,b; Satchell et al. 2022). These and other studies are described in Table 7.3.

Similarly, a 2009 prohibition on flavor additives—except menthol—in cigarettes, little cigars, and cigarillos in two Canadian provinces reduced unit sales of cigars and flavored cigars (Chaiton et al. 2019). A 2010 policy in Canada prohibiting the sale of flavored cigarillos (including menthol) throughout Canada and requiring any unflavored cigarillos to be sold in packs of 20 reduced current use of cigarillos among youth and young adults and resulted in a net decrease in all cigar smoking

Table 7.3 Studies of the impact of prohibiting the sale of flavored tobacco products on tobacco product use

Study	Design, population, and location	Primary outcome(s)	Results
Hymowitz et al. (1995)	• Cross-sectional survey (baseline menthol questionnaire). • Administered to a total of 473 African American and White adults who participants in a stop smoking study.	• Compared use of menthol cigarettes and reasons for smoking menthol cigarettes	• Although White people in the study smoked more cigarettes per day than African American people in the study, a significantly greater proportion of African American males (79%) and females (79%) smoked menthol cigarettes than White males (13%) and females (20%) ($p < 0.01$) • More than half (56%) of African American people and more than one-quarter (28%) of White people reported they would not smoke nonmenthol cigarettes if they could not smoke menthol cigarettes ($p < 0.01$) • African American people (83%) were more likely than White people (74%) to report that menthol cigarettes have a better taste than nonmenthol cigarettes • African American people (48%) were more likely than White people (21%) to cite that menthol cigarettes were easier to inhale compared with nonmenthol cigarettes
Nguyen and Grootendorst (2015)	• Pre-post design • Used data from 2007–2011 Canadian Tobacco Use Monitoring Surveys (n = 46,080) to assess outcomes of the Canadian government's policy that in July 2010 banned the sale of flavored cigarillos and required unflavored cigarillos to be sold in packs of at least 20 units • Constructed a segmented regression model to track trends in outcome variables	• Assessed changes in the use of cigarillos and regular cigars (potential substitutes) after the policy was implemented	• Youth and young adults, 15–24 years of age: – For cigarillos, the prevalence of past-30-day use declined significantly after the policy was implemented, from 13.7% to 9.3% ($p < 0.000$) among male respondents and from 5.3% to 3.3% ($p = 0.001$) among female respondents; in regression analysis, past-30-day use declined 22% (2.3 percentage points) – For regular cigars, the prevalence of past-30-day use declined insignificantly among male respondents, from 5.8% to 4.9% ($p = 0.206$), and increased insignificantly among female respondents, from 0.8% to 0.9% ($p = 0.673$) • Adults, 25–65 years of age: – Changes in the prevalence of past-30-day use of cigarillos and regular cigars were small and statistically insignificant after the policy was implemented

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Courtemanche et al. (2017)	• Pre-post, cross-sectional design • Secondary analysis of data from the National Youth Tobacco Survey (1999, 2000, 2002, 2004, 2006, 2009, 2011, 2012, and 2013 cross-sectional surveys) – Pooled n = 197,834 youth , 11–19 years of age – School-based, nationally representative sample of middle school and high school students – In 2013, 74.8% of sampled schools and 90.7% of eligible students within schools participated • Assessed the association between FDA's ban on flavored cigarettes (excluding menthol) in 2009 and various tobacco use behaviors among adolescents • Regression analysis controlled for covariates: age, gender, race and ethnicity, and national level tax-inclusive prices of cigarettes and other tobacco products	• Past-30-day use of cigarettes, cigars, smokeless tobacco, pipe tobacco, tobacco products excluding cigarettes, and any tobacco product • Cigarettes smoked during the past 30 days (among youth who smoked cigarettes) • Menthol cigarette use (among youth who smoked cigarettes) • Econometric strategy to estimate the covariate-adjusted deviation from the outcome's trend after 2009	• In adjusted analyses, the flavor prohibition was significantly associated with: – 17.1% reduction in the likelihood of cigarette smoking – 59% fewer cigarettes smoked per month among youth who smoked cigarettes – 45% increase in the probability that a person who smoked used menthol cigarettes – 34.4% increase in the prevalence of cigar use – 54.6% increase in the prevalence of pipe use – 14.2% increase in the use of non-cigarette tobacco products • By race and ethnicity, the odds of smoking cigarettes after the flavored cigarette ban was implemented were lower among Black (OR = 0.558) and Asian (OR = 0.372) adolescents than among White adolescents ($p < 0.001$) • The odds of smoking cigarettes after the flavored cigarette ban was implemented were higher among American Indian (OR = 1.419) adolescents compared to White adolescents • Compared with White adolescents who smoked cigarettes, the use of menthol cigarettes increased significantly among adolescents in all racial and ethnic groups, except among American Indian adolescents who smoked cigarettes, for which no association was observed • Results suggest that after a ban on flavored cigarettes, adolescents who smoke may substitute with menthol cigarettes or other tobacco products that may be flavored

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Farley and Johns (2017)	• Pre-post, cross-sectional design with one post-policy time point • Compared 2010 and 2013 data for New York City from the Youth Risk Behavior Survey: – 2010: n = 1,708 students from 28 schools – 2013: n = 8,814 students from 81 schools • Analyzed data on retail tobacco sales of cigars and smokeless and other tobacco products before and after a ban in October 2009 on sales of all flavored tobacco products (excluding menthol cigarettes) in New York City • Multivariable logistic regression analysis adjusted for sex, race and ethnicity, age, and current or ever use of selected tobacco products	• Assessed changes in overall inflation-adjusted sales of flavored and non-flavored tobacco products, by product type • Multivariable logistic regression estimated changes in (a) ever use of flavored tobacco products and of any tobacco product and (b) the prevalence of smoking among adolescents	• Sales of flavored tobacco products declined by 87% overall ($p < 0.001$) after enforcement of the ban • In adjusted models and compared with adolescents in 2010, adolescents in 2013 had: – 37% lower odds of ever trying flavored tobacco products (aOR = 0.63; 95% CI, 0.52–0.77) – 28% lower odds of using any type of tobacco product (aOR = 0.72; 95% CI, 0.62–0.85) – Non-significant change in current smoking prevalence ($p = 0.114$) • Male students were less likely than female students to have ever tried flavored tobacco products (aOR = 0.79; 95% CI, 0.64–0.98) • Black students (aOR = 0.46; 95% CI, 0.35–0.61) and Asian students (aOR = 0.47; 95% CI, 0.34–0.66) were less likely than White students to use any type of tobacco product • Black students (aOR = 0.36; 95% CI, 0.21–0.62) were less likely to currently smoke than White students
Chaiton et al. (2018)	• Pre-post, repeated longitudinal design with no control or comparison • Evaluated associations of a full ban on menthol cigarettes—implemented in January 2017 in Ontario, Canada—on smoking behaviors of people, 16 years of age or older • Conducted phone surveys from September to December 2016 using random-digit dialing to call residents, 16 years of age or older, of Ontario who had smoked at least one menthol cigarette in the past year and smoked in the past month (n = 325) • Contacted participants through an online survey for follow-up in February 2017 (1 month after implementation of the ban) (n = 206)	• Compared respondents' planned behaviors before the ban on menthol cigarettes with their actual behaviors 1 month after the ban	• Most people (n = 123; 59.7%) who smoked menthol cigarettes indicated before the policy that they would switch to or use only nonmenthol cigarettes, but only 51 people (28.2%) had done so at follow-up • Before the policy, 12 people (5.8%) reported that they would use other flavored tobacco or e-cigarette products (including menthol); at the 1-month follow-up, 60 people (29.1%) reported doing so • Thirty people (14.5%) indicated before the policy that they would attempt to quit smoking; at the 1-month follow-up, 60 people (29.1%) reported doing so • Among people who made a quit attempt, 16 (80.0%; 95% CI, 56.3%–92.5%) of those who primarily smoked menthol cigarettes at baseline reported that the policy affected their decision to quit at least a little compared with 10 (25.6%; 95% CI, 14.1%–41.0%) of those who smoked menthol cigarettes only occasionally

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Kingsley et al. (2019)	• Post-design with matched control community • Cross-sectional, difference-in-differences models, with post-policy baseline (October 2016) and 6-month follow-up • Conducted surveys from the Massachusetts Tobacco Control Program with students in Grades 9–12 • Retailer inventories in a census of all retailers in Lowell and Malden, Massachusetts • Evaluated the short-term impact of a policy that restricted the sale of flavored tobacco products (not including menthol cigarettes) in a community (Lowell, Massachusetts) that enforced the restriction policy (baseline n = 593; follow-up n = 524) with a community (Malden, Massachusetts) that did not enforce the policy (baseline n = 636; follow-up n = 646) • Communities were matched with similar demographics, retail characteristics, and point-of-sale tobacco policies	• Youth access to and use of flavored tobacco products • Change in inventory of flavored tobacco products before and after policy implementation	• In Lowell, the number of flavored tobacco products sold per retailer decreased from 77.3% to 7.3% ($p < 0.001$); no significant change observed in Malden during same time frame • Current use of any flavored product (excluding menthol and mint) by youth in Lowell decreased 2.4% (95% CI, -6.2–1.3, $p > 0.05$) from baseline to follow-up and increased 3.3% (95% CI, -0.3–6.9, $p > 0.05$) during the same time frame in Malden, resulting in a significant difference of -5.7% (95% CI, -10.7 to -0.7, $p = 0.03$) between the two communities • Current use of any non-flavored tobacco product (including menthol and mint) by youth in Lowell decreased 1.9% (95% CI, -5.5–1.7, $p > 0.05$) from baseline to follow-up and increased 4.3% (95% CI, 0.9–7.8, $p < 0.05$) during the same time frame in Malden, resulting in a significant difference of -6.2% (95% CI, -11.0 to -1.4, $p = 0.01$) between the two communities • No temporal precedence; baseline survey in Lowell occurred 1–3 months after policy implementation

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Pearlman et al. (2019)	• Pre-post design with no control or comparison • Cross-sectional, with two post-policy time points • Evaluated outcomes of a comprehensive point-of-sale tobacco policy that restricted in January 2013 the sale of flavored tobacco products (excluding menthol) and discounts of tobacco product prices in Providence, Rhode Island • Conducted store observation audits with retailer education in October 2017 (n = 90) and January 2018 (n = 82) • Conducted five rounds of retail compliance checks in November 2017 (round 1; n = 99) and during February–July 2018 (rounds 2-5; n = 408) • Collected data on the current use of tobacco products among 10th- and 12th-grade students from Annie E. Casey Evidence2Success Providence Youth Experience Survey: – Pre-policy (2012): n = 2,150 – 3 years post-policy (2016): n = 2,062 – 5 years post-policy (2018): n = 2,223	• Availability of both flavored and non-flavored tobacco products and tobacco price promotions at retail points of sale • Determine whether citations for illegal sale of flavored tobacco products and tobacco price promotions increased with enforcement and then declined • Examine whether enforcement of these policies decreased smoking among youth	• The availability of flavored products decreased by 24% from 2017 to 2018 • Of the 91 stores cited for a tobacco-sale-related violation: – Violations for sales to an underage person decreased by 12% – Violations for sales of flavored tobacco products to adults increased by 20% – Violations for price discounting increased by 10% • Current cigarette use was 3.2% (95% CI, 2.4–4.0) in 2012, 7.6% (95% CI, 6.3–9.0) in 2016, and 3.0% (95% CI, 2.1–3.8) in 2018 • Current use of any tobacco product declined from 22.2% (95% CI, 20.0–24.3) in 2016 to 12.1% (95% CI, 10.5–13.7) in 2018 • Cigar and cigarillo use decreased from 7.1% (95% CI, 5.7–8.5) in 2016 to 1.9% (95% CI, 1.2–2.6) in 2018 • E-cigarette use decreased from 13.3% (95% CI, 11.4–15.1) in 2016 to 6.6% (95% CI, 5.3–7.8) in 2018 • Hookah use decreased from 13.5% (95% CI, 11.6–15.3) in 2016 to 7.7% (95% CI, 6.4–9.2) in 2018
Rose et al. (2019)	• Data collected every 6 months from December 2011 to October 2016 from respondents, 18–34 years of age, in the Surveyed Truth Initiative Young Adult Cohort • Young adults who smoked menthol cigarettes (n = 806) indicated responses if menthol cigarettes were not available • Weighted analyses accounted for repeated measures and estimated prevalence and correlates of responses and trends over time	• Examined responses to hypothetical restrictions on menthol cigarettes among U.S. young adults who smoked menthol cigarettes	• Overall, 23.5% of young adults who smoked menthol cigarettes indicated that they would quit smoking if menthol cigarettes were not available (largely unchanged during 2011–2016) • In adjusted analyses, certain groups were more likely than other groups to indicate they would quit smoking if menthol restrictions were put in place: – African American respondents: aOR = 2.16 (95% CI, 1.31–3.55) – Women: aOR = 2.21 (95% CI, 1.48–3.29) – Respondents with less than a high school education: aOR = 1.87 (95% CI, 1.01–3.48)

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Bold et al. (2020)	• Novel empirical design to investigate within-person changes in smoking behaviors • Recruited 29 non-treatment-seeking adults who smoked menthol cigarettes in Connecticut in 2017–2018: 15 females; 17 Black people, 10 White people, and 5 Hispanic people • Used repeated-measures analyses to examine within-person changes in smoking behaviors when participants were switched from smoking their usual brands of menthol cigarettes to matched, nonmenthol brands of cigarettes for 2 weeks • Participants returned for weekly visits for 4 weeks: – Conducted a Timeline Follow-Back Interview at each visit – Participants were asked to bring used cigarette filters – Used biochemical measures to assess urine cotinine levels and menthol glucuronide as markers of recent menthol exposures	• Modeled the potential effects of a ban on menthol cigarettes on the smoking behaviors of people who currently smoked menthol cigarettes	• After switching to nonmenthol cigarettes, participants smoked a significantly fewer number of nonmenthol CPD than they did menthol cigarettes (mean decrease = 2.2 cigarettes; SD = 3.2; $p < 0.001$), confirmed by significant reductions in cotinine levels in urine ($p = 0.013$) • After switching to nonmenthol cigarettes, participants had 18% lower scores of nicotine dependence ($p < 0.001$) and greater increases in quitting motivation (mean increase = 2.1; SD = 2.8; $p < 0.001$) and confidence (rated 1–10) (mean increase = 1.3, SD = 3.3, $p = 0.04$) • Exploratory analyses indicated significant interactions by race ($p = 0.004$): Reductions in the number CPD were greater among Black people who smoked (mean decrease = 3.5 cigarettes; SD = 2.8) than were reductions among non-Black people who smoked (mean decrease = 0.2; SD = 2.6)
Chaiton et al. (2020c)	• Pre-post, repeated longitudinal design with no control or comparison • Examined effects before and after a ban of menthol-flavored tobacco products in January 2017 in Ontario, Canada, among adults (16 years of age or older) who reported current smoking (i.e., within the past 30 days) at baseline (September–December 2016) and completed follow-up (January–August 2018) (n = 913) • Poisson regression controlled for smoking and demographic characteristics at baseline	• Assessed relative rates of making a quit attempt and having quit smoking at follow-up	• People who reported smoking menthol cigarettes daily at baseline were more likely to report having quit smoking (aRR = 1.62; 95% CI, 1.08– 2.42) or having made a quit attempt (aRR = 1.25; 95% CI, 1.03–1.50) at follow-up than were people who reported smoking nonmenthol cigarettes at baseline

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Rossheim et al. (2020)	• Pre-post, quasi-experimental design with no control or comparison • Repeated cross-sectional, with elements of interrupted time series analysis and difference-in-difference designs • Evaluated effects of FDA's nationwide ban in 2009 on flavored cigarette products (excluding menthol) using data from the 2002–2017 National Survey on Drug Use and Health (n = 893,226) • Regression models were weighted for national representation	• Examined past-30-day use of cigarettes among youth (12–17 years of age), young adults (18–25 years of age), adults (26–49 years of age), and older adults (50 years of age or older) before and after implementation of FDA's ban on flavored cigarettes	• Youth: – 17% increase in the odds of reporting any current cigarette use immediately after the flavor ban (OR = 1.17; 95% CI, 1.07–1.29), and a 2.2% reduction, over the pre-ban trend, in the odds of reporting any cigarette use each quarter thereafter (OR = 0.98; 95% CI, 0.97–0.98) – Immediate 33% increase in the odds of reporting current use of menthol cigarettes (OR = 1.33; 95% CI, 1.15–1.54), and an additional 3.6% reduction, over the pre-ban trend, in the odds each quarter thereafter (OR = 0.96; 95% CI, 0.96–0.97) – The predicted probability of menthol use was reduced by 60% • Young adults: – Immediate 9% increase in the odds of reporting any current cigarette use (OR = 1.09; 95% CI, 1.03–1.16), and an additional 1.2% reduction, over the pre-ban trend, in the odds of cigarette use each quarter thereafter (OR = 0.99; 95% CI, 0.99–0.99) – Immediate 29% increase in the odds of reporting any current use of menthol cigarettes (OR = 1.29; 95% CI, 1.19–1.41), and a 2.6% reduction, over the pre-ban trend, in the odds of menthol cigarette use each quarter thereafter (OR = 0.97; 95% CI, 0.97–0.98) – The predicted probability of menthol use was reduced by 55% • Adults and older adults: – No significant differences were observed in either group for an immediate change after the flavor ban, and changes in slope were attenuated compared with the younger age groups: 0.25% reduction among adults and 0.5% reduction among older adults – Estimated 17% immediate increase in the odds of past-30-day use of menthol cigarettes among adults (OR = 1.17; 95% CI, 1.06–1.30), with no corresponding reduction after the ban – Among older adults, there was no statistically significant immediate increase in the past-30-day use of menthol cigarettes associated with the ban; reduction in the slope of past-30-day use of menthol cigarettes was attenuated (1.1%) after the ban

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Yang et al. (2020)	• Post-only design with no control or comparison • Cross-sectional study assessed the impact of one of the first comprehensive bans of all flavored tobacco products other than tobacco-flavored e-cigarettes among young adults in San Francisco, California, in January 2019 • Using Amazon Mechanical Turk, collected data from a sample of San Francisco residents, 18–34 years of age, who previously used tobacco products (n = 247); participants were surveyed about their tobacco use before and after the ban • Used logistic regression models to estimate the odds, among the whole sample, of using flavored products after the flavor ban	• Assessed changes in the use of menthol cigarettes, e-cigarettes, and cigars among young adults	• 18- to 24-year-old group: – Use of any tobacco products decreased by 17.7 percentage points (95% CI, -27.5 to -8.0) from 100% to 82.3% – Use of any flavored tobacco products decreased by 11.3 percentage points (95% CI, -23.6–1.0) from 80.7% to 69.4% • 25- to 34-year-old group: – Use of any tobacco products decreased by 7.6 percentage points (95% CI, -11.4 to -3.7) from 100% to 92.4% – Use of any flavored tobacco products decreased by 8.6 percentage points (95% CI, -14.0 to -3.3) from 84.9% to 76.2%
Chaiton et al. (2021a)	• Pre-post, repeated longitudinal design with no control or comparison • Evaluated associations of a full ban on menthol cigarettes—implemented in January 2017 in Ontario, Canada—on smoking behaviors of people, 16 years of age or older, who currently smoked at baseline (September–December 2016; n = 1,821); follow-up survey conducted during January–August 2019 (n=810) • Used Poisson regression to assess probability of quitting smoking by menthol status before the ban, controlling for differences in smoking and demographic characteristics	• Evaluated quitting behavior 2 years after the ban on menthol	• Participants who smoked menthol cigarettes daily at baseline had a significantly higher likelihood of reporting having quit smoking than did participants who smoked nonmenthol cigarettes at baseline (aRR = 2.08; 95% CI, 1.20–3.61) • The probability of reporting more quit attempts increased significantly among participants who, at baseline, smoked menthol cigarettes daily (aRR = 1.45; 95% CI, 1.15–1.82) and occasionally (aRR = 1.27; 95% CI, 1.03–1.56) than it did among participants who, at baseline, smoked nonmenthol cigarettes

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Guydish et al. (2021)	• Pre-post design with no control or comparison • Examined the impact of a San Francisco, California (city and county) ban on the sale of all flavored tobacco products (including menthol cigarettes) among clients enrolled in residential substance use disorder treatment • Three cross-sectional surveys were conducted at two residential substance use disorder facilities before the June 2018 ban was implemented and enforced (Wave 1: June 2018, n = 160) and after enforcement of the ban began in January 2019 (Wave 2: May 2019, n = 102; and Wave 3: November 2019, n = 120) • Multivariate regression analysis assessed changes in smoking behaviors across survey waves	• Assessed effects of ban on smoking behaviors, including number of CPD, quit attempts (for at least 24 hours) in the past year, and readiness to quit smoking (i.e., thinking of quitting smoking within the next 30 days)	• Survey respondents in Wave 2 (5 months post-ban implementation/ enforcement) who currently smoked cigarettes were less likely to have thought about quitting smoking in the next 30 days than respondents surveyed in Wave 1 (6 months pre-ban implementation/enforcement) (OR = 0.44; 95% CI, 0.29–0.67); survey respondents in Wave 3 (11 months post-ban implementation/enforcement) were less likely to have reported a past-year quit attempt than respondents surveyed in Wave 1 (OR = 0.80; 95% CI, 0.71–0.91) • Survey respondents in Wave 2 were less likely to have reported menthol as their usual type of cigarette (OR = 0.80; 95% CI, 0.72–0.90) than were survey respondents in Wave 1; survey respondents in Wave 3 were less likely to have smoked only menthol cigarettes in the past month than were survey respondents in Wave 1 (OR = 0.19; 95% CI, 0.18–0.19) • Among Wave 3 survey participants who currently smoked menthol cigarettes, 30.6% (n = 11) indicated that they had switched to smoking nonmenthol cigarettes and 16.7% (n = 6) reported smoking less because of the ban
Kingsley et al. (2021)	• Pre-post design, comparing two municipalities (Attleboro and Salem, Massachusetts) with restrictions on flavored tobacco products with a matched comparison municipality (Gloucester, Massachusetts) without restrictions on flavored tobacco products • Cross-sectional surveys administered to high school students before (December 2015) (n = 2,432) and after (January or February 2018) (n = 2,814) policy implementation • Focus groups conducted with high school students in each municipality in 2019	• Assessed whether restrictions on flavored tobacco products in Massachusetts decreased tobacco use among youth over time and whether the length of policy implementation had a dose–response effect on tobacco-related outcomes	• Increases in current tobacco use among youth from baseline to follow-up were significantly smaller in the two municipalities with restrictions on flavored tobacco products than they were in the municipality without restrictions • Difference-in-difference estimates of flavored (excluding menthol) tobacco use: -9.4%; 95% CI, -14.2% to -4.6% • Difference-in-difference estimates of non-flavored (including menthol) tobacco use: -6.3%; 95% CI, -10.8% to -1.8%

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Chung-Hall et al. (2022)	• Pre-post design • Used longitudinal data from the Canadian arm of the 2016 and 2018 International Tobacco Control Four Country Smoking and Vaping Survey, which surveyed before and after a ban on menthol cigarettes was implemented in seven Canadian provinces (n = 1, 236) • At baseline, 1,098 people smoked nonmenthol cigarettes and 138 people smoked menthol cigarettes • Used multivariate logistic regression models to examine associations between smoking behaviors before and after the bans on menthol cigarettes	• Evaluated the impact of bans on menthol cigarettes on differences in quit attempts and quitting smoking between people who smoked menthol and nonmenthol cigarettes at baseline	• At follow-up, 59.1% of people who had smoked menthol cigarettes before the ban switched to smoking nonmenthol cigarettes after the ban; 21.5% quit smoking; and 19.5% continued smoking menthol cigarettes, which were purchased primarily from First Nations reserves • Those who smoked menthol cigarettes were more likely than those who smoked nonmenthol cigarettes to make a quit attempt (aOR = 1.61; 95% CI, 1.03–2.51) and to remain quit (aOR = 2.30; 95% CI, 1.06–5.01) • Quit success did not differ significantly between those who smoked menthol cigarettes and those who smoked nonmenthol cigarettes (aOR = 1.72; 95% CI, 0.98–3.01) • People who smoked menthol cigarettes daily were more likely to quit smoking than were people who smoked nonmenthol cigarettes daily (aOR = 2.21; 95% CI, 1.15–4.24), and people who smoked menthol cigarettes daily and quit before the ban were more likely to remain quit than were people who smoked nonmenthol cigarettes daily (aOR = 2.81; 95% CI, 1.15–6.85) • Non-White participants were more likely to make a quit attempt after the ban than were White participants (aOR = 1.77; 95% CI, 1.10–2.85)

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Fong et al. (2022)	• Pre-post design • Pooled data from two pre-post cohort studies conducted in seven Canadian provinces: – Ontario Menthol Ban Study: 1,084 adults who smoked, including 295 people who smoked mainly menthol cigarettes before the ban on menthol-flavored tobacco products – International Tobacco Control Policy Evaluation Canada Survey: 1,236 adults who smoked, including 128 people who smoked mainly menthol cigarettes before the ban on menthol-flavored tobacco products • Used weighted multivariable logistic analyses to compare quit success, after a ban on menthol-cigarettes, among people who smoked menthol cigarettes and people who smoked nonmenthol cigarettes (for daily smoking and for all smoking); controlled for sex, age, ethnicity, education, baseline smoking status, baseline number of cigarettes smoked per day, and study region • Projections to the United States were created by multiplying the effect size of the Canadian menthol ban on quitting by the number of people who smoked menthol cigarettes overall and by the number of African American people from the 2019 National Survey on Drug Use and Health	• Estimated the impact of Canada's menthol ban on quitting smoking and applied the estimates to project the impact of such a ban on menthol in the United States	• After the ban, people who smoked menthol cigarettes at baseline were more likely to quit smoking than people who smoked nonmenthol cigarettes at baseline among those who smoked daily (difference = 8.0%; 95% CI, 2.4–13.7%) and all those who smoked (difference = 7.3%; 95% CI, 2.1–12.5%) • The projected number of people who would quit smoking after such a menthol ban in the United States was 789,724 people who smoked daily (including 199,732 African American people) and 1,337,988 total people who smoked (including 381,272 African American people)
Kyriakos et al. (2022)	• Pre-post design • Data from the International Tobacco Control Netherlands Surveys (February–March 2020, September–November 2020, and June–July 2021) of 1,326 adults, 18 years of age and older, who smoked before and after the European Union's ban on menthol cigarettes in May 2020 • Conducted weighted, bivariate logistic regression and generalized estimating equation model analyses	• Evaluated the impact of the ban on menthol as a characterizing flavor in cigarettes on smoking cessation outcomes	• People who smoked menthol cigarettes before the ban had greater odds of making a quit attempt after the ban than those who smoked nonmenthol cigarettes (66.9% vs. 49.6%, respectively; aOR = 1.89; 95% CI, 1.13–3.16) • Women who smoked menthol cigarettes before the ban had greater odds of quitting by Wave 3 of data collection than did women who smoked nonmenthol cigarettes (aOR = 2.23, 95% CI, 1.10–4.51)

Table 7.3 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Olson et al. (2022a)	• Pre-post design • Examined data from two surveys (Minnesota Youth Tobacco Survey and the Minnesota Student Survey) of in Minneapolis and St. Paul, Minnesota (Twin Cities) and in the rest of the state of Minnesota before and after the implementation of sales restrictions on all flavored tobacco products in 2016 and of restrictions expanded to include menthol tobacco products in 2018	• Assessed changes in the prevalence of tobacco use among youth in Minnesota before and after policies that restricted the sales of all flavored tobacco products and of menthol tobacco products	• According to the Minnesota Youth Tobacco Survey, use of any tobacco product did not change significantly among youth in the Twin Cities after the flavor policies were implemented, but increased 26% (from 12.4% to 15.7%; $p < 0.05$) among youth in the rest of the state of Minnesota • According to the Minnesota Student Survey, use of any tobacco product by youth increased to a greater extent in the rest of the state (from 13.9% to 20.1%; or by 44.6%) than it did in the Twin Cities (from 12.2% to 16.5%, or by 34.6%) after the flavor policies were implemented

Notes: **aOR =** adjusted odds ratio; **aRR =** adjusted risk ratio; **CI =** confidence interval; **CPD =** cigarettes smoked per day; **FDA =** U.S. Food and Drug Administration; **FTC =** Federal Trade Commission; **OR =** odds ratio; **RR =** risk ratio; **SD =** standard deviation.

(Nguyen and Grootendorst 2015). Other studies in Canada have shown decreases in menthol cigarette sales and total cigarette sales following the removal of menthol cigarettes from the market, a greater proportion of people who smoked menthol cigarettes making a quit attempt compared with people who smoked nonmenthol cigarettes, and a significantly higher rate of reported smoking cessation 2 years later for people who smoked menthol cigarettes compared with people who smoked nonmenthol cigarettes (Chaiton et al. 2018, 2020b,c, 2021a,b, 2022; Chung-Hall et al. 2022; FDA 2022c).

Policies prohibiting the sale of flavored products vary in their comprehensiveness, and some evaluation studies have limitations, including lack of a control or comparison group, post-only designs, and limited sampling of population groups of interest. However, when considered in context with studies of the impact of the U.S. prohibition on characterizing flavors other than menthol and tobacco in cigarettes (Courtemanche et al. 2017), these studies of local, state, and Canadian flavor restrictions provide strong additional support for eliminating flavors to reduce use of tobacco products. This is likely to particularly benefit population groups with disproportionate prevalence of tobacco use and tobacco-related health disparities during both adolescence and young adulthood, the period when initiation and progression to regular use is most likely to occur (USDHHS 2012; *Federal Register* 2022b). Further policy evaluation studies will help assess the extent to which this type of regulation reduces tobacco-related health disparities.

Despite the lack of studies to date that have directly assessed the impact of policies banning flavored tobacco products on tobacco-related health disparities in the United States, it is expected that eliminating menthol cigarettes in the United States would reduce tobacco use and, correspondingly, reduce tobacco-related health disparities in youth and other population groups that use menthol cigarettes at high rates, such as Black or African American people (FDA 2022c) (see Chapter 2).

FDA has found that, although there is little evidence to suggest that menthol cigarettes are more toxic than other cigarettes, prohibiting menthol as a characterizing flavor in cigarettes will provide substantial public health benefits because menthol cigarettes facilitate initiation and regular use and make quitting more difficult (FDA 2013, 2022a). FDA's Tobacco Products Scientific Advisory Committee concluded that removing menthol cigarettes from the marketplace would benefit public health, and the WHO recommends that countries ban menthol in cigarettes, including menthol analogues, precursors, and derivatives, and consider prohibiting menthol in products other than cigarettes (Tobacco Products Scientific Advisory Committee 2011; WHO 2016a). As of March 31, 2023, approximately 20% of the U.S. population was covered by state or local-level policies that restrict the sales of all types of flavors across most tobacco products, including menthol cigarettes (Truth Initiative 2023). As noted by FDA, its proposed rules to prohibit menthol cigarettes and flavored cigars nationwide "represent an important step to advance health equity by significantly reducing tobacco-related health disparities" (FDA 2022a).

Several U.S. surveys show that large percentages of young adults and adults who smoke menthol cigarettes reported an intention to quit if menthol cigarettes were no longer sold (WHO 2016a; Wackowski et al. 2018; Cadham et al. 2020). Among young adults and adults who smoke menthol cigarettes, a greater percentage of Black people as compared with White people reported that they would not switch to unflavored cigarettes if menthol cigarettes were no longer available (Hymowitz et al. 1995; Rose et al. 2019; Cadham et al. 2020). A 2010 survey found the strongest support for prohibiting menthol cigarettes, and strong intentions to quit smoking if menthol cigarettes were no longer available, among population groups with the highest prevalence of menthol cigarette use (Pearson et al. 2012). A 2018 survey found that an estimated 28% of people who use menthol cigarettes support eliminating menthol cigarettes, with even broader support among population groups that have been targeted by tobacco industry marketing—such as non-Hispanic African American people and people with lower educational attainment—regardless of smoking status (Czaplicki et al. 2022). A 2021 survey found that 62% of adults surveyed supported a policy prohibiting the sale of menthol cigarettes, including more than one-third of respondents who currently used tobacco products, including menthol cigarettes (Al-Shawaf et al. 2023).

In a small experimental study of 29 adults who currently smoked menthol cigarettes and were not trying to quit, participants were switched to a matched-brand nonmenthol cigarette to model a potential removal of menthol cigarettes from the market. After switching to nonmenthol cigarettes, participants had significantly lower nicotine dependence scores and greater increases in quitting motivation and confidence in their ability to quit smoking. In exploratory analyses, a significant interaction between race and changes in cigarettes per day was observed with results indicating greater reductions in cigarettes smoked per day among Black adults compared with "non-Black" adults (Bold et al. 2020).

A study by Chung-Hall and colleagues (2022) used longitudinal data from the Canadian arm of the International Tobacco Control (ITC) Four Country Smoking and Vaping Survey to evaluate the effects of menthol cigarette sales restrictions in seven Canadian provinces. The sample included a total of 1,236 adults who smoked and were contacted in both 2016 (pre-sales restrictions) and 2018 (post-sales restrictions), including

1,098 adults who smoked nonmenthol cigarettes and 138 adults who smoked menthol cigarettes at baseline. Results showed that people who smoked menthol at baseline were significantly more likely to make a quit attempt at follow-up than those who smoked nonmenthol cigarettes; however, there were no significant differences in short-term quitting after the menthol sales restrictions were implemented between people who did and did not smoke menthol cigarettes at baseline. Additionally, people characterized as “non-White” in the study were more likely than White people to make a quit attempt (Chung-Hall et al. 2022).

A 2022 study used pooled data from two pre–post cohort studies assessing the impact of Canada’s menthol cigarette ban in seven provinces and Ontario’s earlier menthol cigarette ban to estimate the potential impact of FDA’s proposed rule prohibiting menthol as a characterizing flavor in cigarettes in the United States (Fong et al. 2022). On the basis of the pooled Canadian data, 22.3% of adults who smoked mainly menthol cigarettes and 15.0% of adults who smoked nonmenthol cigarettes quit smoking between the pre- and post-surveys. Using these estimates, the authors projected that, if FDA’s proposed rule prohibiting menthol in cigarettes was implemented, an estimated 1.3 million people would quit smoking cigarettes, 381,272 of whom would be Black people who smoke.

A 2022 study assessing the impact in the Netherlands of the European Union’s 2020 menthol cigarette ban using data from the 2020–2021 ITC Netherlands Survey found that people who smoked menthol cigarettes were significantly more likely to make a quit attempt than those who smoked nonmenthol cigarettes (Kyriakos et al. 2022). The data on increased odds of successfully quitting among those who smoked menthol cigarettes were not statistically significant, likely due to limited sample size; however, the quit rates observed in the Netherlands were higher than in Canada, as reported by Chung-Hall and colleagues (2022). The authors explained that because quit rates were highest among women who smoked menthol cigarettes and because the odds of making a quit attempt were higher for people who smoked menthol cigarettes who were young adults, people who smoked daily, or people who had higher nicotine dependence, the policy may have been most successful among population groups of highest risk and may help advance equity (Kyriakos et al. 2022).

Chapter 6 gives detailed descriptions of simulation models to assess the potential impact of prohibiting menthol cigarettes, as well as the effects of menthol cigarettes on the prevalence of smoking, premature deaths, and life-years lost among the general population and among Black or African American people specifically (Levy et al. 2011, 2023; Mendez 2011; Le and Mendez 2021; Mendez and Le 2021; Issabakhsh et al. 2022). The simulation models and the policy evaluation data discussed earlier (showing reductions in sales, reductions in tobacco product use, and increased intentions to quit) show that eliminating flavors, including menthol, in tobacco products would likely reduce disparities in smoking prevalence and quitting. There also is strong evidence to support the conclusion that the elimination of menthol cigarettes in the United States would reduce health disparities, given the substantial differences in menthol cigarette use prevalence and the resulting disproportionate number of premature deaths among specific population groups. As with other evidence-based tobacco control strategies, implementation of policies to prohibit the sale of flavored tobacco products as part of comprehensive tobacco control programs could amplify the public health impact of the policies overall as well as their ability to address tobacco-related disparities (USDHHS 2012; NCI 2017b).

Summary and Recommendations

Several components of FDA’s regulatory authority can help to increase awareness, understanding, and appreciation of the harms of tobacco, reduce initiation, increase intention to quit cigarette smoking, increase quitting, and improve overall health outcomes. Requiring pictorial health warnings on cigarette packages and advertisements increases both understanding of the harms of smoking and intention to quit among different population groups. Reducing the level of nicotine in tobacco products to minimally or nonaddictive levels would reduce cigarette consumption among many different population groups and may improve cessation outcomes. For example, there is some evidence that reduced-nicotine-content cigarettes resulted in increased cessation among people with mood and/or anxiety disorders compared to usual cigarettes. In addition, eliminating flavors in tobacco products—particularly menthol cigarettes—is expected to reduce tobacco initiation, increase quitting, and improve overall health outcomes among certain population groups. Further, as noted in Chapter 3, the scientific evidence to justify prohibiting the marketing, sales, and distribution of menthol tobacco products and flavored cigars has been both substantial and sufficient for years.

Further analysis of how marketing authorizations, product regulations, and implementation strategies affect specific outcomes along the tobacco use continuum from exposure to secondhand tobacco smoke to health outcomes is warranted. In addition, ongoing monitoring of tobacco product marketing, its impact on the use of products by people who experience tobacco-related health disparities, and the related health consequences is critical. Ensuring that surveillance systems collect disaggregated data would provide a better understanding of specific tobacco product use among population groups and the risks and benefits for all.

Place-Based and Product-Focused Retail Policies

In its blueprint to end the U.S. tobacco epidemic, IOM (now the National Academy of Medicine) recommended that governments develop, implement, and evaluate legal mechanisms for restricting the number of tobacco outlets and for restructuring tobacco sales (IOM 2007). To that end, policy interventions to regulate the retail environment (beyond long-standing tax policies) have increased at both the state and local levels and are being adopted by territories and tribes (David et al. 2013; Luke et al. 2016; CounterTobacco.org n.d.b). These strategies may reduce the prevalence of tobacco use as well as disparities in tobacco use and tobacco-related disease and death among population groups (Kong and King 2021). This section examines strategies that are organized into two broad categories: place-based policies and product-focused policies. The place-based policies discussed in this report are supply-side interventions that limit which types of retailers can sell tobacco products, where those retailers can be located, and how many retailers can sell these products. The product-focused policies, in turn, are intended to suppress demand for tobacco by increasing the price for these products through tax and non-tax mechanisms and by regulating what products are sold.

Some jurisdictions have both place-based and product-focused policies. For example, in 2008, San Francisco became the first city to mandate tobacco-free pharmacies (i.e., pharmacies that do not sell tobacco products) and, in 2014, the city set a cap on the number of tobacco sales permits allowed in each of its 11 districts, aiming to reduce disparities in retailer density in lower income neighborhoods and neighborhoods with a high proportion of people from minoritized racial and ethnic groups (San Francisco Tobacco-Free Project 2016; CounterTobacco.org n.d.a). In 2018, San Francisco also prohibited the sale of flavored tobacco products, including menthol products (Public Health Law Center 2018a; San Francisco Tobacco Free Project n.d.). The long-term goal of these interventions is to reduce the concentration of tobacco retailers in socioeconomically disadvantaged areas and ultimately to reduce tobacco use (Rodriguez et al. 2013; Lee et al. 2017).

Retail-based policies use multiple mechanisms to prevent the initiation of tobacco and reduce its use. By reducing the number of tobacco retailers, place-based interventions increase the time and resources needed to obtain tobacco products (IOM 2007). In addition, a reduced concentration of tobacco retailers diminishes residents' exposure to tobacco advertising and product displays, which are linked to smoking initiation (Robertson et al. 2015); nicotine cravings and withdrawal symptoms (Carter et al. 2009; Kirchner et al. 2013); lower self-efficacy to quit among people who smoke (Chaiton et al. 2014); unplanned or impulse purchases of tobacco (Germain et al. 2010; Clattenburg et al. 2013; Kim et al. 2014); and the diversion of money needed for household essentials (such as food or rent) to tobacco product purchases, resulting in a lack of funds for such household essentials (known as "smoking-induced deprivation") (NCI and WHO 2016; Siahpush et al. 2016).

Product-focused interventions that increase the price of tobacco products or prohibit the sale of tobacco products also reduce consumption, promote quitting, and prevent smoking relapse, as well as reduce smoking-induced deprivation among those who quit smoking (Chaloupka et al. 2012; NCI and WHO 2016; Nonnemaker et al. 2016). In addition, establishing minimum prices for tobacco products may reduce variation in purchase patterns within and between product categories (e.g., little cigars or cigarillos and cigarettes), which would limit opportunities of those who use tobacco products to engage in price-minimizing strategies, like buying cheaper products instead of quitting (Golden et al. 2016).

Indirect effects are also plausible. For example, environments with reduced retail availability (such as limits on the type, location, number, or concentration of retailers) and reduced access to products (such as restrictions on the sale of flavored tobacco products) may contribute to denormalization of commercial tobacco in the community (Zhu et al. 2007; McDaniel and Malone 2014; Smith et al. 2017). Zhu and colleagues (2007) compared quit ratios among first-generation immigrants in California from China and Korea with quit ratios among (a) the general population in California and (b) people living in China and Korea. Social norms regarding smoking are vastly different in China and Korea than in California. Results showed that, among people who had ever smoked, quit ratios were comparable between Chinese (52.5%) and Korean (51.1%) first-generation immigrants and the general population (53.3%). However, quit ratios among these immigrant populations were substantially higher than previously reported quit ratios among people in the respective countries (China: 11.5%; Korea: 22.3%). These findings suggest that significant changes in social norms toward smoking can improve cessation at the population level (Zhu et al. 2007).

Furthermore, McDaniel and Malone (2014) conducted 15 focus groups with patrons (n = 84) of retail outlets (grocery stores and pharmacies) that had voluntarily discontinued sales of tobacco products across California, New York, and Ohio to understand normative beliefs around where cigarettes should or should not be sold. Some participants considered cigarettes to be integral to the identity of certain types of retail outlets, specifically convenience stores, whereas it may be inappropriate for other types of retailers, such as pharmacies and grocery stores focused on selling healthy products, stores that are frequented by children, or those selling products for children, to sell tobacco products. Evidence from the evaluation of the California Department of Public Health, California Tobacco Control Program—which utilized a social norm change approach to reduce tobacco use—found that this program was associated with reductions in the overall adult smoking prevalence (from 22.7% in 1988 to 13.8% in 2007), a shift away from daily and/or heavy smoking, and a consistently lower prevalence of smoking among adolescents in California than among adolescents across the nation (Roeseler and Burns 2010). Thus, interventions that change norms in this way can discourage initiation and improve cessation outcomes (Roeseler and Burns 2010).

This section reviews evidence on the benefits of place-based strategies and selected product-focused strategies. The evidence reviewed uses multiple approaches, including (1) evaluations of actual policies; (2) computational modeling and other simulations of hypothetical policies; and (3) experimental manipulations of policy conditions in controlled settings, including both real-world and virtual settings (Kim et al. 2013; Shadel et al. 2016). This review considered evidence of policy effects on outcomes related to the tobacco retail environment, product acquisition, and tobacco use (e.g., reductions in retailers, changes in purchase behaviors, reduced tobacco use prevalence, and cessation-related outcomes).

Retail policies are a complement to long-standing evidence-based tobacco control interventions and are well suited to addressing tobacco-related health disparities because, although the prevalence of smoking in the United States has declined, the number of tobacco retailers has increased (Golden et al. 2022). In general, tobacco retailers are disproportionately clustered in lower income neighborhoods and in neighborhoods with a high proportion of minoritized racial and ethnic groups and of youth and young adults (Fakunle et al. 2019; Berg et al. 2020; Kong et al. 2021; Golden et al. 2022). Furthermore, there is greater advertising of tobacco products in the interior and on the exterior of tobacco retail stores in those neighborhoods (Lee et al. 2015; Rose et al. 2022a). However, the evidence regarding vape shops density is mixed, which may be due, in part, to the different ways in which vape shops are defined (Lee et al. 2018a), as covered in Chapter 5 of this report. Chapter 5 of this report also covers the influence of the tobacco retail environment on tobacco-related health disparities in greater detail. These inequities are not simply the result of consumer demand but are associated with discriminatory housing policies such as redlining and targeted industry marketing in communities specifically identified by the industry as "focus" communities (see "Influences of the Tobacco Retail Environment" in Chapter 5) (Kool USA 2002, 2003; Cruz et al. 2010).

Retail policies may have a greater impact when combined with each other (Luke et al. 2017; Kong et al. 2021; Golden et al. 2022). Indicators of the pro-equity effects of tobacco retail policy interventions include reduced economic, racial and ethnic, or other disparities in the retail availability of tobacco products; reduced exposure to product advertisements and displays; and reduced sale or use of tobacco products. This review highlights what is known about the effects of tobacco retail policy interventions for population groups experiencing tobacco-related disparities.

Place-Based Strategies

State and local policy strategies aim to limit the type, location, and quantity of tobacco retailers. Common mechanisms that have been used to do so include, but are not limited to, (1) mandating that pharmacies be tobacco-free, (2) restricting tobacco sales near schools, and (3) adopting other strategies to reduce the number of retailers (such as maximizing the distance between retailers and placing caps on the number of retailers in a region, usually through the use of tobacco retailer licensing). These specific place-based strategies are described in the following sections.

Tobacco-Free Pharmacies

In 2012, tobacco sales in U.S. pharmacies totaled almost $5 billion (U.S. Census Bureau 2012), even though selling tobacco is incompatible with the mission of pharmacies to promote health and wellness. Pharmacies' tacit approval of the purchase of tobacco products may send mixed messages to consumers and normalize tobacco use (Hudmon et al. 2006). A 2014 assessment of a random sample of tobacco retail outlets in North Carolina, including pharmacies, showed that most (91.7%) pharmacies selling e-cigarettes placed them behind the counter (versus in front of or on top of the counter or in multiple locations); all pharmacies assessed that sold e-cigarettes placed them with cessation medications, even though e-cigarettes are not approved by the FDA as cessation products (Wagoner et al. 2018).

Evidence that pharmacies sell cigarettes at lower prices and offer more cigarette sales promotions than do other types of tobacco retailers raises additional public health concerns (Henriksen et al. 2016; Seidenberg et al. 2022). Between 2005 and 2009, cigarettes sales in U.S. pharmacies increased, but total cigarette sales decreased during this time (Seidenberg et al. 2012). Although pharmacies may not violate laws prohibiting tobacco sales to people who are underage as often as some other types of retailers (Wheeler et al. 2021), a study of FDA retail inspection data from 2012 and 2017 showed that pharmacies failed 7.7% of inspections for selling tobacco products to underage people (Lee et al. 2018b).

The *Tobacco Control Act* precludes FDA from prohibiting tobacco sales in any specific category of retail outlets, including pharmacies, but the Act expressly preserves state, territorial, tribal, and local authority to regulate or prohibit the sale of tobacco products (*Family Smoking Prevention and Tobacco Control Act 2009*; FDA 2018a). Tobacco-free pharmacy policies have the potential to reduce the number of tobacco retailers in a community (Jin et al. 2016b). This section describes results from simulation studies and empirical studies of the impact of tobacco-free pharmacies on retailer density and disparities.

Five of the studies identified by the literature search used simulation modeling to estimate the potential outcomes of a tobacco-free pharmacy policy aimed at reducing the density of tobacco retailers in U.S. jurisdictions where a policy had not yet been implemented (Myers et al. 2015; Tucker-Seeley et al. 2016; Luke et al. 2017; Craigmile et al. 2021; Bourke et al. 2022). According to three of these simulations, having tobacco-free pharmacies would yield a 10% reduction in the total number of tobacco retailers in Rhode Island (Tucker-Seeley et al. 2016), a 14% reduction in the density of tobacco retailers in North Carolina (Myers et al. 2015), and a 3.5% reduction in the density of tobacco retailers in Wilmington, Delaware (Bourke et al. 2022). Another simulation study estimated the impact of policy options to reduce the density of tobacco retailers in four archetypical and abstract town types (higher versus lower income and urban versus suburban towns). The model showed a greater effect in reducing the availability of cigarettes from establishing tobacco-free pharmacies than from a random reduction in tobacco retailers (Luke et al. 2017).

Two of the identified simulation models examined the impact of tobacco-free pharmacies on disparities in retailer density. Luke and colleagues' (2017) model did not project a greater effect in communities where tobacco retailers are disproportionately located. However, a study that simulated the impact of prohibiting all pharmacies in Ohio from selling tobacco products found that such a policy would *increase* disparities; that is, census tracts with the largest prevalence of African American people would experience smaller reductions in the concentration of tobacco retailers than other census tracts (Craigmile et al. 2021).

Evidence from simulation modeling studies may underestimate actual declines over time in the density of tobacco retailers (Jin et al. 2016b). For example, evaluation studies from Massachusetts and California showed that reductions in the density of tobacco retailers over 8–10 years were 1.44 times larger in cities with tobacco-free pharmacies as they were in cities without tobacco-free pharmacies (Jin et al. 2016a,b). These policies may serve as a tipping point for other density-reduction strategies and contribute to the establishment of community norms that reduce demand for tobacco products.

In 2014, CVS Pharmacy discontinued tobacco sales in its 7,600 U.S. pharmacy stores (PR Newswire 2014; Tobacco Control Legal Consortium 2014b). After the voluntary policy was implemented, households that purchased cigarettes from CVS exclusively were 38% more likely to stop purchasing cigarettes than households that purchased cigarettes from other pharmacies. A small but statistically significant decline in pack sales (a decline of 0.14 packs per month per person who smoked) was found in states where CVS had a market share of at least 15% compared with states with no CVS stores (Polinski et al. 2017).

One study found that the impact of CVS's policy in the Southeastern United States, an area with disproportionately high tobacco use, was confounded by the decision of two large dollar-store chains to begin selling tobacco products (Hall et al. 2019a). Another study conducted after CVS implemented its policy analyzed quit attempts among adults who smoked. It found that the CVS policy had a greater impact on quit attempts in urban counties than in rural counties, likely owing to the higher concentration of CVS stores in urban areas (Ali et al. 2020). These studies suggest that policies that are more comprehensive, perhaps in conjunction with other retail strategies, may have a broader impact on reducing tobacco use.

Whether tobacco-free pharmacies have the potential to reduce disparities in tobacco retailer density appears to depend on the sociodemographic characteristics of the neighborhoods in which the pharmacies are located (Smith et al. 2020). In New York City, for example, a law prohibiting the sale of tobacco products in pharmacies resulted in an average decrease in retailer density of 6.8% across neighborhoods. However, neighborhoods with a higher proportion of non-Hispanic White residents and neighborhoods with higher median household incomes benefited the most from the policy because pharmacies that sold tobacco made up a greater proportion of tobacco retailers in those neighborhoods (Giovenco et al. 2019). Further, an analysis of the impact of CVS's removal of tobacco in Rhode Island found that the CVS policy did not impact racial, ethnic, and socioeconomic disparities in retailer density. Further, in a prospective analysis within the same study, the authors concluded that a ban on all tobacco sales in pharmacies would not significantly reduce the disparate concentration of tobacco retailers in census tracts with higher proportions of African American or Black residents, Hispanic residents, or families living in poverty (Tucker-Seeley et al. 2016).

In summary, tobacco-free pharmacy policies on their own may not decrease the number of tobacco retailers equitably across neighborhoods because there are lower odds that pharmacies that sell tobacco are located in neighborhoods with a greater percentage of Black residents or Hispanic or Latino residents (Kong et al. 2022). Most studies that have examined tobacco-free pharmacy policies have simulated impacts of hypothetical policies. Massachusetts and New York have statewide tobacco-free pharmacy laws, and many localities in California, Massachusetts, New York, and Minnesota require tobacco-free pharmacies, but their impact on tobacco use among people experiencing disparities remains to be studied.

Most licensed pharmacists and adults support prohibiting tobacco sales in pharmacies, and studies suggest that such policies would not affect customer visits to pharmacies and potentially could result in increased sales of NRTs (Hudmon et al. 2006; Smith et al. 2012; Journal of the American Pharmacists Association 2015; Wang et al. 2016; Pimentel and Apollonio 2019; Truth Initiative 2019b; Glasser and Roberts 2021). Eliminating tobacco product sales in pharmacies could foster tobacco-free norms and remove a retail source of cheaper cigarettes. The effects of combining tobacco-free pharmacy policies with other retail strategies on tobacco use by groups experiencing tobacco-related health disparities warrants investigation.

Restricting Tobacco Sales Near Schools

Another strategy to reduce the number of tobacco retailers that has been explored in the literature is to restrict the proximity of retailers to schools and other locations where youth congregate, such as youth centers and playgrounds. This type of policy could help address tobacco-related health disparities, particularly among youth who walk to or from school. As described in detail in Chapter 5 of this report, studies suggest that the prevalence of smoking among youth is higher in neighborhoods with higher densities of tobacco retailers (Novak et al. 2006; Henriksen et al. 2008; Trapl et al. 2021a). In this case, *proximity* refers to the number of feet or meters between a tobacco retailer's geographic location and the nearest border of a primary or secondary school campus. For example, more than 50 cities or counties in California restrict the sale of tobacco near schools, although the minimum distance required and measurement method (by a straight line or roadway) and definitions of schools differ among local policies (California Department of Public Health 2016). Local ordinances in the United States vary in the required distance between a tobacco retailer and a school, and often have 500-foot, 1,000-foot, or 1,500-foot buffers (Coxe et al. 2014; Myers et al. 2015; Luke et al. 2017).

Nearly all studies of the impact of restricting tobacco retailers near schools are simulation models, as described later in this chapter. However, one empirical study of Philadelphia's policy to reduce retailer licenses found that, 3 years after implementation, the prohibition on new tobacco retailers within 500 feet of schools benefited 84,300 youth from more than 200 schools, including 10,500 youth from 32 schools who no longer had any tobacco retailers located within 500 feet of their schools. There was no evidence of differences in impact between low-income schools and not-low-income schools (Lawman et al. 2020).

Studies that have assessed the impact of imposing hypothetical restrictions on the proximity of tobacco retailers to schools feature unique assumptions and varying distance thresholds for proximity to schools, but all of them suggest that school proximity requirements could benefit public health. A modeling study focused on North Carolina concluded that a state-level restriction on the sale of tobacco products within 1,000 feet of schools would reduce the number of retailers by 17.8% (Myers et al. 2015). The study found that a tobacco-free pharmacy law combined with a policy limiting sales near schools would result in the greatest reduction in retailers (29.3%) (Myers et al. 2015). Another study modeled the potential impacts of four policies in Wilmington, Delaware: a tobacco-free pharmacy law, a law that capped the number of retailers overall, a law that set a limit of one retailer per 1,000 residents, and a law that prohibited tobacco sales within 500 meters of a school (Bourke et al. 2022). This study estimated that the school proximity policy would be the most effective policy to reduce tobacco retailer density overall (78.2%) and in medium- and high-density residential zones (73.3%), and that average resident-to-retailer distance would increase by 115% overall and by 141.5% in medium- and high-density residential zones.

Pro-equity effects of school proximity policies were evident in simulation studies that examined this issue. Results from the Tobacco Town agent-based simulation model suggested that 500-foot, 1,000-foot, and 1,500-foot restrictions from schools would all reduce the density of tobacco retailers and increase the cost of accessing tobacco (including travel time), with greater effects seen at greater distances (Luke et al. 2017). This model also suggested that restricting the proximity of retailers to schools is more effective at reducing the concentration of tobacco retailers in dense, urban areas and is particularly effective in lower income, urban areas; thus, distance requirements have the potential to have an impact in neighborhoods with population groups experiencing tobacco-related health disparities (Luke et al. 2017). Statistical models focused on New York City and Missouri suggest that implementing a simulated ban on tobacco sales within 1,000 feet of schools would either reduce or eliminate existing disparities in the density of tobacco retailers in predominantly lower income, African American, and Hispanic neighborhoods compared with predominantly higher income and White neighborhoods (Ribisl et al. 2017). A simulation of a policy using licensing laws to eliminate tobacco retailers from within 1,000 feet of all schools in Ohio predicted that the policy would be most effective in lower income, African American, and urban neighborhoods (Craigmile et al. 2021).

These studies suggest that reducing tobacco retailers, including vape shops, near schools may result in a reduction in retailers in neighborhoods with people experiencing tobacco-related health disparities (Chido-Amajuoyi et al. 2020). Tobacco retailer licensing laws require businesses to obtain a license in exchange for the privilege to sell tobacco products. Using a licensing law, such as the one in Philadelphia, as a mechanism to track retailers and implement and enforce this type of policy may help bolster compliance (Mistry et al. 2015; Wang et al. 2017; Lawman et al. 2020; Craigmile et al. 2021). This retailer reduction policy may also indirectly benefit public health by reducing tobacco use among adults who live near schools and experience tobacco-related health disparities (Rogers and Vargas 2018).

Retailer-to-Retailer Proximity Restrictions and Caps on Quantity of Retailers

Policies that maximize the distance between tobacco retailers or that cap the number of retailers in a community are intended to reduce retailer density. A systematic review and meta-analysis identified 37 empirical studies published from eight countries (Australia, Canada, Denmark, England, Finland, New Zealand, Scotland, and the United States) from 2000 through October 2020 (Lee et al. 2022). Analysis of pooled results indicate that reducing the density and proximity of tobacco retailers is consistently associated with reductions in tobacco use among adults and likely will result in improvements in population health, complementing other studies describing the relationship between tobacco retailer density and proximity with tobacco use among youth (Lee et al. 2022).

An empirical study by Lawman and colleagues (2020) showed that 3 years after Philadelphia changed its tobacco retailer licensing law to allow—through attrition—a maximum of only one tobacco retailer per 1,000 people for each of 18 city planning districts, the city observed a 20.3% reduction in the number of retailers. Its reductions in tobacco retailer density were significantly greater in lower income districts than in higher income districts, suggesting that this type of retailer reduction policy could reduce the availability of tobacco and consequent tobacco marketing and advertising in lower SES communities where residents may have reduced access to healthcare and cessation support (Lawman et al. 2020).

Simulation studies also examined proximity restrictions and strategies to cap the quantity of tobacco retailers. As discussed previously, in North Carolina, a modeling study estimated that imposing a minimum distance of 500 feet between tobacco retailers would reduce the total number of retailers by 22.1% at the state level (Myers et al. 2015). The Tobacco Town agent-based simulation model analyzed different policy interventions in four archetypal and abstract town types (a combination of urban–suburban and lower–higher income communities) and found that the effect of different policies will vary according to town type and that implementing multiple policies may be more effective than just one policy on its own (Luke et al. 2017). For example, retailer-to-retailer proximity restrictions with larger distances between retailers had a greater impact in reducing tobacco retailers in lower income urban communities, whereas capping the number of licenses at 50% of the current total had a greater impact in higher income suburban settings (Luke et al. 2017).

A modeling study from New Zealand found that capping the number of retailers would result in reduced tobacco use and tobacco-related disease, increased quality-adjusted life years, and cost savings for the healthcare system. The authors noted that the retailer cap policy would be expected to yield five times greater per capita quality-adjusted life years for Māori people (the indigenous population in New Zealand, which has a higher smoking prevalence and estimated higher price sensitivity compared with other population groups) and could be combined with other policies, such as tobacco taxes, to maximize the intervention's impact (Pearson et al. 2017).

A simulation of four retailer density reduction strategies in Ohio predicted that reducing retailer-to-retailer proximity and capping the number of retailers are strategies that, on their own, would result in the greatest reduction in the number of retailers. This study predicted that retailer-to-retailer proximity policies would have the most impact in high-poverty neighborhoods and African American neighborhoods, whereas capping the number of retailers would have the most impact in high-poverty neighborhoods and rural neighborhoods (Craigmile et al. 2021).

As noted in Chapter 5, there is mixed evidence that retailer proximity to schools impacts some tobacco-related behaviors among youth, including smoking prevalence and cigarette purchasing and borrowing behavior

(Leatherdale and Strath 2007; Henriksen et al. 2008; McCarthy et al. 2009). However, a combination of policies, such as those that reduce retailer-to-retailer proximity and cap the number of retailers, may affect the density of retailers near one's home and have a greater impact on preventing and reducing tobacco use among youth (Abdel Magid et al. 2020). Given that most people, including those experiencing tobacco-related health disparities, begin using tobacco products before the age of 25, these two policies—especially in combination—warrant investigation in terms of whether they also help reduce tobacco-related health disparities.

In summary, place-based strategies show promise in reducing the ubiquity of tobacco retail stores and, thus, the availability of tobacco products and exposure to tobacco marketing. The ability of place-based strategies to reduce initiation and promote cessation may vary depending on the demographics of the communities in which they are implemented. Retailer-to-school proximity, retailer-to-retailer proximity, and retailer cap laws could reduce retailer density in neighborhoods with greater proportions of lower SES, Black, or Hispanic people. Tobacco-free pharmacy policies may have a population-level benefit but not reduce disparities. Thus, it is important to consider adopting tobacco-free pharmacy policies in conjunction with strategies that are likely to reduce tobacco use. The existing literature suggests that retail strategies would be most effective if more than one were adopted and if they were implemented as part of a tobacco retailer licensing program (Combs et al. 2020; Kong and King 2021). Requiring retail licenses to sell tobacco, a strategy recommended by the National Academy of Medicine, (1) could help jurisdictions understand who is selling tobacco products; (2) could be used as a mechanism to reduce tobacco retailer density by limiting the number, location, or type of retailers; and (3) could be used to help enforce other tobacco retail policies (IOM 2007).

Most of the published studies discussed in this section model the hypothetical impacts of place-based policies. Additional studies that examine how these policies can address tobacco-related health disparities are warranted.

Product-Based Strategies

This section discusses product-focused strategies, including increasing prices for tobacco products through tax and non-tax mechanisms and prohibiting the sale of flavored products.

Tobacco Pricing Policies

Decades of robust research across regions and countries and among different population groups has consistently shown that significantly raising the price of cigarettes is the single most effective strategy to reduce cigarette smoking (NCI and WHO 2016; NCI 2017b). Specifically, higher cigarette prices discourage and prevent smoking initiation among youth and young adults, increase smoking cessation among adults who smoke, prevent people who formerly smoked from relapsing, and decrease cigarette consumption among those who continue to smoke (Chaloupka 1999; IOM 2007; IARC and WHO 2011; The Community Guide 2012; USDHHS 2014, 2020; NCI and WHO 2016; Dahne et al. 2020a).

Generally, studies have found that a 10% increase in purchase price reduces cigarette consumption among adults by 2–6% (4% on average) in higher income countries, and by about 2–8% (5% on average) in lower and middle-income countries (NCI and WHO 2016). Similarly, a review by the Community Preventive Services Task Force of 116 studies from higher income countries concluded that a 20% increase in the price of tobacco products "would reduce overall consumption of tobacco products by 10.4%, prevalence of adult tobacco use by 3.6%, and initiation of tobacco use by young people by 8.6%" (The Community Guide 2012, p. 2; NCI and WHO 2016).

Over the last few decades, research has also demonstrated that the impact of raising cigarette prices on reducing smoking can vary among certain population groups, defined by SES, age, gender, and race and ethnicity (IARC 2011; NCI and WHO 2016; NCI 2017b). Importantly, price increases particularly benefit young people by deterring youth tobacco initiation (Chapman 2000; Chaloupka et al. 2011; IARC 2011; USDHHS 2012; NCI 2017b).

In addition to the key findings that higher prices prevent youth smoking initiation, the potential differential impact of higher cigarette prices on reducing cigarette consumption, preventing relapse, and encouraging cessation among different population groups has important policy implications. For example, research generally shows that people with lower incomes who use tobacco products are more responsive to price increases than people of higher incomes who use tobacco products, and that young people are more responsive to price increases than adults; people with substance use disorders or other behavioral health conditions also may be responsive to price increases (Ong et al. 2010; IARC 2011; Hill et al. 2014; NCI and WHO 2016; NCI 2017b; Smith et al. 2020). Raising tobacco prices may have the added benefit of further reducing tobacco use among these price-sensitive population groups beyond the overall reduction in tobacco use realized by the general population, which would, in turn, reduce tobacco-related health disparities (NCI and WHO 2016; NCI 2017b). This strategy may be especially helpful considering that cheaper tobacco products are marketed to young people and to population groups that experience tobacco-related health disparities, as discussed in Chapter 5 (Henriksen et al. 2020; Raskind et al. 2022).

Comprehensive and systematic reviews of studies examining the overall impact of tobacco prices on tobacco use have been conducted elsewhere (IARC 2011; USDHHS 2014; NCI and WHO 2016). This section (1) highlights research that examined the differential impact of tobacco prices among population groups; (2) synthesizes relevant studies that have been published since the previous comprehensive reviews; and (3) discusses research gaps in understanding how tobacco pricing policies can be used effectively to reduce tobacco-related health disparities. The evidence is organized around the policy tools that affect tobacco retail prices. Under each policy tool, and when evidence is available, studies are summarized for population groups that experience tobacco-related health disparities.

Tobacco product prices and demand. Several policies could affect retail prices for tobacco products, with the most widely implemented policy being the levying of tobacco-specific excise taxes (discussed in more detail later in this section). In addition to tobacco-specific excise taxes, minimum price laws, which require tobacco product prices (at the manufacturer, wholesale, or retail level) to be above a predetermined floor, could influence the retail prices of tobacco products. Similarly, minimum markup laws, which require a minimum markup above manufacturer or wholesale prices, could influence retail prices. In addition, policies that prohibit price-reducing strategies, such as prohibiting coupons and discounts, direct promotion to retailers, and free samples could influence how much consumers pay for tobacco products (Golden et al. 2016).

Because multiple policy approaches influence tobacco use behaviors through their impact on tobacco retail prices, this section begins by summarizing the evidence on the impact of cigarette retail prices on smoking. One of the most widely used measures to assess how responsive cigarette consumption is to changes in cigarette price is price elasticity of demand, which is the degree of responsiveness of quantity demanded to a change in price. For example, a price elasticity of -0.4 means that a 10% increase in cigarette prices will result in a 4% decrease in the quantity demanded.

Demand for little cigars and cigarillos is more elastic (i.e., sensitive to price changes) compared with other cigars, and the price elasticity for smokeless tobacco varies depending on the type of product (Huang et al. 2018). Studies on price elasticity for smokeless tobacco may have mixed results because price increases for some products (e.g., dry snuff and chewing tobacco) may reduce demand more than price increases for other products (e.g., moist snuff and snus), and studies tend to combine many different smokeless tobacco products into one broad category (Huang et al. 2018). Data from the United States on price elasticity for tobacco products other than cigarettes, broken down by population group, are limited.

Differential impact of cigarette prices by SES. People of lower SES are especially sensitive to significant tax and price increases and consistently reduce their consumption of cigarettes in response to price increases (NCI 2017b). In one of the earliest studies to examine the impact of cigarette price on smoking, Chaloupka (1991), analyzing data compiled from the National Health and Nutrition Examination Survey, found that people with fewer years of formal schooling were more responsive to changes in cigarette prices than were people with more years of formal education. In fact, people with more education did not change their cigarette consumption in response to changes in cigarette prices.

Several studies assessing various prevalence surveys in the United States provide additional evidence that corroborates the finding that price responsiveness and income levels are inversely related, indicating that people with lower incomes were more price responsive than their higher income counterparts in the United States (CDC 1998; Hersch 2000; Farrelly et al. 2001; Gruber and Koszegi 2004; Levy et al. 2006; Colman and Remler 2008; DeCicca and McLeod 2008; Farrelly and Engelen 2008). A systematic review by Brown and colleagues (2014) found that 27 studies published from 1995 through 2013 concluded that cigarette price or tax increases in Australia, Canada, Europe, and the United States were associated with larger reductions in tobacco use and prevalence among lower SES population groups as compared with higher SES population groups. Fourteen of the 27 studies demonstrated a positive equity impact (defined in the study as reduced socioeconomic inequalities in smoking among adults). Of the remainder, six were neutral, one was mixed, two were unclear, and four were negative. Of the seven categories of interventions reviewed, price or tax increases had the most consistent positive equity impact with respect to this population. The authors noted that, because people of lower SES are more price sensitive, some studies may capture short-term reductions in use and not necessarily sustained quitting (Brown et al. 2014).

This literature has important policy implications. Specifically, although people of lower SES are more likely to smoke, use a larger share of their income to purchase tobacco products, and, as a group, bear a disproportionate share of the tobacco health burden, they are also more likely to reduce their cigarette consumption in response to an increase in cigarette price (IARC 2011). An increase in cigarette price might result in a greater benefit (in terms of reduced tobacco use) among people who smoke with lower SES than people who smoke with higher SES due to reduced consumption or increased quitting (IARC 2011). This could ultimately lead to reductions in tobacco-related health disparities by SES. However, if tax increases are too modest, they may result in reduced consumption but not cessation (Colman and Remler 2008; Verguet et al. 2021).

The benefit of increasing cigarette prices would be even larger if the increased tax revenue were earmarked for tobacco control programs and other health programs that serve lower SES population groups, particularly for sustained cessation interventions to reach people who may not quit in response to the price increase or people who are at risk of relapse (Colman and Remler 2008; Blakely and Gartner 2019; Fuchs et al. 2019; WHO n.d.).

Despite these findings, lower priced alternatives to cigarettes can undermine the impact of cigarette price increases. For example, as documented in the 2014 Surgeon General's report, when the federal tax on cigarettes, cigarette-like small cigars, and "roll your own" tobacco was increased in 2009, the industry changed some of its products and product packaging to avoid the tax (USDHHS 2014). Specifically, tobacco companies slightly increased the weight of little cigars so that they shifted to the cigar category, which is more favorable for tax purposes. This allowed for the introduction of a new "filtered cigar" product with a lower retail price than little cigars and cigarettes (USDHHS 2014). This practice is believed to partially account for increased use of cigars, which are disproportionately used by certain groups, such as Black high school students (see Chapter 2) (NCI 2017b). Parity in taxation across products could help to prevent similar situations.

Differential impact of cigarette prices by race and ethnicity. The studies highlighted in this section specifically examined the differential impact of cigarette price by race and ethnicity. As discussed in NCI Tobacco Control Monograph 22, research has generally found that Hispanic and Black adolescents and adults are more responsive to changes in cigarette prices than their White counterparts, in terms of smoking prevalence, consumption of cigarettes, and smoking initiation (NCI 2017b). For instance, a study conducted by Chaloupka and Pacula (1999) was one of the first to examine racial differences in the impact of cigarette prices on the prevalence of smoking among adolescents. Using data from the 1992, 1993, and 1994 Monitoring the Future (MTF) Study and controlling for SES, the authors found that Black adolescents who smoked were more responsive to price changes than were White adolescents who smoked, with the estimated prevalence price elasticity of demand -1.11 for Black adolescents, compared with -0.64 for White adolescents.

Later, using data from the MTF Study and the Youth Risk Behavior Surveillance System, Gruber and Zinman (2001) found that White 12th graders were relatively less responsive to changes in cigarette prices compared with 12th graders who were Black or characterized by the study as "non-White." Black and "non-White" 12th graders were extremely responsive to these changes, although similar findings were not reached when they analyzed price responsiveness among Black and White teen mothers. Using data from the 1991–2010 MTF Study surveys, another study (Tauras et al. 2013) found that Black and Hispanic youth had the strongest response to cigarette price changes among all racial and ethnic population groups, with their price elasticities estimated to be -0.72 and -0.44, respectively. Farrelly and colleagues (2001) found that NHIS data from 1976 to 1993 showed that Black adults and Hispanic adults were more than two and six times as responsive to cigarette prices, respectively, compared with White adults.

In contrast, a study (Yao et al. 2018) that evaluated the impact of cigarette prices on adult smoking participation (use vs. no use) and smoking intensity among four U.S. racial and ethnic groups—White, African American, Asian, and Hispanic—using the 2006–2011 TUS-CPS found that African American and Hispanic adults were less sensitive to cigarette price changes than White adults (total price elasticity of cigarette demand was -0.27 and -0.15, respectively, vs. -0.48, meaning that a 20% increase in cigarette price would be expected to reduce the quantity of cigarettes demanded by 5.4% among African American adults and by 3.0% among Hispanic adults compared to 9.6% among White adults). Asian adults were more price-sensitive than White adults relative to smoking participation (-0.42 vs -0.26) but they were not sensitive to price with respect to smoking intensity. Given the differences in price sensitivity across the population groups, the authors suggested that tobacco tax increases should be implemented with tailored, non-price-related tobacco control strategies to ensure that tobacco control policy interventions reach all population groups. Similarly, Parks and colleagues (2021, 2022) conducted two studies using longitudinal data from the MTF Study (2001–2017 and 2000–2014 data) to examine the impact of cigarette prices on smoking behaviors among young adults from the age of 18 to 19–20 and 21–22 years of age. The studies found that changes in cigarette pack price may not affect existing disparities in cigarette use among young adults. The authors discussed evidence showing that tobacco taxes can reduce tobacco use in the general population, including among adolescents (Fleischer et al. 2021), and that taxes may also reduce disparities among older adults, but the authors concluded that their findings suggest that other policies, such as menthol bans, may have higher potential than tax policies to reduce racial and ethnic disparities in tobacco use among young adults.

In conclusion, most people initiate tobacco use before the age of 25. Youth are especially price-sensitive, and cigarette price increases could help address health disparities among people at the age when they are most likely to begin smoking. There is evidence that Black and

Hispanic youth are more sensitive to price increases for cigarettes than are youth from other racial and ethnic groups, such as White youth. However, the differential impact of cigarette price increases by race and ethnicity may have changed over time (Fleischer et al. 2021). The evidence is mixed regarding the impact of cigarette price increases on reducing racial and ethnic disparities in tobacco use among adults.

Cigarette excise taxes. Tobacco excise taxation policies represent one of the most widely used and direct policy strategies to increase the retail prices of cigarettes. Studies that examined who bore the economic burden of cigarette taxes have generally assessed whether cigarette taxes were overshifted (the retail price increase was larger than the tax increase) or undershifted (the retail price increase was smaller than the tax increase) (see Chapter 5 for additional details on undershifting and overshifting). Analyzing consumer-reported prices from the 2003 and 2006–2007 TUS-CPS, DeCicca and colleagues (2015) and Pesko and colleagues (2013) documented a pass-through rate of approximately 1, indicating that consumers bear approximately 100% of the burden of taxes.

The degree of pass-through could be reduced by price-minimizing behaviors among people who smoke. These behaviors can include purchasing cartons or buying in bulk, using coupons, buying cigarettes from retailers on tribal reservations (which may be less expensive), and purchasing generic brands (Xu et al. 2014). A cigarette tax increase may have the greatest impact on reducing tobacco use when the tax increase is large and combined with comprehensive cessation support. A 2019 study of data from the Minnesota Adult Tobacco Survey found that following a cigarette tax increase, the perceived tax increase effect and low nicotine dependence were associated with making a quit attempt in adjusted models (Boyle et al. 2019). Predictors of successful quit attempts were college education, use of cessation support, and reporting that the tax increase had helped to maintain a quit.

An evaluation of a 2002 strategy in New York City that increased cigarette excise taxes, extended the scope of its smokefree law, increased cessation services, and expanded public education efforts showed declines in smoking prevalence across all population groups (Frieden et al. 2005). It attributed 33% to 54% of the decline in smoking prevalence—which was greatest among young adults 18–24 years of age and was greater among Black, Hispanic, and Asian adults than among White adults—to the excise tax increase. The study attributed 13–21% of the reduced smoking prevalence to the extension of the smokefree law, and 8% to the increased cessation services. The authors suggested that the remaining decline may have been caused by the synergistic effects of the four interventions.

More evidence is needed to fully document the extent to which sociodemographic population groups, other than people of lower SES and youth, respond differentially to increases in cigarette excise taxes. This evidence is critical to fully understand the impact of cigarette excise tax increases on tobacco-related health disparities and helpful for understanding the broader public health and economic benefits that individual jurisdictions can expect to experience (Chaloupka et al. 2012).

Non-tax tobacco pricing policies. Tobacco companies use a variety of strategies to mitigate the impact of higher tobacco taxes (see Chapter 5). For example, they may reduce tax pass-through to minimize the price increases on lower priced brands, offer price discounts to retailers, and give coupons to consumers (Ross et al. 2017; Ribisl et al. 2022). Of the $7.62 billion that cigarette companies spent on advertising and promotion in 2019, approximately 75% ($5.7 billion) was paid to retailers and wholesalers to reduce cigarette prices (Federal Trade Commission 2021; CDC n.d.k). As such, tobacco control policy efforts that complement tobacco excise taxes, such as minimum price laws and prohibitions on price promotions, are also warranted (Golden et al. 2016; Ribisl et al. 2022).

There are two types of minimum price laws: minimum markup and minimum retail price. Minimum markup policies require tobacco to be sold at a minimum markup (e.g., $1–$10) above the manufacturer and/or wholesale price. Tobacco companies can undermine the effects of minimum markup policies by offering trade discounts to manufacturers and retailers that lower the base price, so the markup is applied to the new, discounted base price (Tobacco Control Legal Consortium 2011). A minimum retail price policy requires tobacco product prices at the manufacturer, wholesale, and/or retail level to be above a predetermined minimum. This section focuses on minimum retail price policies, which set a pricing floor for the actual purchase price and better protect the purchase price from tobacco industry manipulation.

Findings from one modeling study (Doogan et al. 2018) suggest that the impact of a federal minimum price requirement for cigarettes could range from a minimal effect at the $4 level, to a reduction of 5.7 billion packs of cigarettes sold per year and 10 million fewer people who smoke at the $10 level. Another modeling study (Marynak et al. 2016) complemented these findings and predicted that the introduction of a $10 per-pack minimum retail price could significantly reduce the prevalence of smoking, particularly when accompanied by legislation to ban price promotions and discounts. The projected effects were especially large among adults 18–25 years of age, with this intervention associated with an estimated 12% decrease in the prevalence of smoking among members of this age group.

Golden and colleagues (2016) note that strong minimum retail price laws could eliminate discount brands from the market and increase the average prices for middle-priced brands. Because people with lower incomes who smoke are more likely to buy discount brands, the removal of these products from the market could reduce use among people with lower incomes. Mills and colleagues (2020) found that New York was the only U.S. state that reduced disparities in smoking between lower and higher income population groups between 2011 and 2017. Although the authors did not evaluate the impact of specific policies, they noted that further research was warranted given that during this timeframe the state increased its cigarette tax and New York City (where nearly two-thirds of the state's residents live) implemented a minimum price policy.

In one study, Ribisl and colleagues (2022) noted that the evaluation data analyzing the effects of minimum retail price policies were of somewhat limited utility because the minimum prices in the two jurisdictions that were evaluated were lower than the average price before the policies were adopted. Many countries have implemented minimum excise tax laws to ensure that a minimum baseline tax is paid on each product, regardless of its wholesale price; this may be a potential alternative in jurisdictions with effective excise tax systems that wish to direct all revenue increases to the government rather than allowing the industry to possibly obtain increased revenue as the result of a minimum price law (Ribisl et al. 2022). Although minimum price laws or minimum excise tax laws would be expected to help reduce tobacco use among people with lower incomes and other price-sensitive consumers, more research on these strategies and their impact on the wider array of population groups experiencing tobacco-related disparities is necessary.

Prohibiting price promotions (e.g., discounts, multipack offers, redemption of coupons) is another non-tax tobacco pricing strategy intended to maximize the impact of tobacco excise taxes and minimum price laws. Studies have documented tobacco price-related discounts offered to or used by people experiencing disparities (Moran et al. 2019). For example, Xu and colleagues (2016) found that data from the National Adult Tobacco Survey from 2009 to 2010 showed that the use of discounts was most common among people who smoked premium cigarette brands and that, within that group, discount use was most common among people under 65 years of age, non-Hispanic Native Hawaiian and Pacific Islander people, and people with low incomes.

Cornelius and colleagues (2014) analyzed data from the ITC Project's cohort of U.S. adults who smoke and were recruited and followed from 2002 through 2011. That study found an increase in people using discounted cigarette brands after the federal cigarette excise tax was increased in 2009, including older people and people with lower incomes. A study examining 2013–2014 data from the U.S. PATH Study showed that adults with lower incomes were more likely than adults with higher incomes to receive coupons for tobacco products, and that receipt of the coupons through direct mail or email increased the chances that someone who did not smoke would start smoking and decreased the odds that someone who currently smoked would successfully quit (National Institutes of Health [NIH] 2017; Choi et al. 2018). Findings from a study by El-Toukhy and colleagues (2018) that examined national bans on tobacco price promotions, including tobacco product coupons, using data from the 2008 to 2011 ITC Project indicated that national bans could reduce exposure to tobacco price promotions and thereby eliminate their association with smoking behaviors.

Strategies that have been studied less but may warrant further investigation include minimum pack size requirements and fee-based policies. Minimum pack size laws require a minimum number of units per pack and aim to reduce the availability of inexpensive cigarillos and little cigars. For example, although cigarettes are required to be sold in packs of 20 in the United States, similar minimum pack size requirements are not required for other tobacco products. This allows for smaller unit sales and, therefore, lower prices. Smaller pack sizes may affect younger adults who are experimenting with cigar products and styles (Ganz et al. 2021). Given disparities in cigar use among young people (at ages when most tobacco use initiation occurs) (Chen-Sankey et al. 2021; Gentzke et al. 2022) as well as increased cigar use between 2013–2014 and 2018–2019 among Black adults, Hispanic adults, and adults with a high school diploma or less (NIH and FDA 2021), this type of strategy could hold promise for reducing disparities in cigar use.

Fee-based policies include tobacco retail license fees to manage retailer licensing programs or fees directly applied to tobacco products to offset costs incurred by the government for activities such as mitigating cigarette litter and other tobacco waste (Golden et al. 2016). Because the costs associated with these fees may be passed on to the consumer, it is possible that they could affect consumption. However, because licensing fees usually cannot exceed the costs of implementing the services to which they are attached, the resulting increase in tobacco product prices may be too incremental to have an impact on consumption among the general population or among people experiencing disparities.

Taxation and other pricing policies for newer tobacco products. Research on the impact of price strategies, including taxation and prohibitions on price-reducing promotions, pertaining to e-cigarettes and other newer tobacco products is relatively limited compared with the substantial amount of research on the impact of such policies on the use of cigarettes. Most existing studies of this topic have examined the extent to which e-cigarette use may decrease in response to e-cigarette tax or pricing policies or whether other products may be used as substitutes for e-cigarettes (or vice versa) when products are not taxed at parity (Huang et al. 2018; Pesko et al. 2020; Yao et al. 2020; Wang et al. 2021; Cotti et al. 2022; Diaz et al. 2023). Other research has documented the variation in e-cigarette taxation strategies and made preliminary recommendations, based on states' experiences, on effective ways to tax e-cigarettes and other newer tobacco products, such as heated tobacco products (Chaloupka and Tauras 2020; Shang et al. 2021; Dauchy and Shang 2022).

Studies that explore the potential differential impact of pricing policies on the use of noncigarette tobacco products among various population groups and the potential impact to reduce tobacco-related disparities are warranted.

Prohibiting the Sale of Flavored Tobacco Products

In 2014, the Surgeon General's report, *The Health Consequences of Smoking—50 Years of Progress* concluded that a promising endgame strategy for eliminating smoking in the United States was to impose greater restrictions on sales of products, including banning entire categories of tobacco products (USDHHS 2014). As discussed earlier in this chapter, the *Tobacco Control Act* expressly preserves state, territorial, tribal, and local authority to adopt and enforce requirements related to the sale and distribution of tobacco products (*Family Smoking Prevention and Tobacco Control Act* 2009). States, territories, tribes, and localities have enacted a variety of laws that prohibit the sale of tobacco products, such as those that prohibit online sales, the sale of products that have not received premarket authorization from FDA, and the sale of tobacco products altogether (described more fully in Chapter 8) (City and County of San Francisco 2019; Public Health Law Center 2019a; Kong and King 2021).

In the United States, the sales restriction laws most frequently adopted in recent years are those that prohibit the sale of flavored tobacco products (Rogers et al. 2022b; Truth Initiative n.d.). As of February 2024, nearly 200 of the more than 375 local and tribal laws restricting the sale of flavored tobacco products include restrictions on the sale of menthol cigarettes, the only type of flavored cigarette that still can be sold under federal law (Truth Initiative 2023; Campaign for Tobacco-Free Kids 2024b).

In June 2020, Massachusetts became the first state to implement a restriction on the sale of flavored tobacco products that applies to menthol cigarettes (Campaign for Tobacco-Free Kids 2024b). A similar law was passed in California in August 2020 but was put on hold pending the results of a referendum vote in November 2022 (Campaign for Tobacco-Free Kids 2022). The voters approved California's law, which went into effect in December 2022 (Angst et al. 2022; Public Health Law Center 2022a; Campaign for Tobacco-Free Kids 2024a). Courts have found that the *Family Smoking Prevention and Tobacco Control Act* does not preempt local governments from restricting the sale of flavored tobacco products (*National Association of Tobacco Outlets, Inc. v. City of Providence, R.I.* 2013; *Independents Gas & Service Stations Associations Inc. v. City of Chicago* 2015).

As described earlier in this chapter (see "Elimination of Flavors in Tobacco Products" section) and summarized in Tables 7.3 and 7.4, there is strong evidence regarding the role of flavored tobacco products in creating and sustaining tobacco use and the efficacy of policies that prohibit the sale of flavored products.

Further, sales restrictions on flavored products in the United States and Canada have been shown to reduce (1) sales of tobacco products, (2) the odds of youth trying flavored tobacco products, (3) the odds of youth ever using tobacco products, and (4) youth current use of tobacco products, particularly when the restrictions apply to all flavors in all tobacco products (Farley and Johns 2017; Rogers et al. 2017, 2020; Kingsley et al. 2019; Pearlman et al. 2019; Chaiton et al. 2020a; Gammon et al. 2021; Asare et al. 2022; Olson et al. 2022a,b; Satchell et al. 2022; FDA 2022c). Surveys and experimental studies, as well as evaluation studies from Canada and the Netherlands, suggest that prohibiting the sale of menthol cigarettes will lead to (1) declines in menthol cigarette sales and in smoking, (2) increased quit attempts among people who smoke menthol versus nonmenthol cigarettes, and (3) increased likelihood of successful quitting. Further, the effect may be greater among people from minoritized racial and ethnic groups than it is among White people, among women than it is among men, among young adults than it is among older adults, and among other population groups that have disproportionately higher use of menthol cigarettes (Hymowitz et al. 1995; WHO 2016a; Chaiton et al. 2018, 2020c, 2021b; Rose et al. 2019; Bold et al. 2020; Cadham et al. 2020; Chung-Hall et al. 2022; Kyriakos et al. 2022).

A study measuring the potential equity impact of a range of state and local restrictions on flavored sales in the United States found that, as of December 31, 2018, existing policies reached certain population groups experiencing health disparities, such as people of lower SES, young adults, women, and partnered same-sex households

Table 7.4 Studies of the impact of eliminating or prohibiting the sale of flavors in tobacco products on sales of tobacco products

Study	Design, population, and location	Primary outcome(s)	Results
Rogers et al. (2017)	• Pre-post design with control group • Used retail scanner data from The Nielsen Company from January 2010 to January 2014 for New York City, a proximal comparison area surrounding New York City and the United States to examine the effects of the city's policy (passed in October 2009 and implemented in July 2010) of restricting the sales of flavored, non-cigarette tobacco products • Used regression models to assess trends in sales of flavored cigars, smokeless tobacco, loose tobacco, and total cigars	• Assessed the effects on retail sales of New York City's policy to restrict sales of flavored non-cigarette tobacco products • Assessed possible cross-border purchasing and product substitution by consumers	• Unit sales declined significantly (all p <0.01) after policy implementation: – All flavored tobacco products combined: -27.1% – Flavored cigars: -22.3% – Flavored smokeless tobacco: -97.6% – Flavored roll-your-own tobacco: -42.5% • For total cigar sales, implementation was associated with – An immediate and significant decrease of 11.6% in New York City (p <0.05) – A non-significant decrease of 6.4% in the control area – A non-significant increase of 2.1% nationally • Average pre-to-post sales of all cigars: – Decreased 7.4% in New York City (p <0.01) – Increased 9.8% in the control area (p <0.01) – Increased 12.0% nationally (p <0.01)
Chaiton et al. (2019)	• Pre-post design • Repeated data from 2001 to 2016 were reported by manufacturers to Health Canada • Interrupted time series analysis was used to examine the association between nationwide Canadian regulations passed in 2009 banning flavor additives (except menthol) in cigarettes and all cigars under 1.4 g (or any cigar with a filter or non-spiral wrap) and changes in cigar sales	• Estimated changes in sales of cigars with and without flavors • Assessed changes in flavor types over time	• Sales of flavored cigars decreased significantly by 59.2 million units (95% CI, -86.0 to -32.4, p <0.001) in the quarter immediately following policy enactment • Overall sales of cigars decreased 49.6 million units (95% CI, -73.5–25.8, p <0.001) in the quarter immediately following policy enactment
Chaiton et al. (2020b)	• Pre-post design with control group • Analyzed before-and-after data from the ban on menthol tobacco products in Ontario, Canada, in May 2015; the province of British Columbia was the comparison • Used interrupted time series analysis to examine wholesale data from October 2012 to September 2017 from manufacturers in Health Canada	• Assessed the effects of a provincial ban on menthol on wholesale cigarette sales in Ontario • Estimated changes in sales of cigarettes with and without menthol	• In the month immediately after policy implementation in Ontario, sales of menthol cigarettes declined 55 million units (95% CI, -78.5 to -31.5; p <0.01) and overall sales of cigarettes declined 127.8 million units (95% CI, -208.2 to -47.4; p <0.01), both relative to the control • The significant decline in the overall sales of cigarette units in Ontario after policy implementation was followed by a significant increase in the sale of nonmenthol cigarettes: 23.8 million units per month (95% CI, 10.2–37.4; p <0.001) relative to the control during the post-policy period

Table 7.4 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Rogers et al. (2020)	• Pre-post design with comparison group • Used weekly retail scanner sales data from The Nielson Company from January 2012 to December 2016 to evaluate the effects of enforcing restrictions on retail sales of all non-cigarette flavored tobacco products (excluding menthol) in Providence, Rhode Island, over time and compared with the rest of the state • Used regression models to assess changes in sales in Providence and in the rest of the state before and after the restriction policy was implemented	• Assessed the impact of the policy on sales of cigars in Providence and in the rest of the state of Rhode Island	• Average weekly sales of units of flavored cigars decreased by 51% ($p < 0.01$) in Providence but increased by 10% ($p < 0.01$) in the rest of the state • The decline in flavored cigar sales in Providence is attributed to a 93% reduction ($p < 0.01$) in sales of cigars labeled with explicit names of flavors. • Average weekly sales of units of cigars labeled with concept flavor names increased by 74% in Providence and by 119% in the rest of the state (both $p < 0.01$) • Overall sales of cigars decreased 31% ($p < 0.01$) in Providence
Chaiton et al. (2021b)	• Pre-post design with no control or comparison • Economic evaluation used data from wholesale cigarette sales reported by manufacturers to Health Canada to compare sales of cigarettes before and after the implementation of provincial bans of menthol cigarettes starting in May 2015 and of a nationwide ban of menthol cigarettes starting in October 2017 • Conducted interrupted time series regression analyses	• Assessed overall changes in cigarette sales between 2010 and 2018 in association with the implementation of menthol cigarette bans in Canada	• After the bans (province specific from May 2015 to October 2017), sales of menthol cigarettes decreased to 0 in all provinces; the overall percentage change in cigarette sales compared to the same month in the previous year was -4.6% (95% CI, -8.2% to -1.0%; $p = 0.02$) • Wholesale cigarette sales decreased in all 10 Canadian provinces that were studied after the ban on menthol cigarettes; the decrease was statistically significant ($p < 0.05$) in three provinces (Alberta, New Brunswick, and Saskatchewan)

Table 7.4 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Asare et al. (2022)	• Pre-post design with comparison group • Used retail scanner data, from The Nielsen Company, of sales volumes of menthol and non-flavored cigarette brands sold by U.S.-based retailers • Examined, per 1,000 people, state-level sales of packs of menthol, non-flavored, and all cigarettes from January 2017 to July 2021, based on state-level annual population data obtained from the U.S. Census Bureau • Controlled pre-post design with difference-in differences model to examine temporal changes in sales of cigarettes in Massachusetts before (January 2017–May 2020) and after (June 2020–July 2021) a comprehensive ban on menthol-flavored tobacco products and in states without a flavor ban during this period • Analyzed 1,652 observations of data from 4-week sales of cigarettes: 59 observations from Massachusetts and 1,593 observations from comparison states	• Examined whether cigarette sales changed after Massachusetts banned menthol-flavored tobacco products compared with sales in other U.S. states without a flavor ban	• After the comprehensive ban on flavored tobacco products (including menthol) in Massachusetts, the unadjusted 4-week sales of packs of cigarettes per 1,000 people decreased in Massachusetts for menthol (from 404.93 packs to 32.24), non-flavored (from 916.37 packs to 856.79), and all (from 1,321.32 packs to 887.69) cigarettes • The unadjusted 4-week sales of packs of cigarettes per 1,000 people also decreased during this period in comparison states. • After the flavor ban and compared with control states, the adjusted 4-week sales of cigarettes in Massachusetts decreased by 372.27 (95% CI, -428.90 to -315.64, $p<0.001$) packs per 1,000 people for menthol cigarettes but increased by 120.25 (95% CI, 72.61–167.88; $p<0.001$) packs per 1,000 people for non-flavored cigarettes • Overall, the adjusted 4-week sales of all cigarettes (menthol and non-flavored) decreased by 282.65 (95% CI, -356.07 to -209.23; $p<0.001$) packs per 1,000 people in Massachusetts compared with control states.
Kingsley et al. (2022)	• Pre-post design with comparison group • Massachusetts used rigorous enforcement infrastructure to communicate with and provide educational visits to retailers before and after the implementation of a policy to restrict the sales of menthol and other flavored tobacco products • Used retail scanner data from The Nielsen Company, which provided timely surveillance data, to monitor compliance with and evaluate the impact of the policy • Compared data from 3 years before the policy was implemented to 1 year after it began (June 2017–June 2021) in five state-specific markets in Massachusetts and four neighboring control states (New Hampshire, New York, Rhode Island, and Vermont) • Aggregated unit sales of four categories of tobacco (cigarettes, cigars/cigarillos, smokeless tobacco, and vape products) were stratified by flavor category (menthol, other flavor, and unflavored)	• Evaluated the impact of statewide law in Massachusetts that restricted in June 2020 sales of menthol and other flavored tobacco products	• One year after implementation of the policy, overall tobacco sales in Massachusetts decreased 25.4% (from 33,917,494 to 25,315,189 units) compared with the previous year • Compared with the previous year, sales of: – Unflavored tobacco products increased by 10.3% (from 22,609,326 to 24,947,827 units) – Menthol products decreased by 96.9% (from 10,355,518 to 317,863 units) – Other flavored tobacco products decreased by 94.8% (from 952,650 to 49,499 units) • One year after implementation of the policy, total sales of tobacco products in neighboring control states decreased by 1.8% (from 106,863,560 to 104,937,096 units) compared with the previous year

Table 7.4 Continued

Study	Design, population, and location	Primary outcome(s)	Results
Olson et al. (2022b)	• Pre-post design with comparison group • Used NielsenIQ retail scanner data from 2015 to 2019 and single-group, interrupted time series models to compare tobacco sales before and after Minneapolis and St. Paul, Minnesota, expanded existing local sales restrictions on flavored tobacco products to include menthol-, mint-, and wintergreen-flavored products, with exemptions for certain types of stores • Comparison NielsenIQ retail scanner data from 2015 to 2019 for the rest of the state of Minnesota and the total United States was also assessed	• Analyzed unit sales of tobacco products by product category and by flavor for the communities with sales restrictions in Minneapolis and St. Paul and compared those units with the rest of state and with the United States	• Unit sales of menthol cigarettes and menthol smokeless tobacco products decreased in both cities; smaller decreases occurred in comparison areas • Sales of flavored cigars decreased after implementation of the initial flavor policy and decreased further after that policy was expanded in 2019 • Sales of menthol-flavored e-cigarettes increased in both cities and sales of flavored e-cigarettes increased in St. Paul; these increases may be associated with legal sales by exempt retailers or illicit sales by noncompliant retailers
Satchell et al. (2022)	• Pre-post design with comparison group • Used NielsenIQ retail scanner data and difference-in-differences models to compare (a) comprehensive restrictions on flavored tobacco products in Massachusetts in June 2020 and (b) partial restrictions on flavored tobacco products (prohibiting the sale and distribution of flavored e-cigarettes but excluded menthol cigarettes and other flavored combustible tobacco products) in New Jersey in April 2020, with two control states: Virginia and Pennsylvania	• Evaluated the impacts of comprehensive tobacco sales restrictions in Massachusetts and of partial tobacco sales restrictions in New Jersey	• In Massachusetts, sales decreased significantly for all flavored tobacco products, including – Fruit (-99.83%, $p<0.01$), menthol (-98.33%, $p<0.01$), tobacco-flavored (-81.18%, $p<0.05$), and all other flavored (-99.28%, $p<0.01$) e-cigarettes; – Fruit (-95.45%, $p<0.05$) and all other flavored cigars (-99.92%, $p<0.01$); and – Menthol cigarettes (-95.36%, $p<0.01$) • In New Jersey, sales decreased significantly per capita for menthol-flavored e-cigarettes (-83.80%, $p<0.05$), but sales of all other-flavored cigars, including menthol-flavored cigars, increased significantly per capita (380.66%, $p<0.01$)

Note. **CI =** confidence interval.

(Rose et al. 2020a). The study also found that although the policies generally reached African American people, the proportion of African American people protected by a strong policy (i.e., applied to menthol cigarettes and also applied throughout the entire jurisdiction, rather than only near schools or other limited geographic areas) was smaller than the proportion of African American people in the national population. In addition, the study found a notable lack of flavor policies reaching American Indian and Alaskan Native people and Native Hawaiian and Pacific Islander people, population groups that have some of the greatest tobacco use disparities (Rose et al. 2020a).

One study outlined a proposed classification system to examine state and local sales restrictions on flavored tobacco products, guided by relevant studies, legal resources, and experts on flavored tobacco products (Donovan et al. 2021). The authors recommended that policies prohibit the sale of menthol cigarettes and all other flavored tobacco products (e.g., cigars, e-cigarettes, smokeless, hookah) and avoid exemptions for certain types of retailers to prevent youth initiation and reduce tobacco-related disparities, to reduce industry exploitation of policy gaps, and aid enforcement (Donovan et al. 2021).

From a public health perspective, territories, tribes, states, and localities would benefit from continuing to implement comprehensive policies in this arena, despite FDA's stated intent to move forward with rulemaking to eliminate certain flavored tobacco products (cigarettes with menthol as a characterizing flavor and cigars with any characterizing flavors), given the breadth of flavored products on the market, the length of the federal rulemaking process, and potential litigation delays following publication of a final rule (Public Health Law Center 2021a).

Sustained implementation of evidence-based policies at the federal, territorial, tribal, state, and local levels is needed to accelerate the decline of tobacco use in the United States, including among people experiencing tobacco-related health disparities (USDHHS 2014). As discussed earlier in this chapter, there is strong evidence that prohibiting the sale of flavored tobacco products would reduce tobacco-related health disparities. Researchers have proposed a framework for engaging communities and centering equity through each stage of the policy process (Rose et al. 2022b).

The impact of any population-level tobacco control policy will be maximized if access to evidence-based cessation services is ensured (USDHHS 2020). Because people who smoke menthol cigarettes can face more difficulties quitting smoking, it is particularly important to promote, and have accessible, evidence-based cessation treatments when implementing policies prohibiting the sale of flavored tobacco products. Some researchers have suggested that menthol-flavored e-cigarettes may help people who smoke menthol cigarettes transition away from cigarette smoking (Webb Hooper and Smiley 2018; Mok et al. 2023). However, this has not been clinically evaluated. Through the premarket review process, FDA assesses whether allowing the marketing of the menthol-flavored e-cigarette for which an application has been submitted is appropriate for the protection of public health, considering the risks and benefits to the population as a whole and taking into account the likely impact on initiation and cessation.

Cessation treatments, and their promotion, are discussed in further detail elsewhere in this chapter. In addition, it is important to continue to evaluate territorial, tribal, state, and local policies to develop a better understanding of evolving promising practices both with respect to communicating the effectiveness of these policies to community members (Wackowski et al. 2018) and decision makers and with respect to implementing and enforcing the policies in ways that maximize their effectiveness. It also is essential to continue updating and sustaining surveillance systems to monitor tobacco-related health disparities and to better understand which complementary interventions (such as retailer reduction policies) (Combs et al. 2020) may be needed to further reach certain population groups.

Summary and Recommendations

This section described the evidence base regarding the impact of place-based and product-focused retail policy strategies on tobacco use patterns at the population level and among specific groups. Place-based interventions that reduce the number of tobacco retailers increase the time and resources needed to obtain tobacco products and likely have the added benefit of reducing exposure to tobacco advertising and product displays. As such, these interventions can contribute to reducing tobacco use initiation and cigarette cravings and to supporting cessation. Product-focused interventions reduce initiation and consumption, promote quitting, and reduce smoking-induced deprivation among those who quit smoking. Both types of policies can influence social norms around tobacco, further discouraging initiation and improving cessation outcomes.

Retail policies may be more effective and equitable if more than one policy were to be applied in concert with one another and if they were implemented as part of a tobacco retailer licensing program. They may also have a greater impact if accompanied by retailer education to help overcome industry influence (Blackman et al. 2019). Specifically, the evidence suggests that tobacco-free pharmacy policies may have a population-level benefit but not reduce tobacco-related disparities as there are lower odds of pharmacies being located in neighborhoods with high proportions of lower income people or minoritized racial and ethnic groups compared with higher income groups or predominately White neighborhoods. However, these policies could have more impact when combined with other retail strategies, especially given their potential to change social norms regarding tobacco use. The evidence suggests that reducing the number of retailers near schools would help reduce the density of retailers in neighborhoods with greater proportions of people with lower incomes or minoritized racial and ethnic groups, although reducing retailer-to-retailer proximity and capping the number of retailers may be more influential in terms of equitably reducing the number and location of retailers within a jurisdiction. The approach best suited to reduce disparities may vary based on the population demographics of a jurisdiction and the characteristics or type of community (rural, urban, suburban). However, this finding should not deter tobacco control practitioners from taking action to reduce the type, number, and location of tobacco retailers and evaluating and reporting on the impact of these policies on tobacco use among people experiencing disparities.

Significantly raising tobacco prices is the single most consistently effective tobacco prevention intervention for reducing tobacco use in the general population. Further, price increases are particularly effective among youth and people of lower SES. Given that most people initiate tobacco product use as youth, raising tobacco product prices could help reduce tobacco use among all population groups, including those that have higher tobacco use prevalence. Tobacco control practitioners and researchers could further expand the evidence base by working with jurisdictions that raise tobacco product prices to evaluate and report on the impact of these policies among people experiencing disparities in tobacco use. Given the rapidly changing tobacco product market in the United States, research is also needed to better understand the potential differential impacts of pricing policies on the use of e-cigarettes and other noncombustible tobacco products to inform future efforts.

Evidence supports prohibiting the sale of flavored tobacco products to reduce initiation and increase tobacco cessation at the population level. Prohibiting the sale of flavored products is also expected to lead to a reduction in tobacco-related disparities. The effect of menthol cigarette sales restrictions is expected to be particularly impactful among people from minoritized racial and ethnic groups. Although promotion of cessation services can aid with implementation of all tobacco control policies and maximize their impact, it is strongly recommended that cessation services be accessible and promoted when implementing policies that raise the price of tobacco products or that prohibit the sale of flavored tobacco products. It is also recommended that these policies continue to be evaluated and that surveillance systems continue to be updated to allow for ongoing monitoring of progress in reducing tobacco-related health disparities and to better understand whether complementary interventions may be needed to further reach specific population groups.

In recent decades, evidence has been accumulating on the effectiveness of various tobacco control policies in reducing tobacco use in the general population and in some population groups, such as youth or people with lower incomes. The current literature is limited by the scope of populations that are studied and an incomplete understanding of policies that may best complement one another (Main et al. 2008; Hatzenbuehler et al. 2014; Daley et al. 2021b).

Community-Level Efforts and Programs

Critical components of community-level programs for reducing the prevalence of tobacco use include preventing initiation and promoting abstinence and quitting among adults and youth (CDC 2012c). Providing cessation resources and conducting mass media campaigns (CDC 2012c) are two strategies that could reduce tobacco-related health disparities. Unfortunately, according to the American Lung Association's 2023 *State of Tobacco Control* report, 40 of 50 states received an "F" in tobacco prevention and cessation funding, and only 5 states received an "A" (American Lung Association 2023). The American Lung Association's grading of state-level cessation access (based on Medicaid coverage of tobacco dependence treatment, state employee health plan coverage of treatment, and quitline funding) is not much better, with only 6 states receiving an "A" grade, and 24 receiving a "D" or an "F." Moreover, cultural and linguistic adaptations of state-level cessation resources and mass media campaigns for populations that are disproportionately affected by tobacco are somewhat limited.

Tobacco Quitlines

Quitlines were developed, evaluated, and then disseminated beginning in the late 1980s and 1990s in response to perceived health inequities faced by people who smoked, particularly the lack of access to effective support for quitting smoking (Orleans et al. 1991; Lichtenstein et al. 1996). The initial goal of quitlines was to create a system that could provide easily accessible and evidence-based support for all people who want to quit smoking. Evidence regarding the effectiveness of quitlines for cessation was reviewed in the 2020 Surgeon General's report on smoking cessation, which concluded that "proactive quitline counseling, when provided alone or in combination with cessation medications, increases smoking cessation" (USDHHS 2020, p. 11).

The 2020 Surgeon General's report also reviewed the evidence for quitlines as a population-based approach to cessation and concluded that "tobacco quitlines are an effective population-based approach to motivate quit attempts and increase smoking cessation" (USDHHS 2020, p. 11). Multiple studies have found cessation quitlines to be highly cost-effective relative to other commonly used interventions to prevent disease (Tomson et al. 2004; Hollis et al. 2007; Fiore et al. 2008; Reisinger et al. 2019). State quitlines can also play an important role in (1) educating callers about the available coverage from their health insurer for cessation services; (2) referring callers to community-based cessation services; and (3) supporting and increasing provider cessation interventions by being a resource for additional, more intensive cessation counseling (CDC 2014). Taken together, these elements underscore the need for "adequately funding and promoting tobacco quitlines to enable their operations and services to function at levels sufficient to maximize their reach and impact" (USDHHS 2020, p. 660).

In the 1990s and early 2000s, a nationwide quitline infrastructure was created, including a single national portal number (1-800-QUIT-NOW), which launched in 2004 (USDHHS 2020); currently, all 50 states, Washington, D.C., and all U.S. territories have quitlines (Keller et al. 2010; North American Quitline Consortium n.d.c). Quitline funding mechanisms have relied principally on state public health funding (including revenue from state cigarette excise taxes and the Master Settlement Agreement), with supplemental funding from CDC, telecommunications support from NCI, and, in some instances, coordination with private and public health insurers (Lemaire et al. 2015).

Quitlines have potential to reduce or eliminate disparities in access to tobacco treatment "by removing barriers to accessing evidence-based treatment (e.g., cost, location, and time)" (Webb Hooper et al. 2019, p. 500). In addition to addressing inequities in access to cessation services, state-based quitlines have focused on maximizing services for population groups experiencing tobacco-related health disparities (North American Quitline Consortium 2016).

Several studies have found that state-based quitlines generate increased rates of cessation treatment utilization and comparable cessation success rates among key populations experiencing disparities (Abrams et al. 2010; Zhu 2011; Rabius et al. 2012; NCI 2017b). NCI Tobacco Control Monograph 22 determined that quitlines could play a role in decreasing disparities related to both treatment access and cessation, including among racial and ethnic groups (NCI 2017b). For example, a RCT conducted by the American Cancer Society investigating the effectiveness of quitlines found that quit rates were similar between Black and White people (Rabius et al. 2012). Studies in California, Texas, Louisiana, and Washington, DC have shown that proportionately more African American people than White people who smoke use quitlines (Zhu et al. 2011; Rabius et al. 2012). In contrast, rates of use of quitlines were comparable between LGBT adults who smoked and heterosexual adults who smoked, but GBT males who smoked reported less awareness of the availability of quitlines (Fallin et al. 2016).

The benefits to health equity of certain quitline services may depend on the larger availability of cessation support within communities. For example, when NRTs were first introduced, they were seldom covered by health insurers (McAfee et al. 2015), which posed issues for equitable access. In the early 2000s, many quitlines introduced free NRT initiatives in which callers meeting specific eligibility criteria could receive medication via mail order or pharmacy voucher (North American Quitline Consortium 2015). Multiple studies showed that in the environment of relative scarcity for NRT in the United States, this approach markedly increased calls to quitlines and quit success of quitline callers (An et al. 2006; Cummings et al. 2006; Fellows et al. 2007; Hollis et al. 2007). However, studies in other settings have had different results. A study in the United Kingdom a decade later found that the addition of NRT or additional proactive calls to quitline services did not produce the same improvements (Ferguson et al. 2012). One explanation for this finding may be that, unlike in the United States, NRT in the United Kingdom has been strongly integrated into the national health system such that all people who smoked could easily access free NRT from general practitioners and pharmacies (McAfee et al. 2012).

Specific Populations

Populations with Mental Health Conditions

Smoking is two to three times more prevalent among people with mental health conditions (Center for Behavioral Health Statistics and Quality 2020) compared with people without such conditions, and mental health service providers have been less engaged in providing cessation assistance than other healthcare providers (Prochaska et al. 2017). State-based quitlines have indicated that a high percentage of callers report mental health conditions (Hebert et al. 2011; Lukowski et al. 2015; Vickerman et al. 2015a; North American Quitline Consortium 2021). Many state quitlines have created tailored programs for these callers. An evaluation of tailored programs from the two largest quitline service providers suggests that callers with self-reported mental health conditions benefit from both standard and tailored programs, with higher engagement levels observed for the tailored program. However, no statistically significant differences in abstinence rates were observed in a preliminary analysis of cessation outcomes, potentially due to small sample sizes and low response rates (Morris et al. 2021).

American Indian and Alaska Native Populations

American Indian and Alaska Native populations have the highest prevalence of smoking of commercial tobacco of any racial or ethnic group (Cornelius et al. 2022). Many quitlines train counselors in cultural competency, including training regarding American Indian and Alaska Native cultures and ceremonial tobacco use (CDC 2014; North American Quitline Consortium 2021).

Some studies have examined quitline utilization and cessation success rates among American Indian and Alaska Native populations, as well as the use and success rates of culturally tailored interventions. A study of data collected from 2012 to 2014 across 14 states by a multistate quitline service provider showed that 3.5% of callers were American Indian and Alaska Native people (Lukowski et al. 2016); these callers were predominantly American Indian and represented 47 tribes.

A study from the California Smokers' Helpline found that the proportion of quitline callers who were American Indian and Alaska Native was comparable to the American Indian and Alaska Native population in California who smoked (4.6% vs. 4.3%) (Lienemann et al. 2021). This study also compared the engagement and quitting behaviors of American Indian and Alaska Native callers with that of White callers. All callers received the helpline's standard, individualized counseling protocol, which was delivered by staff trained in cultural competency. Compared with White callers, American Indian and Alaska Native callers were more likely to engage in counseling and make a quit attempt (adjusted odds ratio [aOR] = 1.39; 95% CI, 1.06–1.81), and had similar odds of quitting for 180 days (aOR = 0.95; 95% CI, 0.69–1.31).

Another study comparing cessation outcomes between American Indian and Alaska Native and White quitline callers in Arizona found that the two groups had similar rates of 30-day cessation (based on self-report) at 7-month follow-up (Yuan et al. 2020).

Populations of Lower Socioeconomic Status

People who smoke and are of lower SES have been a population group of focus for many quitlines because of their higher prevalence of smoking, barriers to healthcare access, and other factors that can make cessation more challenging for this population group (North American Quitline Consortium 2016). In the face of often limited funding, some state quitlines previously prioritized services for callers who were uninsured or enrolled in Medicaid, providing a more comprehensive set of services (e.g., multisession counseling, free NRT) to these callers (North American Quitline Consortium 2016). Several studies have shown the promising effects of quitlines for smoking cessation among people who smoke and have lower incomes (Vidrine et al. 2013; Bernstein et al. 2016; Slater et al. 2016; Fraser et al. 2017). Another study found that people with lower incomes who called a quitline were less likely to quit using smokeless tobacco than their counterparts with higher incomes (Mushtaq et al. 2015).

Certain programmatic characteristics of quitlines may enhance the acceptability and effectiveness of services for callers of lower SES. For example, state quitlines provide free services to callers and many offer free starter kits of cessation medications, often sent by mail. Quitlines have also experimented with additional ways to increase engagement with callers of lower SES. For example, the California Smokers' Helpline Medi-Cal Incentives to Quit Smoking program offered a modest financial incentive ($20) for calling the quitline (not contingent upon quitting) as well as direct mailings to Medi-Cal (California Medicaid) members and free NRT (Anderson et al. 2018; Vijayaraghavan et al. 2018b). Studies evaluating the Medi-Cal Incentives to Quit Smoking program found that these approaches were effective at increasing quitline calls from Medi-Cal members as well as short- and long-term abstinence, with some differences in engagement with different approaches by race and ethnicity (Saw et al. 2018b; Tong et al. 2018b; Cummins et al. 2023). In addition, increased quitline utilization was seen among women of reproductive age and pregnant women who were enrolled in Medi-Cal (Dove et al. 2018).

Population Groups that Use Menthol

Use of mentholated tobacco products has not been routinely measured during the quitline intake process, so less is known about quitline reach among people who smoke menthol cigarettes. One study of Minnesota's quitline reported that 30.7% of callers who smoked used menthol cigarettes and estimated a reach ratio (percentage of callers in the study who smoked menthol divided by the percentage of people in Minnesota who smoked menthol) of 1.12 (95% CI, 0.99–1.25), indicating proportionate representation of people who smoke menthol among quitline callers (D'Silva et al. 2021). This study also found that callers who smoked menthol cigarettes were more likely to be young, female, Black or African American or Hispanic, and live in an urban area. Service utilization patterns were similar between callers who used menthol and nonmenthol cigarettes, except callers who used menthol cigarettes were more likely to enroll in text messaging. Quit outcomes were not reported.

In 2022, about one-third (35%) of state quitlines reported using a specific treatment protocol for individuals who use menthol products, and 3 state quitlines reported use of an incentive program for these callers (North American Quitline Consortium 2023). Bourne and colleagues (2023) described Vermont's experience with an incentive program which offered a monetary incentive for counseling call completion to those callers that used menthol tobacco products. During the 14-month evaluation period, 58% of enrollees in the menthol incentive protocol completed at least 3 counseling calls compared to 38% of enrollees in the non-incentive protocol. Quit outcomes were not reported.

Quitline Reach and Engagement

In 2015, about half of adults who currently smoked reported a past-year quit attempt (Babb et al. 2017). Among adults with a past-year quit attempt and those who successfully quit in the last 2 years, about 7% reported using counseling and about 30% reported using cessation medication (Babb et al. 2017). Among those who used counseling, 4.1% used a telephone quitline. In an analysis of 2014–2015 TUS-CPS data, an estimated 3.5% of U.S. adults who currently smoked and made a past-year quit attempt used a telephone quitline (USDHHS 2020). Generating calls to quitlines has sometimes been a challenge, and, as found in one Colorado study, interest in calling a quitline may vary based on sociodemographic characteristics, including ethnicity, insurance status, and sexual orientation (Burns et al. 2011).

Some strategies have been employed to increase quitline reach and engagement. For example, mass media campaigns that encourage calls to quitlines have been successful in increasing quitline calls across multiple populations (Davis et al. 2018). Using ads that are directed to specific population groups, such as individuals with mental health conditions, has been successful (Prochaska et al. 2019). In most states, quitline promotions via media campaigns are moderated based on budget allocations which, in turn, correlate to the volume of calls that can be managed. Funding levels for quitline promotion and quitline utilization are highly correlated (R +0.74; $p <0.001$) (Cummins et al. 2007). Additional reviews of mass media campaigns are found elsewhere in this chapter.

Additional strategies to increase calls to quitlines include expansion of services to new communication technologies, language and cultural adaptation and promotion, and healthcare-mediated connection to quitlines. These strategies are discussed in greater detail in the sections that follow. Dyadic engagement, in which assistance is solicited from support people who do not smoke (i.e., family members and friends) during the process of engaging people in quitline interventions, has also been examined as a way of increasing enrollment in quitlines. One study found that as little as one phone intervention with family members and friends who do not smoke more than doubled quitline enrollment among people who smoke (from 6% to 15%) (Patten et al. 2017). Dyadic interventions are explored further elsewhere in this chapter.

Internationally, quitlines have been promoted by requiring that the quitline number be included on graphic warning labels on cigarette packages. Using intake data, a Canadian quasi-experimental pre–post study of seven provincial quitlines examined the effect of including quitline numbers on cigarette package labels on quitline reach and reach equity in three selected populations of concern: young males, those with a high school education or less, and those living in rural areas (Baskerville et al. 2015a). After the new warning labels were introduced, 86% of callers indicated that they saw the quitline number on the labels. Call volume almost tripled, with increased reach equity for young males ($p <0.0001$) and those with a high school education or less ($p = 0.004$). WHO has determined that quitlines can play an important role in overcoming inequities between the availability of cessation treatment support in higher income countries and the lack of availability in lower and middle-income countries (WHO 2011).

Measuring the effect of quitlines via call volume alone may underestimate their population impact. There is evidence of additional effects from the interaction between mass media campaigns and the quitline services promoted in such campaigns. These synergistic effects include increases in population-level quit attempts and success that are markedly larger than those attributable solely to quitline calls (Ossip-Klein et al. 1991; McAfee et al. 2013). Increased quit attempts motivated by campaign exposure but made without calling the quitline are the primary driver of these population effects. This benefit is explored in greater depth elsewhere in this chapter.

Technology-Mediated Quitline Services

The revolution in digital communication technologies has created both opportunities and challenges for quitlines in engaging populations affected by tobacco-related health disparities. Opportunities include technology-mediated services that can make it even easier for people to get immediate, customized, and interactive cessation support. Such services include web-based, texting, and chat programs, as well as emerging approaches such as smartphone applications and social media (USDHHS 2020). The evidence regarding the effectiveness of cessation interventions delivered using these technologies was reviewed in the 2020 Surgeon General's report, which concluded that web- and text-based interventions are effective in increasing smoking cessation (USDHHS 2020). Challenges in leveraging digital communication technologies to engage groups disproportionately affected by tobacco-related disparities include state variation in service availability, uneven availability of broadband Internet service, and differential engagement with these service modalities among different population groups.

Many state quitlines have incorporated a suite of digital cessation support options (Zbikowski et al. 2008) and offering multiple modality options is now a common practice for most U.S. state quitlines (North American Quitline Consortium n.d.a). For example, in 2014, ClearWay Minnesota changed its suite of quitline services so that clients could choose to use the telephone quitline or one or more individual QUITPLAN services including an NRT starter kit, text messaging, an email program, or a quit guide. In addition, the quitline services website was redesigned, online enrollment was added, and a new advertising campaign was created and launched. An evaluation of the impact of the changes to the program found substantial increases in the quitline's reach, with a 169% increase in enrollment compared with the year prior to the QUITPLAN model, as well as strong quit outcomes (Keller et al. 2016). Similar program expansion and promotion in two additional states (Oklahoma and Florida) was also found to be associated with increased treatment reach (Keller et al. 2016).

The impact of increasing reliance on digital delivery of cessation support on tobacco-related health disparities is unclear. Initial studies of web-based interventions suggest that when offered multiple options for accessing services, most quitline callers still opt for live phone services (Zbikowski et al. 2008), and that minoritized racial and ethnic groups tend to not use web-based quitline services, as described next.

In a 2015 study of enrollment and utilization patterns in five state quitlines that offered web-only services as an option, Webb Hooper and colleagues (2019) found lower rates of web enrollment and web-only service utilization among African American, Hispanic, and American Indian and Alaska Native clients compared with White clients. In the same study, utilization of web-only services was also associated with increasing level of education and annual income and inversely associated with age.

A different study of subscribers to NCI's text message-based cessation support program, SmokefreeTXT, examined program enrollment, engagement, and cessation by race (N = 8,487) (Robinson et al. 2020). Program enrollment rates matched race proportions of people who smoke in the general population. Black subscribers were more likely to complete the program than White subscribers (aOR 1.71; 95% CI, 1.43–2.06). Program engagement (assessed by responsiveness to program prompts) and end-of-program abstinence were lower among Black subscribers (abstinence: 4% for Black people and 7% for White people), though quit status assessment completion rates were low. Such differential utilization of, and engagement with, digital service options, as seen in these studies, has the potential to exacerbate disparities in quitting, particularly if quitlines begin to rely more heavily on potentially less expensive digital services in the face of diminishing budgets (Saul et al. 2012).

Language and Culture Adaptations

Increasing linguistically and culturally appropriate cessation services is another potential way to increase quitline engagement among populations disproportionately affected by tobacco. Most state quitlines can provide cessation support in multiple languages via interpreters (North American Quitline Consortium 2016). In addition, language-specific quitlines are available in Spanish and Asian languages, both of which have been successfully promoted in linguistically and culturally relevant ways (see "Mass Media Campaigns" section for more detail).

The Spanish Language quitline portal (1-855-DÉJELO-YA) was developed as a companion to 1-800-QUIT-NOW and was integrated into the existing infrastructure of state quitline service providers; it is promoted with Spanish-language ads in Spanish media channels. A community-based quality improvement process was used to develop and deliver a media campaign promoting DÉJELO-YA in New Mexico. Pre–post quitline data showed that the project was associated with a 31% increase in Spanish-speaking calls to DÉJELO-YA, compared with a 3% increase among non-Hispanic calls to the English quitline (Dilley et al. 2020). Quit success increased from 33% to 46% among Spanish speakers but did not change among English speakers. Another study in Colorado examined quitline call volume before and during a culturally relevant Spanish-language media campaign that promoted the quitline and found increased quitline calls from Latino people during the campaign; furthermore, more Latino callers to the quitline spoke Spanish during the campaign compared with Latino callers before the campaign (Burns and Levinson 2010).

The Asian language quitline, currently operated by the University of California, San Diego with funding from CDC under the name "Asian Smokers' Quitline" (ASQ), provides cessation services across the United States in Mandarin, Cantonese, Korean, and Vietnamese. Before formation of the Asian language quitline, Zhu and colleagues (2012) conducted an RCT in California which demonstrated the efficacy of culturally tailored and language-adapted telephone-based counseling among Asian American people who smoked (see "Individual Interventions" section for more detail).

A more recent study (Chen et al. 2021) examined the service utilization and outcomes of the ASQ from 2012 through 2019 and found that the 14,073 enrollees learned of the quitline primarily from Asian-language newspapers; 37% of callers were uninsured and 74% opted to use quitline-supplied pharmacotherapy. The 6-month abstinence rate was 28.6%. A California study found that culturally appropriate and community-focused promotion of the ASQ resulted in increased calls to the quitline by Medi-Cal (California Medicaid) enrollees. Promotion efforts included in-language materials from the Medi-Cal Incentives to Quit Smoking project (including direct-to-member mailings), utilizing the California quitline's Asian print media campaign, press releases to ethnic media incorporating Lunar New Year messages, and community-based outreach such as in ethnic supermarkets (Saw et al. 2018b).

Healthcare Connections to Quitlines

Healthcare referrals to quitlines, in which a clinician provides a patient with direct or indirect connection to a quitline, is another strategy to increase quitline engagement and connect people to evidence-based cessation supports. Recent community-based healthcare system trials have documented quitline enrollment rates at markedly higher levels than those seen when quitlines are promoted in standard fashion. One example of a health system-level strategy designed to link patients to quitline cessation resources is the Ask, Advise, Connect (AAC) model. Using this model, trained medical staff "Ask" patients about their smoking status, "Advise" those who smoke to quit, and offer to immediately "Connect" individuals with quitlines through an automated link within the patient's electronic health record (EHR).

This approach was evaluated in a 34-month implementation trial from 2013 to 2016. The trial was conducted in a large safety-net healthcare system with 13 community clinics that provided care to patients who were predominantly from minoritized racial and ethnic groups. The proportion of all identified adults who smoked who enrolled in treatment was 11.8%, which was high relative to engagement rates for more traditional referral-based approaches (Pineiro et al. 2020). Self-reported abstinence at 6 months was 16.6%, and biochemically verified abstinence was 4.5%—in line with reports from other studies of quitline-delivered treatment (Pineiro et al. 2020).

Similar results were found in a trial conducted in 30 primary care clinics in which reach and effectiveness were measured before, during, and after the implementation of EHR workflow changes to facilitate electronic quitline referrals. Quitline referrals increased from 1.7% to 11.3%. Referral rates were especially high for women, African American patients, and patients enrolled in Medicaid. Referral rates diminished over the 8 months after the implementation period but remained higher than they were prior to the project (Baker et al. 2021).

Summary and Recommendations

The literature on the effectiveness of quitlines for cessation highlights the accomplishments and potential of quitlines to reduce disparities in access to cessation services. Evidence also indicates that the reach and effectiveness of quitlines can be as good, or better, for key population groups experiencing tobacco-related disparities as they are for the overall population of people who smoke. However, quitline use by some population groups may be limited by barriers to adoption and maintenance, and in particular, restrictions on funding for state-based programs and policies or programs designed to limit barrier-free access to the range of quitline services including live support, digital support, and medications. Such barriers may decrease the impact of quitlines on increasing successful quitting. Accordingly, more research is needed to determine the best approaches and policies to maximize the reach, utilization, and effectiveness of quitlines, including both digital and telephonic resources, among diverse population groups.

Evidence to date strongly suggests that traditional phone and digital quitline services, as currently promoted and delivered, have the capacity to reach and benefit populations who experience tobacco-related health disparities. Although there is likely some additional benefit to be gained from further research and implementation of services with additional cultural specificity, increasing the reach and dissemination of existing proven services, with special attention to ensuring use by priority populations, may be the most important current health equity task for quitline services. Further understanding of the policy, resource, promotional, and programmatic barriers to accomplishing this task is critical.

In the ensuing decade, the primary focus will not be on whether quitlines, including new digital services, can reduce health disparities, but rather on how to ensure that the mix of services provided by quitlines and the promotion of such services and of quitlines are designed, evaluated, and delivered in a manner that maximally leverages their potential to reduce tobacco-related health disparities. Future evaluations of cessation services delivered via quitlines should include data collection and analysis by race and ethnicity and SES, as well as other disparity population group characteristics of importance such as age, sexual orientation, gender identity, mental health condition status, and rural residency.

In addition, analyses should examine how the reach, engagement, and effectiveness of quitlines are affected by (1) the communication channel used to provide services (e.g., live phone, text messaging, web-based, smartphone app, or automated interactive voice response); (2) intervention elements and characteristics; and (3) dosing effects, particularly among priority populations. In some cases, effective evaluation may require oversampling of smaller population groups, such as American Indian and Alaska Native people, Asian people, and people who identify as LGBTQI+ to have sufficient power to detect or rule out differences in reach or effectiveness.

Other policy interventions that may improve quitline use include changes in healthcare systems to prompt, guide, and incentivize tobacco cessation treatments; integration of access and feedback between healthcare systems and quitline service providers (including with referral capacity through EHRs); enhanced capacity of quitlines to leverage health insurance coverage to pay for services and decrease reliance on public health funds; promotion of evidence-based treatments via technology-based or technology-assisted platforms and/or the integration of quitline services with other technologies; increased dose and duration of media campaigns that promote quitlines as a cessation resource; increased funding of state tobacco control programs; and research to improve the long-term effectiveness of evidence-based treatments via individually tailored approaches (CDC 2014, 2020; Athar et al. 2016).

The 2020 Surgeon General's report on smoking cessation underscores the need to enhance the reach of existing evidence-based programs, particularly for populations with distinct needs (USDHHS 2020). Achieving this objective is likely to require the universal provision of comprehensive quitline services with robust promotion and sufficient funding so that these services can be obtained by all who need them.

Mass Media Campaigns

This section addresses the role of mass media campaigns in decreasing tobacco-related health disparities. Historically, media campaigns have often been a part of broader population-based tobacco control programs that discourage smoking initiation among youth and young adults, encourage quitting among people who smoke (NCI 2008; USDHHS 2014, 2020), and strengthen social norms against tobacco use (NCI and WHO 2016). National evidence reviews conducted over the past two decades have found that media campaigns can prevent smoking initiation and increase smoking cessation at the population level (Table 7.5). Most recently, the 2020 Surgeon General's report summarized evidence showing that smoking cessation can be increased by implementing high-impact mass media campaigns that have sufficient reach, frequency, and duration (USDHHS 2020).

Table 7.5 Key conclusions, findings, and recommendations about mass media campaigns

Source	Conclusions, findings, or recommendations
Conclusions from Surgeon General's Reports	
USDHHS (1998)	"Numerous strategies are needed to control tobacco use among racial/ethnic youths: restricting minors' access to tobacco products, establishing culturally appropriate school-based programs, and designing mass media efforts geared to young people's interests, attitudes, expectations, and norms. Recent provisions of the Synar Amendment, designed to prevent minors' access to tobacco products, and the FDA regulations aimed at reducing the access to and appeal of tobacco products to young people are intended to reduce tobacco use among all youth, including members of racial/ethnic minority groups" (p. 14).

Table 7.5 Continued

Source	Conclusions, findings, or recommendations
USDHHS (2012)	"Coordinated, multicomponent interventions that combine mass media campaigns, price increases including those that result from tax increases, school-based policies and programs, and statewide or community-wide changes in smoke-free policies and norms are effective in reducing the initiation, prevalence, and intensity of smoking among youth and young adults" (p. 8).
USDHHS (2014)	"The evidence is sufficient to conclude that mass media campaigns, comprehensive community programs, and comprehensive statewide tobacco control programs prevent initiation of tobacco use and reduce the prevalence of tobacco use among youth and adults" (p. 12).
USDHHS (2020)	"The evidence is sufficient to infer that mass media campaigns increase the number of calls to quitlines and increase smoking cessation" (p. 12). "The evidence is sufficient to infer that comprehensive state tobacco control programs reduce smoking prevalence, increase quit attempts, and increase smoking cessation" (p. 12). Mass media campaigns are part of comprehensive state tobacco control programs.
Findings from National Cancer Institute Monographs	
NCI Tobacco Control Monograph 19 (2008)	"Evidence from controlled field experiments and population studies shows that mass media campaigns designed to discourage tobacco use can change youth attitudes about tobacco use, curb smoking initiation, and encourage adult cessation. The initiation effect appears greater in controlled field experiments when mass media campaigns are combined with school- and/or community-based programming. Many population studies document reductions in smoking prevalence when mass media campaigns are combined with other strategies in multicomponent tobacco control programs" (p. 12).
NCI and WHO Tobacco Control Monograph 21 (2016)	"Well-designed and -implemented anti-tobacco mass media campaigns are effective in improving understanding about the health consequences of tobacco use, building support for tobacco control policies, strengthening social norms against tobacco use, and reducing tobacco consumption among youth and adults" (p. 13).
NCI Tobacco Control Monograph 22 (2017b)	Among youth, "[A]nti-tobacco TV campaigns can effectively reduce smoking prevalence among the general population, but there is less evidence about their effectiveness among different population groups. For youth, communication inequalities may contribute to differences in awareness of tobacco prevention campaigns across groups but may not affect receptivity to campaigns or the impact of campaign messaging on attitudes, beliefs, and behaviors. … Low-SES youth and racial/ethnic minorities are receptive to campaign messages, and campaigns can influence knowledge, attitudes, and beliefs among diverse groups. …[D]ifferences in message processing should be considered in campaign development. Further, campaigns with the strongest short- and long-term behavioral effects among low-SES and racially diverse youth were often complemented by community, school, or state programs that supplemented campaign messaging with other tobacco control programming" (pp. 418–419). Among adults, "[C]ampaigns with (1) high exposure, targeted media efforts; (2) additional tobacco-related program components; or (3) language-appropriate and/or culturally tailored messaging can be effective and may reduce potential communication inequalities that lead to gaps in tobacco-related knowledge. Additionally, campaigns with graphic and emotionally arousing messages can also stimulate quitting among racial/ethnic minorities and low-SES groups. By ensuring that additional supportive resources are available, such as quitline support, free NRT, and other community-based programs and policies, campaign effectiveness can be improved among diverse populations" (p. 419).
Recommendations from Community Preventive Services Task Force	
Community Preventive Services Task Force (2013)	The Community Preventive Services Task Force recommends "mass-reach health communications interventions based on strong evidence of effectiveness in decreasing the prevalence of tobacco use; increasing cessation and use of available services such as quitlines; and decreasing initiation of tobacco use among young people."

Notes: **FDA =** U.S. Food and Drug Administration; **NRT =** nicotine replacement therapy; **SES =** socioeconomic status.

Given their proven positive impact on tobacco prevention and control at the population level, the role of mass media campaigns in decreasing tobacco-related health disparities is especially critical to examine. From a historical perspective, the 1998 Surgeon General's report, *Tobacco Use Among U.S. Racial/Ethnic Minority Groups*, indicated that mass media campaigns were an effective strategy to address disparities, but the report cautioned that campaigns for "racial and ethnic youth" should be "geared to young people's interests, attitudes, expectations, and norms" (USDHHS 1998, p. 14). The 2012 Surgeon General's report cautioned that although tailoring message content to specific population groups may be more persuasive, the finite resources of most public health campaigns mean that the extent of tailoring and segmentation "needs to be weighed carefully against goals of maximizing campaign exposure" (USDHHS 2012, p. 635).

NCI Tobacco Control Monograph 22 provides the most recent comprehensive and systematic review of the evidence related to tobacco-related health disparities and tobacco countermarketing campaigns, including summary findings from literature published between 1990 and 2014. The monograph concluded that mass media campaigns are effective at influencing tobacco-related knowledge, attitudes, and beliefs, as well as stimulating quitting for the general population, minoritized racial and ethnic groups, and socioeconomically disadvantaged populations (NCI 2017b).

The review in NCI Tobacco Control Monograph 22, as it pertained to adults and tobacco-related disparities, found that "campaigns with (1) high-exposure, targeted media efforts, (2) additional tobacco-related program components, or (3) language-appropriate and/or culturally tailored messaging can be effective and may reduce potential communication inequalities that lead to gaps in tobacco-related knowledge" (NCI 2017b, p. 419). The monograph also emphasized that mass media campaigns are most effective at increasing cessation for socioeconomically disadvantaged populations when both state and community-based programs that support behavior change complement countermarketing media campaign efforts.

NCI Tobacco Control Monograph 22 also reviewed several health disparity frameworks, including the "Structural Influence Model," a theoretical framework that explains how communication may differentially affect tobacco use among minoritized racial and ethnic groups. Based on social epidemiologic and media theories, this framework posits that "social determinants [of health] (such as SES and geographic location) act through social networks and demographic characteristics (such as age and gender) to influence how individuals access and comprehend health information" (NCI 2017b, p. 363). An implication of this framework is that, given how demographic characteristics (such as age) inform how media channels are accessed (e.g., adolescents tend to use different social media applications than adults do), rigorous evaluation studies are warranted to inform the reach and effectiveness of tobacco countermarketing mass media campaigns for priority populations.

Numerous mass media campaigns have targeted a broad array of audiences, ranging from the general public to people who use tobacco products (usually with a focus on cigarettes) to a range of racial and ethnic, sexual orientation and gender identity, and lower SES population groups. Campaigns have been conducted at different levels of intensity and duration, by a variety of governmental and nongovernmental organizations, and with different aims, including preventing the initiation and progression of smoking in youth and young adults, promoting smoking cessation and use of evidence-based support, increasing support for tobacco control policies, and shifting the attitudes of community members toward denormalizing tobacco use and tobacco industry practices (NCI 2008).

Some members of priority populations may have less exposure to campaign messages, insufficient literacy to process information from a campaign, or inadequate resources to take action toward quitting. These inequalities may, in turn, influence tobacco product use, initiation, and cessation among diverse population groups. The intersection of multiple sociodemographic categories (such as an individual who identifies as LGBTQI+ and Multi-Race) may further complicate tobacco-related health disparities (Potter et al. 2021). Intersectionality may make it more challenging to develop and deliver targeted media campaigns and community-based interventions based on a single sociodemographic characteristic because people who use tobacco may identify with multiple population groups.

This section summarizes the characteristics of tobacco countermarketing mass media campaigns from the last 15–20 years, including their general and tailored strategies and specific targeted approaches to communication. The section also reviews evidence from critical studies regarding countermarketing media campaigns. Because the published literature is limited, this section does not review in-depth evidence regarding digital and social media campaigns as they relate to tobacco-related health disparities. The section concludes with recommendations for building the evidence base for using mass media strategies as part of a comprehensive effort to reduce and eliminate tobacco-related health disparities.

Strategies for Tobacco Countermarketing Media Campaigns

CDC defines tobacco countermarketing as media campaigns that use existing commercial marketing strategies to reduce the prevalence of tobacco use (CDC 2003). Currently, media campaigns employ several strategies to address disparities in tobacco use. Campaigns aimed primarily at geographically defined populations (such as states) generally use one or more of the following campaign development approaches to address tobacco-related health disparities: (1) crafting ads that include strong priority population representation, with messaging developed and tested to ensure appeal and generate action across most sociodemographic population groups of focus; (2) using tailored or modified messaging in some ads (including language translation and/or cultural specificity) to enhance reach and effectiveness for specific priority populations; and (3) designing a campaign to specifically address tobacco use solely among members of a disproportionately affected population group. In addition to the development of countermarketing ads and materials, all three of these approaches require careful attention to purchasing strategies for ad placement to ensure that ads are seen by target priority populations, along with evaluation strategies that include outcomes among priority populations (Cowell et al. 2009; Richardson et al. 2011).

NCI Tobacco Control Monograph 22, which summarizes an evidence review through 2014, concluded that "the available evidence is inconsistent about the degree of effectiveness of media campaigns among socioeconomically disadvantaged populations, particularly the most highly disadvantaged" (NCI 2017b, p. 366). Similarly, the monograph's review of evidence on targeted campaigns through 2014 specifically designed for diverse racial and ethnic groups was inconclusive and limited. Emerging research and practice support the idea that campaigns, whether general or targeted, should be adapted to better disseminate tobacco prevention and control messages among socioeconomically disadvantaged populations (NCI 2017b).

Targeted communication approaches may be based on demographic characteristics; for example, these campaigns may target people according to their age, gender, race or ethnicity, geographic region, or a combination of characteristics. Innovative approaches that do not focus on demographic characteristics, such as targeting people by psychosocial factors or their use of specific tobacco products, are emerging and have shown some positive effects in addressing tobacco use among disproportionately affected groups; they may also affect multiple sociodemographic groups simultaneously (Ling et al. 2014; Fallin et al. 2015b; Kalkhoran et al. 2016; Kowitt et al. 2018; Wagner et al. 2018).

Communication Approaches for Specific Focus Populations

Objectives related to reaching populations affected by health disparities have been included in the development and execution of many of the large-scale, broad-based media campaigns of the twenty-first century (Vallone et al. 2009; McAfee et al. 2017; Saw et al. 2018b; Guillory et al. 2022). There is also growing experience with smaller campaigns that are focused on a particular population group, referred to in this section as focus populations. Focus populations for media campaigns can include groups of a particular age, race or ethnicity, sexual orientation or gender identity, mental health condition, SES, and geographic area, or combinations of these groups. Mass media campaigns in the twenty-first century are designed to reach large groups of people through multiple media channels, including newer channels such as digital and social media. Although ad buys on various platforms typically require specification of a primary audience, this does not necessarily preclude reach to other groups, as there may be overlap in media viewing patterns between groups.

This section first presents a media campaign topography based on age, as this is the largest differentiator in most national and state campaigns, particularly with respect to campaign goals (initiation prevention vs. cessation) and media channels. Some population groups' findings are presented within the context of the age divisions. Following this section, additional findings are presented in sections on race and ethnicity and mental health conditions. The largest evidence base for effectiveness of specific approaches is for campaigns based on (1) age and (2) race and ethnicity.

Media Campaigns Designed to Reach People of Specific Ages

Among campaigns directed at specific age groups, those that aim to prevent initiation of tobacco use among youth and young adults have received considerable attention, in part because people in this developmental period are vulnerable to both the initiation and establishment of smoking. These campaigns have also received strong public and policymaker support because of the documented targeted marketing practices of the tobacco industry toward youth (NCI 2008). Although most prevention campaigns aim primarily to influence youth, most cessation campaigns aim primarily to reach adults.

Youth. Several national countermarketing campaigns have focused on youth under 25 years of age. The *Truth* campaign and *The Real Cost* campaign are reviewed in this section in addition to a brief discussion of state-based campaigns focused on youth.

Truth. The *Truth* campaign from the Truth Initiative (until 2015, the American Legacy Foundation) is a national campaign focused on preventing smoking initiation. A 2009 evaluation showed that this campaign effectively prevented smoking initiation among people who never smoked who were Black or African American but not among people who never smoked who were members of other racial and ethnic groups (Cowell et al. 2009). Black and Hispanic youth and young adult viewers of the campaign's materials discussed the campaign with friends and family members more frequently than did non-Hispanic White youth and young adults (Dunlop 2011). Lower awareness of the campaign was found among people with lower levels of education and among female youth (Vallone et al. 2009). On the other hand, a 2018 evaluation of the Truth Initiative's *Finish It* campaign (Hair et al. 2019), which ran from 2014 to 2016, found no moderating effect of key demographic factors (including age, gender, race and ethnicity, or parent education) on the relationship between awareness of the *Truth* ads and intentions to smoke (Vallone et al. 2018).

The Real Cost. In 2014, FDA launched *The Real Cost* campaign, the first federally funded education campaign to prevent and reduce tobacco use among youth 12–17 years of age who did not smoke or were tobacco experimenters. Since its launch, several evaluations have shown that the campaign has had a successful overall impact, as it prevented an estimated 380,000–587,000 adolescents from initiating smoking from 2014 through 2016 (Duke et al. 2019), influenced tobacco-related beliefs among youth nationwide (Huang et al. 2017b), and demonstrated cost-effectiveness (MacMonegle et al. 2018).

In an observational longitudinal study, Duke and colleagues (2019) noted that the campaign was associated with a decreased risk of smoking initiation among youth overall, but not among Hispanic youth compared with non-Hispanic White youth. In a separate national study, Huang and colleagues (2017b) found that, although most youth reported negative attitudes toward tobacco products after seeing or hearing the ads, Black youth who recalled *The Real Cost* campaign slogan were less likely to report negative attitudes toward tobacco products than were White youth (aOR = 0.46; 95% CI, 0.25–0.85). Separately, Delahanty and colleagues (2019) found in a national survey that, 3 years after the campaign's launch, more than half (58.5%) of middle and high school students reported awareness of *The Real Cost* campaign. Campaign awareness, however, varied by race and ethnicity, with the highest awareness among non-Hispanic White students and lower awareness among Hispanic and non-Hispanic Black students ($p < 0.001$) (Delahanty et al. 2019). Taken together, these results suggest a need for increased reach of tobacco prevention messages to Hispanic and Black youth.

To complement *The Real Cost* in the general youth market, FDA has also funded several tailored campaigns designed to reduce tobacco-related disparities among youth and young adult populations who are at risk. For example, *Fresh Empire* (FDA 2018b) targeted at-risk adolescents from priority populations (including Black or African American, Hispanic, Asian American, and Pacific Islander adolescents) who identify with "hip-hop culture." Campaign evaluations have demonstrated reach among target populations, greater recall among the focus populations, and youth-reported negative attitudes toward tobacco products after seeing campaign ads (Kowitt et al. 2018; Guillory et al. 2020, 2022). One evaluation study demonstrated that adolescents 13–17 years of age who recalled ads from multiple campaigns (e.g., *Fresh Empire, The Real Cost*) had higher odds of reporting negative feelings toward tobacco products, suggesting that cumulative crossover campaign exposure may have positive effects (Kowitt et al. 2018). Another campaign, *This Free Life* (FDA 2022d), which focused on LGBTQI+ people 18–24 years of age, reached and generally resonated with the young adult LGBTQI+ population group (based on perceived ad effectiveness and brand equity) and had a small effect on beliefs involving the social aspects of smoking (Crankshaw et al. 2022). In addition to the campaigns described in the published literature, FDA launched *Next Legends* in 2022, which focuses on youth e-cigarette prevention among American Indian and Alaska Native youth 12–17 years of age (FDA 2022b). This campaign uses tailored messaging and branding designed to reach American Indian and Alaska Native youth using a largely digital-based media approach.

State-level campaigns. State governments have also invested in campaigns to prevent tobacco use among youth. For example, North Carolina's *Tobacco. Reality. Unfiltered.* (TRU) campaign was implemented in 2004–2009 (Kandra et al. 2013). Awareness of this campaign was significantly associated with substantially lower smoking experimentation and current smoking among high-sensation-seeking youth (Kandra et al. 2013). Elsewhere, a randomized community trial of a youth prevention media campaign in four states found no impact on the prevalence of youth smoking overall (Flynn et al. 2010). However, marginal effects were seen on the prevalence of smoking and on the psychosocial mediators of smoking among Hispanic youth, suggesting that the novelty of targeted messaging may have had a greater impact on this underserved population group, even though no effect was seen among African American youth (Flynn et al. 2010). However, the ability to detect a difference in this population-level trial was weakened by concurrent real-world non-research-related mass media campaigns and tobacco control activities.

Adults. A 2017 Cochrane review of media campaigns to promote smoking cessation found evidence that such campaigns were generally effective, with no consistent variation in effect strength by age, gender, education, or race and ethnicity (Bala et al. 2013, 2017). Notably, most campaigns that focused on adults have largely been designed to reach people 55 years of age and younger. Because older adults may respond differently to campaign messaging (McAfee et al. 2013; Cataldo et al. 2015), this may have relevance to age-related disparities in campaign reach and impact (Isenberg et al. 2016; McAfee et al. 2021); however, research is limited in this area. Campaigns have often had secondary foci related to other population groups disproportionately affected by commercial tobacco. The *BecomeAnEX*, *Tips From Former Smokers*, and *Every Try Counts* campaigns are reviewed in this section.

BecomeAnEX. The first major adult, national, branded tobacco countermarketing campaign of the twentieth century, *BecomeAnEX* was launched in 2008 by the American Legacy Foundation (now Truth Initiative) with funding from the Master Settlement Agreement. The campaign and its evaluation focused on people who smoked and were between 25 and 49 years of age (Vallone et al. 2011b). The campaign also had a goal of encouraging quitting among manual labor and service ("blue collar") workers and people with lower incomes who smoked, with an emphasis on diverse racial and ethnic groups. Ad placement emphasized media outlets that were popular with the target audiences. Evaluations focused on campaign effects in a cohort of 4,000 adults (18–49 years of age) who smoked in designated media markets with campaign media buys and examined baseline and post-campaign attitudes, awareness of exposure to ads, and quit behaviors (Vallone et al. 2011a). Quit attempt outcomes relied on individual recall of exposure to campaign ads and were thus subject to recall bias. People recalling exposure to campaign ads were 24% more likely to have made a quit attempt ($p = 0.048$).

Tips From Former Smokers. CDC launched the first federally funded national tobacco education campaign, *Tips From Former Smokers* (*Tips*), in March 2012 (McAfee et al. 2013), with the goal of encouraging and supporting smoking cessation among people 18–54 years of age. The *Tips* campaign features stories from real people and their families who are living with serious long-term health effects from smoking and exposure to secondhand tobacco smoke. All ads from this campaign include the promotion of evidence-based smoking cessation resources (e.g., the national quitline portal).

Research suggests that, from 2012 to 2018, an estimated 1 million people who smoked quit and more than 16.4 million people attempted to quit smoking because of the *Tips* campaign (Murphy-Hoefer et al. 2020). In addition, studies of the *Tips* campaign have found increases in calls to quitlines (CDC 2012d, 2013; McAfee et al. 2013; Zhang et al. 2014, 2015, 2016a,b, 2021; Davis et al. 2015; Duke et al. 2015b; Vickerman et al. 2015b; Mann et al. 2020); visits to campaign websites (CDC 2012d, 2013; Davis et al. 2016; Kim et al. 2016a; Shafer et al. 2016); changes in knowledge, beliefs, and cognitions (Duke et al. 2015b); and campaign cost-effectiveness (Xu et al. 2015; Maciosek et al. 2020; Shrestha et al. 2021).

The *Tips* campaign has several attributes that make it particularly relevant when considering the impact of media campaigns on priority populations. These attributes include the *Tips* campaign's long duration, as it has run nationwide for 12–24 weeks annually for more than 10 years with high levels of ad reach and messaging frequency; inclusion of a diverse group of campaign participants, many of whom are from population groups that are disparately affected by tobacco use (CDC n.d.e); use of multimodal media channels, including specific placement designed to reach priority populations (USDHHS 2014); development of culturally and linguistically tailored ads and resources; partnership with governmental, nongovernmental, and healthcare entities to extend the campaign's relevance, reach, and promotion of cessation resources; and a record of rigorous evaluation and research.

Several evaluations of the *Tips* campaign have investigated the campaign's impact on specific population groups. One such study looked at the association between the *Tips* campaign's media dose (via Gross Rating Points [GRPs]) and cessation behaviors using data from 2012 through 2015. This study found an association between GRPs and increased quit attempts overall. As the study was not explicitly powered to detect campaign effects among individual population groups, the authors conducted exploratory analyses to test for interactions between the Tips campaign GRPs and population groups of interest. No statistically significant interactions between GRPs and race or ethnicity, education level, or mental health status were observed (Davis et al. 2018).

Another study involving a large, nationally representative sample of U.S. adults who smoke demonstrated an association between an ad's perceived effectiveness score and prospective quit attempts (Davis et al. 2017). This study reported that non-Hispanic Black and Hispanic adults scored ads higher in perceived effectiveness regardless of the race and ethnicity of the ad participant, and that message characteristics, such as graphic visuals and emotional content, may play a more important role in perceived effectiveness than the race and ethnicity of ad participants.

Additional research has demonstrated that the *Tips* campaign is associated with increased quit attempts among specific populations of people who smoke, including African American people (McAfee et al. 2017), pregnant women (England et al. 2017), people with mental health conditions (Prochaska et al. 2019), and those with lower educational attainment (Davis et al. 2017). For example, a longitudinal pre–post cohort study of the 2012 *Tips* campaign (McAfee et al. 2013) modeled changes in quit attempts before and after the campaign for separate racial and ethnic groups; results from the models demonstrated significant pre–post changes in quit attempts among both African American people who smoked (OR = 1.61; 95% CI, 1.01–2.55) and White people who smoked (OR = 1.23; 95% CI, 1.05–1.45). During the 2013 campaign, a randomized trial of regional media markets was conducted to examine the impact of higher doses of the campaign (i.e., 2,400 vs. 800 quarterly GRPs) on quit attempts (McAfee et al. 2017). The study found that African American people were strongly responsive to the increased dose, with quit attempt rates increasing from 31.8% with standard dosing to 50.9% with increased dosing ($p < 0.01$); White people did not experience an increase in quit attempt rates in response to increased dose (33.4% vs. 34.8%; $p = 0.23$). In other *Tips* studies, African American people had higher perceived ad effectiveness compared with other groups (Davis et al. 2017) as well as the highest awareness of the *Tips* campaign (Zhang et al. 2015a). Exposure to the *Tips* campaign has also been associated with increased smoking cessation among pregnant women overall as well as among specific groups of pregnant women, including those insured by Medicaid and those with less than a high school education (England et al. 2017).

In addition to motivating people who smoke to quit, the *Tips* campaign also promotes quitlines for smoking cessation support. The immediate impact of the *Tips* campaign on increasing quitline call volume has been well documented (CDC 2012d, 2013; McAfee et al. 2013; Zhang et al. 2014, 2015, 2016a,b, 2021; Davis et al. 2015; Duke et al. 2015b; Vickerman et al. 2015b; Mann et al. 2020), and several findings address specific populations.

In a study of quitline registrants who called 1-800-QUIT-NOW, Zhang and colleagues (2021) found that those who reported hearing about the quitline from radio ads were more likely to be male, younger, or have more education, whereas those who reported hearing about the quitline from TV ads, which compose the bulk of *Tips'* paid media, were more likely to be Black or not of-Hispanic ethnicity or have less education. In a different study, Zhang and colleagues (2014) demonstrated increases in quitline call volume among all population groups, particularly those who were uninsured, during periods that *Tips* was on air. Similarly, increases in call volume have been noted to the national Spanish-language quitline portal, 1-855-DÉJELO-YA, during *Tips* Spanish promotions, suggesting that Spanish-language tobacco education media campaigns may be effective in motivating Spanish-speaking people who smoke to seek help from a Spanish-language quitline (Zhang et al. 2018).

The findings from the *Tips* campaign contribute to the evidence base of interventions designed to increase awareness of, access to, and utilization of cessation services. These findings provide evidence that broad-based national media campaigns, if designed and delivered with careful attention to addressing populations affected by tobacco-related health disparities with sufficient dose and duration as well as ad placement strategies that are focused on reaching population groups affected by tobacco-related disparities, may contribute to reducing such disparities by influencing smoking cessation behaviors, including quit attempts and other quit-seeking behaviors.

Every Try Counts. FDA's first smoking cessation campaign, *Every Try Counts*, ran from January 2018 to April 2020. Understanding that multiple quit attempts are often required to achieve long-term cessation (USDHHS 2014), the campaign underscored the health benefits of quitting and used positive messaging to increase motivation to quit among adults who had previously attempted to quit smoking unsuccessfully. The campaign was active in 35 U.S. counties with high prevalence of adult smoking. Messages were delivered through geotargeted digital, radio, and outdoor print advertisements. Each ad included a call to action to drive people who smoke to the campaign website, which was developed in partnership with NCI and which features quitting tips; chat-based counseling on cessation; and links to phone-, text messaging-, and app-based cessation interventions.

In early 2020, *Every Try Counts* shifted to a national digital campaign to reach a broader audience. During the time the campaign was in market, *Every Try Counts* had more than 769 million digital views and sent more than 1.6 million unique visitors to EveryTryCounts.gov, prompting more than 15,000 sign-ups for a text messaging-based cessation program (FDA n.d.a).

Media Campaigns Designed to Reach Population Groups of Specific Races or Ethnicities

This section briefly highlights the evidence regarding campaigns focusing specifically on racial and ethnic population groups, including evidence published after 2014, but does not repeat the systematic review of the literature found in NCI Tobacco Control Monograph 22. Chapter 5 of the 1998 Surgeon General's report concluded that interventions addressing tobacco-related health disparities in racial and ethnic groups should reflect the focus population's cultural values and psychosocial correlates of tobacco use, be language appropriate, and use strategies that are acceptable and credible to members of the group (USDHHS 1998).

A 2017 Cochrane review suggested that the incremental benefits of behavior change-oriented mass media campaigns intended to reach people of a single race or ethnicity were limited compared with nontargeted campaigns, concluding that "the available evidence is inadequate for understanding whether mass media interventions targeted toward ethnic minority populations are more effective in changing health behaviors than mass media interventions intended for the population at large" (Mosdol et al. 2017, p. 2). However, this review included only randomized trials and interrupted time series, examined other conditions besides smoking, and identified only six trials that met the eligibility criteria through 2016, of which four were smoking related. One of the four smoking-related trials assessed the use of a generic booklet versus a tailored booklet, and trial sizes were small in the others.

Several tobacco countermarketing campaigns have focused on different racial or ethnic groups and were either designed specifically for a priority population or as tailored components of a campaign designed for the general population; tailoring strategies in such campaigns have included language adaptation (e.g., California's 2018 *Flavors Hook Kids* campaign appeared in seven languages), cultural adaptation, or both.

One community cluster randomized trial of mass media campaigns that included messages developed for African American and Hispanic youth found no significant effect on smoking among youth overall, although some changes in attitudes among Hispanic youth were observed (Flynn et al. 2010). However, the authors noted that this trial occurred in a relatively strong tobacco control environment with other nonexperimental community interventions occurring contemporaneously, including a substantial national media campaign that would have been viewed by both controls and intervention participants at higher exposure levels than the experiment provided, thus diminishing their ability to detect an effect (Flynn et al. 2010).

Analyses of comparative effects for specific racial and ethnic groups within more recent large media campaigns intended to reach all people who smoke—but with attention to salience, motivation, and media placement for key health disparity focus populations—have found strong evidence of benefit in all priority populations, especially for African American people (reviewed in detail elsewhere in this section) (Vallone et al. 2011b; Davis et al. 2017; McAfee et al. 2017).

It is also possible that media campaigns may be necessary, but not sufficient in themselves, to reach priority populations. In a study reviewing the effect of media campaigns on socioeconomically disadvantaged populations, Niederdeppe and colleagues (2008) suggested that, to increase efficacy, general campaigns should be combined with other programs (e.g., school-based interventions, state programs) to better influence priority populations. A later study in Boston, which compared mass media strategies for referring Black and Hispanic people who smoke to the Massachusetts quitline, found that a large-scale media campaign resulted in more provider referrals based in community health centers (pediatric and dental clinics) for Black and Hispanic people who smoke compared with self-referral to the quitline based on campaign exposure (Russo et al. 2018).

Media Campaigns Designed to Reach People with Mental Health Conditions

People with mental health conditions are more likely than those without such conditions to smoke cigarettes; in 2021, 28.1% of adults experiencing serious psychological distress (vs. 10.9% of those who were not experiencing such distress) reported smoking cigarettes (Cornelius et al. 2023a). Few campaigns have been directed specifically at this population. In 2016, the *Tips From Former Smokers* campaign designed and aired an ad specifically to motivate quit attempts among people who smoked and were living with anxiety or depression (Prochaska et al. 2019). The ad was developed in consultation with mental health and tobacco treatment experts. Evaluation of this ad's effect using a pre–post longitudinal survey demonstrated that adults with a mental health condition who reported exposure to the ad (vs. no exposure) were more likely to report a quit attempt when controlling for overall campaign exposure (aOR = 1.25; 95% CI, 1.03–1.52). Exposure to this ad was not associated with trying to quit smoking among adults without a mental health condition (aOR = 0.97; 95% CI, 0.83–1.14). Exposure to other *Tips* ads was associated with quit attempts among adults without a mental health condition (aOR = 1.19; 95% CI, 1.02–1.40) (Prochaska et al. 2019).

In an earlier randomized *Tips* dosing trial without tailored ads, McAfee and colleagues (2017) found that people with mental health conditions who were receiving standard dosing exposure to the campaign were more likely to make a quit attempt than those without a mental health condition (42.5% vs. 32.0%; $p < 0.01$), but increased dose exposure did not increase quit attempts (39.5% vs. 42.5%; $p = 0.79$).

Additional Design, Delivery, and Evaluation Considerations

One advantage of using targeted communication to address tobacco-related health disparities is that this approach focuses on audience characteristics when designing and delivering the message, which can improve audience engagement with the message and, in turn, can improve acceptance of the message (see Chapter 5 in USDHHS 1998) (Kim et al. 2016b). However, limited resources often present a challenge to programs' capacity to develop, pretest, deliver, evaluate, and sustain separate ad campaigns for each potential priority focus population (USDHHS 2012; CDC n.d.c). Furthermore, consideration of intersectional identities may add to the complexity of campaign development. Some campaigns have approached these challenges by developing a comprehensive, integrated approach to include a broad-based campaign with ads that are carefully designed with focus population representation in ad content, ads tested to appeal to multiple focus populations, and ad placement strategies that ensure exposure by focus populations as well as the overall population of people who smoke.

This integrated approach is sometimes supplemented with additional ads that focus on specific health disparity messages, focus populations (including both language-specific and culture-specific ads), and more specialized delivery channels (NCI 2017b). The components of a successful campaign include effective message design, pretesting including with focus populations, delivery channels that are appropriate and widely used by focus audiences, sufficient duration and funding, and process and outcome evaluation (CDC 2014; Baig et al. 2017; Hair et al. 2017; McAfee et al. 2017; Sanders et al. 2018).

Message Design

Health interventions and media campaigns should consider designing messages to meet the literacy, language, cultural, and motivational needs of various populations (Resnicow et al. 2002; Liu et al. 2013). Media campaigns intended to reach diverse ethnic groups are encouraged to translate their messages into multiple languages, as seen in California's *Flavors Hook Kids* campaign, Asian-language adult campaigns, and *Tips* Spanish-language ads. Rather than simply translating messages into different languages, however, these and other campaigns, such as FDA's *Fresh Empire* campaign, also incorporate cultural values into the messages that are relevant to the intended audience. For example, the Asian Tobacco Education, Cancer Awareness, and Research's (ATECAR's) media campaigns (Ma et al. 2004) focused on Chinese, Korean, Vietnamese, and Cambodian American population groups, who have disproportionately high rates of smoking among men (but not women) compared with the national average smoking rate across race and ethnicity. ATECAR's newspaper columns and 30-minute radio programs (which ran in 2001 and 2002 in Philadelphia and neighboring areas) were composed in the four relevant languages (Chinese, Korean, Vietnamese, and Cambodian) and acknowledged the highly favorable social norms toward smoking in Asian cultures with the intent of effectively approaching Asian American people who smoke and changing their norms, perceptions, and behaviors around tobacco use. Although a formal, large-scale evaluation was not conducted, ATECAR's campaigns were received favorably among the intended audience, who gave the content high ratings for its helpfulness with quitting smoking.

Using tailored format features that are appropriate for and preferred by the intended audience is also an important strategy for engaging priority populations in smoking prevention and cessation campaigns. Both the *Truth* and *The Real Cost* campaigns sought to reach at-risk youth populations by designing messages to appeal to the audience's sensation-seeking tendencies, through both execution styles (such as graphic images, special visual effects, fast-paced edits) and content (such as shocking, relevant narratives). The use of narratives that shock or otherwise engage the audience and intense format features in countermarketing media campaigns was found to increase recall among youth audiences (Allen et al. 2015). Similar messaging strategies should continue to be evaluated to determine whether specific execution styles and thematic content styles, that resonate with priority populations, influence tobacco-free behavior among these populations.

In addition, tobacco countermarketing advertisements that had emotional personal testimonials about the consequences of smoking or graphic images depicting the negative health consequences of smoking were found to have greater recall and perceived effectiveness among adults who smoke compared with advertisements without these types of content (Niederdeppe et al. 2011). Moreover, these advertisements were found to be more effective in motivating quit attempts by lower income adults who smoke and who have lower levels of education compared with advertisements without testimonials or graphics (Garrett et al. 2015).

Featuring people who are relatable to the target audience in tobacco countermarketing messages may be an effective strategy to increase the audience's engagement with the messages. For example, campaigns that target specific populations—such as Black, Hispanic or Latino, or minoritized sexual and gender identity groups—were more likely to be supported by the in-group members who shared the social identity than by members of other social identities (Baig et al. 2017). In addition, having actors dressed in styles that were similar to those of the audience members was shown to increase smokefree attitudes, increase the effectiveness of smokefree messages, and lower susceptibility to smoking among the adolescents who saw those messages (Moran and Sussman 2014, 2015). Tobacco control public service announcements featuring characters who smoked and had demographic similarities to members of the target audience were also shown to increase the audience's engagement with the message, which, in turn, increased the perceived effectiveness of the message (Kim et al. 2016b).

Other studies have demonstrated different engagement factors. In a study of perceived and actual effects on quit behavior in the *Tips* campaign (Davis et al. 2017), study participants were asked about the perceived effectiveness of ads before they were run and then months later after exposure to the full campaign. Higher perceived effectiveness scores for an ad were more predictive of increased quit attempts than concordance between the race or ethnicity of the study participant and that of the ad participant. The authors concluded that message characteristics (such as graphic or otherwise engaging visuals and emotional content) may play a more important role in perceived effectiveness than the race or ethnicity of ad participants.

Conducting formative research to understand the key beliefs and preferences of focus audiences is a critical strategy for tobacco prevention and control campaigns (Atkin and Freimuth 2001; CDC 2014; Davis et al. 2017). For example, when conceiving *The Real Cost* campaign, FDA worked with marketing groups that conducted formative qualitative research with adolescents to inform the development of the campaign brand and campaign advertisements (Duke et al. 2015a) and quantitative research to examine adolescents' beliefs about tobacco use, which identified the consequences of smoking, social acceptance, and social popularity as salient themes that resonated with youth (Brennan et al. 2017). Based on this formative work, FDA used messages about the cosmetic and health effects of smoking and addiction-related loss of control.

Similarly, formative focus group research for the development of NCI's *Smokefree Teen* website found that teens attributed their own smoking to stress from their home life, friends, and school. Therefore, website messages highlighted the reasons why young people smoke and challenged the misperception that smoking could alleviate these issues. Campaigns that use a peer-crowd approach are designed to resonate with the values of these groups, such as independence and control (*Fresh Empire*) or self-expression and inclusion (*This Free Life*).

Finally, focus group interviews with key informants are an important step in developing culturally appropriate tobacco prevention and control messages for underserved and high-risk populations, including people living in rural communities (Riker et al. 2015). In summary, using a comprehensive process that fully assesses knowledge, attitudes, behaviors, and beliefs about smoking related to culture should be a formative part of message design in future mass media campaigns that target population-level tobacco prevention and cessation outcomes.

Delivery Channels

Diverse delivery channels are used in health campaigns to reach and engage target audiences through multiple platforms. The most successful campaigns have historically used a mix of mass media channels—usually with television and radio predominating for adults because of their high reach and proven impact, supplemented with social and digital media, which are channels used by many key populations. Youth campaigns may reverse this channel prioritization. Delivery channels may also include school curricula (for youth); various sections of a newspaper; earned media announcements on the radio and television; posters; the Internet; out-of-home ads such as those on billboards, buses, and buildings; movies; cartoons; music videos; online streaming and on-demand media; testimonials; social media (such as Instagram, TikTok); brand ambassadors; and local outreach events. Furthermore, newer media placement purchasing algorithms now allow for more precise tailoring of delivery based on audience characteristics (Singh 2020). However, because the delivery channel media environment—especially for youth and young adults—is continuously and rapidly evolving, it is important that media campaigns ensure that they have up-to-date knowledge and/or engage media placement firms that are tracking viewing trends in target populations.

Several examples exist for the successful use of targeted delivery channels to reach focus audiences. For example, messages from the *Truth* campaign were strategically placed on television during programs with high teen viewership and that were particularly attractive to sensation-seeking youth (Duke et al. 2009). Using a dissemination strategy that reflects the culture of the focus audience has been a cost-effective method for achieving substantial exposure for the *Truth* campaign as well as for social media engagement in general and for population-level health improvement (Hair et al. 2017). Another example of using a dissemination strategy reflective of the culture of the focus audience is CDC's *Tips* campaign; in addition to translating ads into Spanish and having Hispanic or Latino ad participants featured in the campaign, the campaign worked with Spanish-language stations to develop earned media segments, which led to increased reach (Zhang et al. 2018; Dilley et al. 2020).

Use of digital channels is critical when trying to reach many priority populations, particularly given the high levels of smartphone ownership among Black and Hispanic people of all income levels (Atske and Perrin 2021). Several campaigns have incorporated digital approaches into their dissemination strategies. For example, the *Smokefree Teen* promotion campaign actively used social media channels to reach adolescents, as past research suggested that teens spend more time using their cell phones or computers to access social media rather than using traditional media, such as broadcast network television (Sanders et al. 2018). Messages for the *Smokefree Teen* promotion campaign were placed on online platforms that provide video, music, and social networking services, such as Facebook, Twitter, YouTube, Hulu, Pandora, Spotify, and the CW network. *Smokefree Teen* online marketing campaigns turned out to be more cost-effective in increasing engagement with text message services than traditional media campaigns (Sanders et al. 2018).

Similarly, *The Real Cost* campaign leveraged a variety of communication channels, including television, online videos, social media, media partnerships with youth-focused content, posters for schools, and a campaign website (Duke et al. 2019; Zeller 2019). In addition, FDA's *Fresh Empire* and *This Free Life* campaigns used digital marketing tactics and innovative approaches with social media and influencers, interactive websites (such as games and quizzes), and local events (Guillory et al. 2020; Crankshaw et al. 2022).

The use of social media platforms by such campaigns represents a rapidly emerging strategy and area for research. A review by Chan and colleagues (2020) examined evaluation measures of tobacco control campaigns using traditional and digital media platforms for 17 campaigns. The review included evaluations reported in 51 peer-reviewed articles, 17 marketing reports, and 4 gray literature evaluation reports and focused largely on behavior change outcomes. Evaluation measures commonly assessed engagement (e.g., number of website visits) with other measures, including engagement on social media, changes in attitudes, and number of people initiating contact for smoking cessation services. However, few evaluations included measures of media platform attribution (i.e., where participants saw the campaign). This review highlighted the need for guidance about selecting digital media-related metrics for campaign evaluations. Moreover, case studies of digital segmentation efforts in the nonprofit, government, and academic sectors have indicated that such segmentation increases the reach and frequency of messages delivered to targeted populations and, as a result, may enhance future public health campaigns (Evans et al. 2019).

Using influencers to spread tobacco prevention and control messages is another strategy that goes beyond traditional mass media to disseminate health messages to focus audiences. For example, the *HAVOC* (Fallin et al. 2015a) and *Commune* (Commune n.d.) social branding campaigns hired influential community members from the young adult target audience as brand ambassadors, which was effective in maximizing the outreach of each campaign. Working with social media influencers could be particularly relevant to populations facing tobacco-related health disparities by identifying members of these communities to serve as influencers (Fallin et al. 2015b). Campaigns should, however, be aware that attempting to enter financial relationships with social media influencers or brand ambassadors may add a less controllable element into the campaign mix and potentially pose particular challenges for government-sponsored campaigns.

Any existing gaps in media access, including digital channels, such as in rural areas and among people of lower SES (Vallone et al. 2015), have narrowed substantially in part due to almost universal access to cell phones in the United States (Pew Research Center 2021) and increasing access to broadband Internet, although some gaps in broadband access remain (Federal Communications Commission 2021). For example, data from 2019 indicated that most rural residents had smartphones (71%) and home Internet access (63%) (Perrin 2019) and 85% of rural residents used the Internet, 68% of whom used it to obtain health information (Harvard T.H. Chan School of Public Health 2019). The vast majority of rural residents view technology as vital to compensate for sparse or absent community resources, limited access to healthcare professionals, and to avoid the need for long-distance travel (Perrin 2019). Thus, digital health resources are increasingly relevant to the rural population. It is important to assess which dissemination channels are both popular and likely to be accessible by priority populations experiencing tobacco-related health disparities. Chapter 5 provides additional detail on access to media and the Internet among different population groups.

In summary, digital campaigns are an emerging area that warrants further evaluation and offers potentially cost-effective ways to reach priority populations, particularly among youth. Ultimately, evaluation and research methodologies that allow for reliable estimates of the impact of digital campaigns on quit attempts and quit success, including among population groups affected by tobacco-related disparities, are needed.

Evaluation Considerations

Media campaigns may have practical and political considerations and limitations that may make it difficult to evaluate certain aspects of these campaigns both for the overall population and among priority populations experiencing tobacco-related health disparities. For example, publicly funded campaigns may be limited ethically and politically in their capacity to include a control condition that receives no exposure to a media campaign. Thus, comparison often relies on time series or geographically similar groups or recall of campaign exposure, which is subject to confounding and bias. There have been a few large, randomized trials of large media campaigns in which, for example, the dose of the media buy is varied randomly by ad market (Flynn et al. 2010; McAfee et al. 2017). Some time series trials have gone to great lengths to overcome potential environmental biases, such as other tobacco control variables or seasonal variations. For example, a campaign conducted in the spring of a year may examine pre-, post-, and the previous year's outcomes to minimize non-intervention-related temporal trends. Alternatively, media "doses" can be delivered in discrete, brief, and repeated pulses separated by no media exposure, with tracking of a meaningful outcome that can be reliably measured on a daily or weekly basis. For example, CDC's *Tips* campaign has delivered national ad buys tagged with a call to action to call 1-800-QUIT-NOW (the national quitline portal); these ads were turned off and on weekly or biweekly, with calls to quitlines roughly doubling during the weeks when the campaign was on air (CDC 2013). Quitline call volume and caller demographic characteristics have also been correlated with changes in ad buy intensity or content (Zhang et al. 2015a; McAfee et al. 2017; Davis et al. 2018).

Some media campaigns have developed synergistic relationships with state-based quitlines, which can benefit quitline reach, media message engagement, and campaign evaluation. This symbiosis has included quitline reliance on campaigns to increase quitline calls, particularly among focus populations such as people who are uninsured or enrolled in Medicaid (Zhang et al. 2015a). In turn, many characteristics make quitlines a valuable tool for evaluating the effect of media campaigns on cessation behaviors, including among priority populations:

- Quitlines collect a uniform set of sociodemographic and behavior-related data elements for all callers receiving services (known as the "minimal dataset") (North American Quitline Consortium n.d.b).
- Quitlines routinely collect intermediate behavioral metrics (e.g., calls to quitlines, program enrollment and participation) that can be correlated with media buys, potentially to the level of specific ads.
- Quitlines collect metrics examining satisfaction and quit outcomes on subsets of callers.
- Funding levels and media characteristics have varied over time and between states; quitline utilization is correlated to both funding and media promotion.

One health equity question regarding media campaigns is whether they selectively influence quit behaviors in some groups of people who smoke more than in others, thereby either increasing or decreasing health disparities in successful quitting. Thus, studies evaluating the effectiveness of such campaigns in diverse population groups must be sufficiently powered to detect such differences. This question has been examined using population-based surveys, but because demographic information on state quitline callers is collected routinely, the impact of media campaigns on specific focus populations has also been examined by observing caller characteristics before, during, and after campaigns. In general, calls from priority populations have either remained proportional, or in some instances increased, during campaigns, such as increases in uninsured callers observed during the first year of the *Tips* campaign (Zhang et al. 2015a) and increases in Medi-Cal callers and engagement during California targeted campaigns, particularly among African American and English-speaking Latinx population groups (Vijayaraghavan et al. 2018b). Media campaigns remain a critical component of comprehensive tobacco control programs for the general population and for reaching priority populations.

Summary and Recommendations

As outlined in the 2014 and 2020 Surgeon General's reports, NCI Tobacco Control Monograph 22, and the evidence reviewed in this chapter, the efficacy of media campaigns has been demonstrated in a diversity of population groups. Tobacco countermarketing mass media campaigns are known to prevent initiation of tobacco use, increase calls to quitlines, increase smoking cessation, and reduce the prevalence of tobacco use among adults and youth (USDHHS 2014, 2020; NCI 2017b). However, it remains unclear whether media campaigns aimed at a specific focus population are more effective at decreasing disparities in tobacco initiation, use, and cessation (including use of cessation services) than broader campaigns designed to resonate with multiple focus populations.

The evidence base regarding the impact of countermarketing campaigns on several focus populations has increased in recent years, including among minoritized racial and ethnic groups, sexual orientation and gender identity groups, groups with lower SES, and those with mental health conditions. Evidence reviewed in this section highlights the potential benefits of designing, developing, and delivering media campaigns that focus on, or are developed to reach, priority populations.

The recommendations made here are relevant within the context of both broad-based and priority population-specific campaigns. Careful attention should be paid during message development to ensure that campaign messages resonate with the specific population(s) a campaign aims to influence; group characteristics to keep in mind during message development include sociodemographic factors, tobacco products used, quitting interest, psychographics (e.g., cultural values), preference for media channels, literacy needs, language preferences, and intersectionality of multiple factors.

Supplemental media efforts may also be added to general market campaigns to (1) increase campaign reach as well as integration with rural communities, school interventions, community programs, and other social support networks; and (2) influence policy changes that might enhance the effect of these campaigns on priority populations (Niederdeppe et al. 2008; Durkin et al. 2012; NCI 2017b). Given that demographic characteristics may inform how media channels are accessed (e.g., adolescents tend to use different social media applications than adults), further evaluation studies are warranted to inform how best to enhance the reach and effectiveness of targeted and general tobacco countermarketing campaigns.

Beyond programmatic recommendations, specific areas that may benefit from further investigation to reduce tobacco-related health disparities include studies to examine

- How different campaign approaches (designed and delivered to maximize impact for multiple groups or to primarily influence a specific population group) compare in their effects on both specific populations and the overall population;

- How different components of media campaigns (message content, framing, targeting, duration, dose, channels) affect the campaign's effectiveness;

- How to maximize the reach and effectiveness of media campaigns for population groups with a primary language other than the dominant language;

- Use of controlled time series, sequential randomized trials, and pilot RCTs, when feasible, to evaluate targeted and broad-based media campaigns before the widespread dissemination of such cessation campaigns among priority populations, as recommended by Guillaumier and colleagues (2012); such studies should be sufficiently powered to detect differences among population groups of interest;

- How to maximize the reach and effectiveness of general and focused media campaigns among specific understudied population groups, particularly the LGBTQI+ community, American Indian and Alaska Native population groups, Native Hawaiian and Pacific Islander population groups, older adults who smoke, those with mental health conditions, and rural population groups;

- Whether different framing and tones are perceived as more effective by different focus populations (e.g., negative vs. positive gain framing, internal vs. external motivation);

- Trends in patterns of media use within different focus populations, including continued use of broadcast media as well as shifts to digital and social media;

- Approaches to digital and social media marketing that can help address, and not exacerbate, disparities in tobacco use;

- How general media market campaigns that bolster support for equitable tobacco control policies, such as those related to flavors and menthol, affect tobacco-related health disparities;

- How media countermarketing can help reduce the impact of new tobacco industry campaigns that attempt to renormalize tobacco use behavior and influence the public health policy environment (see Chapter 5); and

- The effect of media campaigns on the use of noncigarette tobacco products, including whether campaigns designed to reduce smoking or vaping have the intended effects on use and perceptions of all tobacco products equally or differentially.

Mass media campaigns should be developed to meet the literacy, language, cultural, and other needs of priority populations. Their development may benefit from the following:

- The use of community-engaged research approaches to optimize the understanding of the needs of priority populations;

- Formative testing and post-deployment evaluation, especially for new campaign ads, strategies, materials, media channels, and resources;

- The use of appropriate media channels that are used by priority populations;

- The inclusion of linkages to barrier-free, evidence-based cessation support resources; and

- Deployment to support policies and programs that promote health equity in addition to supporting tobacco cessation efforts by individual people.

Finally, to achieve equity and eliminate tobacco-related health disparities, media campaigns should be integrated with multicomponent, comprehensive, well-funded, and sustainable tobacco control programs, with ongoing evaluation of impact (CDC 2015). It is critical that, regardless of whether a campaign is aimed at a single focus population or a broader audience of people who use tobacco, extra steps be taken to ensure that campaign evaluations have sufficient capacity to examine the impact among population groups experiencing health disparities. This may, for example, require oversampling of focus populations, careful attention to sample recruitment and retention methods, and community-engaged research approaches.

The evidence reviewed in this section is sufficient to infer that mass media countermarketing campaigns are effective at increasing quit attempts among many population groups that are impacted by tobacco-related disparities, particularly when designed and delivered with attention to reach and relevance to these population groups. Mass media campaigns should be well funded and of sufficient ongoing duration and dose to create meaningful population-level decreases in tobacco use initiation and prevalence, including among population groups affected by tobacco-related disparities. Ultimately, implementing these recommendations for mass media campaigns focused on tobacco prevention or cessation has the capacity, when combined with other tobacco control strategies, to improve health outcomes in population groups suffering from tobacco-related health disparities.

Organizational-Level Programs and Interventions

Opportunities exist to address tobacco-related health disparities at multiple levels, including by implementing interventions, policies, and practices within organizational and institutional settings. This section focuses on interventions in environments where people learn, seek healthcare, and work, but does not summarize all possible organizational programs or interventions that could potentially reduce tobacco-related health disparities. This should not preclude tobacco control practitioners from taking action to pursue interventions in other settings and to evaluate and report on the results of those activities.

School-Based Tobacco Prevention Programs

Youth and young adults are disproportionately affected by tobacco product marketing and have disproportionately high tobacco use prevalence. This is problematic not only because of the dangers of nicotine for the developing brain, but also because most adults began using tobacco products when they were adolescents (USDHHS 2012, 2014, 2020). Disparities in tobacco product use among youth of different population groups can lead to disparities in use among adults. Health promotion efforts intended to reach youth are often centered in schools, which are a promising venue for preventive efforts because youth spend many of their waking hours in school and because schools are a major socializing institution for youth (Trickett and Moos 1973; Comer 1988; Flay and Collins 2005; NCI and WHO 2016). School-based interventions for tobacco prevention and cessation are particularly appealing because they leverage an existing institutional setting with broad reach to youth (Wiehe et al. 2005). School-based programs may be helpful in reaching youth who do not receive tobacco prevention and treatment information from other sources (NCI and WHO 2016).

The evidence on school-based programs to prevent and reduce youth tobacco use is mixed. However, programs "with evidence of effectiveness, containing specific components, can produce at least short-term effects and reduce the prevalence of tobacco use among school-aged youth" (USDHHS 2012, p. 10). School-based programs will be most effective when combined with a comprehensive approach that also addresses more distal, social, and community influences (USDHHS 2012). In a critical review of reviews of school-based smoking prevention programs, Flay (2009a) found suggestive evidence of long-term effectiveness in terms of reducing tobacco use among youth if programs (a) included interactive exercises that emphasized the social influences of tobacco use or learning refusal skills; (b) offered 15 or more sessions with the same group of youth; and (c) targeted participation starting in middle school, with at least some exposure to tobacco prevention materials in ninth grade.

Key Practices for School-Based Programs to Prevent Tobacco Use Among Youth

The 2012 Surgeon General's report recommended that school-based programs "should be comprehensive, interactive, start early, be sustained, incorporate an appropriate amount of lessons, and be integrated into a community-wide approach" (USDHHS 2012, p. 792). Effective curricula should employ the existing key practices for school-based prevention curricula and address the main reasons why youth find tobacco products appealing, especially emerging tobacco products. Reviews, meta-analyses, and the broad literature about school-based tobacco prevention programs show that successful programs:

- Are based on the social influences approach (i.e., educating youth about social norms and social influences and providing skills for resisting peer and media influences and tobacco product marketing);
- Involve interactive learning strategies that include discussions about social norms and building refusal skills; and
- Rely on theories of positive youth development, including using same- or similar-age peers as leaders or facilitators (Wiehe et al. 2005; Flay 2009a,b; USDHHS 2012; Thomas et al. 2013, 2015; Bonell et al. 2016; Harvey et al. 2016).

Social influence theory is a part of the social influences approach, which highlights the importance of educating youth about social norms and provides them with skills for resisting the influence of their peers and others. That approach also involves behavioral theories, which assert that decisions to use tobacco products are shaped by perceptions of tobacco-related risk and benefit and perceived acceptability of the tobacco product, which in turn can be shaped by both public health educational campaigns and tobacco product marketing (Ajzen 1985; Catalano et al. 2004; Song et al. 2009). Components of school-based programs that have focused on combustible and smokeless tobacco use also show promise for addressing e-cigarette use (Kelder et al. 2020).

Positive youth development is an approach that allows educators to work with youth in a way that provides support and opportunities to learn about the larger process of development, mainly the cognitive development that occurs during adolescence as youth make life decisions (Bonell et al. 2016). The positive youth development approach includes learning in the classroom setting, but it also incorporates community involvement to provide the proper resources to help guide youth through their critical journey to young adulthood. The positive youth development approach can be implemented through promoting positive relationships with family and friends, encouraging youth to be leaders or to participate in activities that interest them, providing youth with adult mentorship, and ultimately providing a safe environment in which youth can focus on personal development (Bonell et al. 2016). Programs involving a youth development framework typically share components, such as the following:

- Increase participants' exposure to supportive and empowering environments that include positive relationships with peers, parents, and other adults;
- Engage youth in activities and opportunities for a range of skill-building and perspective-broadening experiences;
- Encourage youth involvement, empowerment, and leadership; and
- Encourage peer involvement, which tends to have more frequent and intense interactions compared with adult interactions; peers are powerful influences on a child's development of identity and autonomy (Leffert et al. 1998; Roth and Brooks-Gunn 2003; Mannes 2006; Ramirez et al. 2006; Morton and Montgomery 2011; Lowry et al. 2017; National Institute for Health Care and Excellence 2022a, b).

Tobacco prevention curricula also should educate youth on factors that influence their susceptibility to initiating tobacco use, such as marketing, flavors, social pressures, and perceptions of harm regarding different products. In terms of marketing, manufacturers and retailers of tobacco products aggressively market to youth through the Internet, social media, television, radio, event sponsorship, celebrity placement, and strategic positioning in convenience stores, often next to candy products (Cobb et al. 2013; de Andrade et al. 2013; Grana et al. 2013; Mantey et al. 2016; Singh et al. 2016a,b,c; Hammig et al. 2017; Marynak et al. 2018a). As discussed earlier, tobacco products often contain flavorings (candy, fruit, menthol, mint, and others) that make them particularly appealing to youth (see Chapters 3 and 5) (Grana et al. 2013).

Moreover, adolescents generally lack knowledge about tobacco products and harbor misperceptions about their harm (Trumbo and Harper 2013; Ambrose et al. 2014; Akl et al. 2015; Anand et al. 2015; Roditis and Halpern-Felsher 2015; Amrock et al. 2016; Roditis et al. 2016a,b; Dobbs et al. 2017; Giovacchini et al. 2017; Huang et al. 2017a; Kowitt et al. 2017; McKeganey et al. 2018; Zare et al. 2018; Goldenson et al. 2019; Chen-Sankey et al. 2021; Gentzke et al. 2022). Knowledge gaps and misperceptions may be particularly prevalent among some population groups, owing to communication barriers (Cowgill et al. 2020).

The strategies listed earlier are key practices for school-based prevention programs that can help address tobacco use among youth generally. Little research has been done to assess whether these strategies, if implemented comprehensively, can help reduce disparities in tobacco use among youth or whether any specific elements of these programs are particularly effective at or can be enhanced to help reduce disparities in tobacco use. Public health departments and education departments in some states, like California, have collaborated to implement youth-engaged tobacco prevention programs to address tobacco-related disparities (California Department of Education n.d.). Evaluation studies regarding these types of programs would help inform efforts elsewhere.

The tobacco industry has also sponsored tobacco prevention curricula, but historically these curricula have been shown to serve as additional indirect marketing strategies and strategies implemented to avoid regulation and legal liability (USDHHS 2012; NCI and WHO 2016). Such curricula should not be considered to be effective or evidence-based prevention or cessation curricula (NCI and WHO 2016; WHO 2018). Studies of tobacco industry documents have found that tobacco industry curricula (a) failed to portray the true detrimental harm of their products to youth and (b) subtly promoted smoking to maintain a youth audience (Landman et al. 2002). Industry-sponsored curricula also failed to follow the best practices for addressing the targeted marketing and building skills needed to resist the industry's advertising efforts (Landman et al. 2002). These same practices have been implemented by e-cigarette companies, such as JUUL Labs' attempts to implement school-based e-cigarette prevention curricula (Liu and Halpern-Felsher 2018).

Most young people who use tobacco products want to quit (Gentzke et al. 2022). School-based tobacco prevention and cessation programs can be bolstered by well-implemented policies prohibiting tobacco use in schools (Galanti et al. 2014; Cole et al. 2019). Traditional disciplinary measures used to enforce violations of school policies, such as suspension for students caught using a tobacco product on campus, are unlikely to help students quit tobacco use and could permanently impact their academic and future prospects (CDC n.d.). Such actions could also exacerbate socioeconomic disparities as suspensions disproportionately affect students of color, students from families with lower incomes, LGBTQI+ students, male students, and those receiving services for special education (Leung-Gagné et al. 2022; CDC n.d.). Tobacco-free school policies that focus on educating, rather than penalizing, youth who violate tobacco-free school campus policies can help bolster efforts to reduce tobacco use prevalence and advance equity (Public Health Law Center 2019b; American Lung Association 2022). Additionally, given that some school-aged youth already use tobacco products, school-based prevention programs that include a cessation component, including resources for quitting use of e-cigarettes, could increase program impact for all students. Cessation components of programs can also be utilized for tobacco-free school policies that adopt a non-punitive approach to enforcement to help support educational success among vulnerable youth.

Given the changing landscape of tobacco product availability, marketing and use, it is important that developers of school-based tobacco prevention and cessation programs update, evaluate, and adapt their curricula to include evidence-based best practices, include content on emerging tobacco products, and be technologically savvy and integrated with platforms that resonate with youth (Baskerville et al. 2015b). Developers should continue to monitor the effectiveness of efforts to change perceptions about tobacco products and patterns of tobacco use among youth, including among population groups that experience tobacco-related health disparities.

Interventions and Policies in College-Based Settings

In the fall of 2019, a large majority of undergraduate students at 4-year public institutions (90%), private nonprofit institutions (86%), and 2-year public institutions (80%) were under the age of 25 (National Center for Education Statistics 2022)—a critical age given that nearly 1 out of every 10 people who smoke start between the ages of 18 and 25 (USDHHS 2012). In addition, some studies have shown that young adults who smoke often increase their cigarette use while in college (Bardus et al. 2020). Tobacco-free college campus policies are just one tool to address tobacco use among young adults, given that only 42.3% of U.S. young adults 18–24 years of age were enrolled in college or graduate school in 2021 (U.S. Census Bureau n.d.). These interventions can reduce tobacco use, create changes in social norms, and tend to have the support of students, which increases following policy implementation (Lupton and Townsend 2015; Bardus et al. 2020; Glasgow et al. 2021).

As with other adult population groups, disparities in tobacco use and exposure to secondhand tobacco smoke exist among college students. For example, data from the 2017 National Survey on Drug Use and Health showed that tobacco use was higher among college students with disabilities than among students without disabilities (Casseus et al. 2020). One study found that college students who were from minoritized racial and ethnic groups (including Black, Latino, and Asian study participants) and from rural areas had higher tobacco use than other students (Derefinko et al. 2018). The prevalence of tobacco use has been shown to be higher at community or technical colleges and at tribal colleges or universities than it is at 4-year colleges and universities (Berg et al. 2011, 2021c; Choi et al. 2016b; McIntosh et al. 2016). In addition, although exposure to secondhand tobacco smoke tends to be lower among people with more years of formal educational, one study (Pacheco et al. 2018) surveyed 1,256 American Indian college students from three tribal colleges in the Midwest and Northern Plains and found that nearly 60% reported being exposed to secondhand tobacco smoke during the preceding 7 days; 66% of those surveyed who did not smoke and 34% of those surveyed who smoked supported having a smokefree campus.

Tobacco-Free College Campus Policies

Young adults who attend 2-year colleges or have a 2-year college degree have higher rates of tobacco use, compared with those attending 4-year colleges or with a 4-year college degree, and those who do not attend college or do not have a college degree have the highest rates of tobacco use among people in this age group (Lenk et al. 2012; Odani et al. 2019; Schulenberg et al. 2021). Disparities in tobacco use on college campuses may be attributable in part to a wide variety of contextual factors, including the presence and strength of campus-based tobacco control policies (Venkataramani et al. 2019; Berg et al. 2021c).

Tobacco control programs that have been implemented at the state, territorial, tribal, and local levels to address multiple factors—such as policy, education, and cessation—have contributed to declines in the prevalence of tobacco use (CDC 2012c). The evidence base that these programs rely on can inform key practices for campus-based tobacco interventions, such as tobacco-free campus policies. For example, more than a decade ago, the American Nonsmokers' Rights Foundation developed tools for the adoption of smokefree college campus policies based on its experience providing support for other smokefree policies throughout the United States (American Nonsmokers' Rights Foundation 2009). Since then, the Foundation also developed tools for tobacco-free campus policies (American Nonsmokers' Rights Foundation 2023b) that prohibit smoking and other tobacco product use. The American College Health Association (ACHA), in its Position Statement on Tobacco on College and University Campuses, incorporates many principles similar to those from the American Nonsmokers' Rights Foundation when recommending that college campuses:

- Develop a strongly worded tobacco control policy that applies to all products and reflects best practices in tobacco prevention, cessation, and control, including barring relationships with the tobacco industry and prohibiting the sale of tobacco products;
- Distribute the policy widely and annually to inform all members of the campus community about the policy;
- Offer and promote initiatives in prevention and education that actively support a tobacco-free lifestyle and address the risks of all forms of tobacco use;
- Offer and promote programs and services that include practical, evidence- and theory-informed approaches to end tobacco use (such as screenings through health and counseling services, free or reduced-cost cessation counseling and medication options, including NRT, on campus);
- Advocate for requiring the inclusion of tobacco cessation medications and services in health insurance plans for students;
- Provide comprehensive marketing and signage to ensure that all college and university visitors, vendors, guests, and others are aware of the campus's tobacco-free policy;
- Effectively implement, administer, and enforce all college and university tobacco-related policies, rules, regulations, and practices;
- Collaborate with local, state, and national public health entities to support and maintain a healthy tobacco-free environment; and
- Develop and maintain a campus-based tobacco task force to identify and address tobacco-related issues (ACHA 2012).

Policies such as this, which affect physical and social environments and provide cessation support, can reduce exposure to and use of tobacco (Blake et al. 2020; Berg et al. 2021c).

Prevalence and Characteristics of Tobacco-Free Campus Policies

The number of U.S. colleges and universities implementing comprehensive tobacco control policies doubled between 2012 and 2017 (Wang et al. 2018b). Of the more than 6,000 colleges and universities in the United States (National Center for Education Statistics n.d.), at least 2,599 had 100% smokefree campuses as of February 2022. Of these, 2,162 were also 100% tobacco-free, 2,233 prohibited e-cigarette use, 1,217 prohibited hookah use, and 571 prohibited smoking or vaping marijuana on school grounds (American Nonsmokers' Rights Foundation 2023). A 2020 analysis found that 39.2%, 26.0%, and 20.0% of a sample of postsecondary educational institutions had enacted e-cigarette-free, hookah-free, and ACHA-recommended tobacco-free (all tobacco products including e-cigarettes and hookah) policies, respectively (Bayly et al. 2020). Elsewhere, a 2019 study estimated that, based on data from 2015 to 2017, 14.9 million college students (26.9%) and 8.9 million faculty and staff (25.4%) were protected by campus-based tobacco-free policies and state laws (Blake et al. 2020). Although the adoption of campus-based tobacco-free policies is on the rise, more attention is needed to address tobacco-related disparities among college students, including among minoritized racial and ethnic and sexual orientation and gender identity population groups, people of lower SES, and those from rural areas.

In addition to colleges and universities adopting their own tobacco-free policies, some colleges and universities are tobacco-free as the result of legislation. In the United States, as of February 2022, five states (Arkansas, Hawaii, Illinois, Iowa, and Louisiana) and one territory (the Northern Mariana Islands) required 100% smokefree campuses (all indoor and outdoor areas) for public postsecondary educational institutions (American Nonsmokers' Rights Foundation 2023; CDC n.d.g). Of these, Iowa also required 100% smokefree campuses for private postsecondary educational institutions, and Hawaii and the Northern Mariana Islands required 100% tobacco-free campuses for public postsecondary educational institutions (American Nonsmokers' Rights Foundation 2023; CDC n.d.g).

There were 32 fully accredited tribal colleges and universities in the United States in 2020 (U.S. Department of Education 2020). As of April, 2023, five tribal colleges spread across 18 campuses require their campuses to be 100% tobacco-free (all indoor and outdoor areas) (American Nonsmokers' Rights Foundation 2023). Finally, Bayly and colleagues (2020) found that, compared with public postsecondary institutions, proprietary (privately owned, for-profit) institutions were less likely to have ACHA-recommended tobacco-free policies. Proprietary institutions have a higher percentage of students from minoritized racial and ethnic groups than public or private, nonprofit institutions (National Center for Education Statistics 2017; Bayly et al. 2020). Postsecondary educational institutions in the South and Midwest were more likely than those in the West to have enacted ACHA-recommended tobacco-free policies (Bayly et al. 2020). The student body at most 2-year colleges is more diverse compared with most 4-year colleges (National Center for Education Statistics 2022); thus, they provide a critical context for prevention and cessation interventions. However, 2-year institutions offer limited support for smoking cessation initiatives and efforts to prevent exposure to secondhand tobacco smoke (McIntosh et al. 2016). Differences in the adoption of tobacco-free college campus policies, based on setting, can be problematic in terms of tobacco-related disparities.

Continued adoption of tobacco-free campus policies, and especially in locations such as community or technical colleges, HBCUs, Hispanic- or Latino-serving institutions, and tribal colleges and universities can reach a diverse intersection of students, faculty, and staff; protect them from exposure to secondhand tobacco smoke; and reduce the social acceptability of tobacco use, thereby preventing initiation and promoting cessation (Wang et al. 2018b; Rath et al. 2019; Berg et al. 2021c).

In 2012, USDHHS launched the Tobacco-Free College Campus Initiative in partnership with the ACHA and the University of Michigan with the goal of encouraging the voluntary adoption of smokefree and tobacco-free campus policies across the United States (Blake et al. 2020). Truth Initiative has also supported the Tobacco-Free College Campus Initiative. In 2014, Truth Initiative—recognizing the lagging implementation of smokefree and tobacco-free policies in community colleges and HBCUs—developed its own programs and policies to provide grants and technical assistance to support the adoption of smokefree and tobacco-free policies in these educational settings (Rath et al. 2019; Blake et al. 2020). Since 2016, the CVS Health Foundation has partnered with the American Cancer Society, the Truth Initiative, and others to accelerate the adoption of tobacco-free campus policies, including at HBCUs, community colleges, and institutions that serve minoritized racial and ethnic groups (CVS Health 2019, Rath et al. 2019; Truth Initiative 2019a; Blake et al. 2020).

Impact of Tobacco-Free Campus Policies and Gaps in Tobacco-Free Campus Policy Research

Results from systematic reviews and meta-analyses have shown that tobacco-free campus policies reduce the prevalence of tobacco use, exposure to secondhand tobacco smoke, and protobacco attitudes among college students (Lupton and Townsend 2015; Bennett et al. 2017; Bardus et al. 2020; Berg et al. 2021c). Studies in other settings have also documented decreases in tobacco use after tobacco-free policies have been implemented (Fallin et al. 2015c; Wong et al. 2020; Wray et al. 2020). Other studies have shown that the presence of a campus tobacco-free policy may have other effects. For example, Barker and colleagues (2018) reported significantly lower odds of the presence of exterior tobacco marketing—specifically, e-cigarette advertising—at retailers near public university campuses with established tobacco-free policies compared to those without such policies. Additionally, using data from the American College Association National College Health Assessment study, Cannonier and colleagues (2019) reported improved academic performance among the general student population at a public university in a state with a high prevalence of smoking and the presence of a tobacco-free campus policy.

Although studies assessing the impact of tobacco-free campus policies included students who experience tobacco-related disparities, very little research has focused on how these policies, or specific aspects of these policies (such as capacity building, education, implementation, enforcement, tailored cessation programs) could help reduce tobacco-related disparities (Bardus et al. 2020; Berg et al. 2021c; Cuomo et al. 2021).

For example, challenges have been reported in the enforcement of tobacco-free college campus policies (Fallin et al. 2012; Russette et al. 2014; Braverman et al. 2018). Various measures to support implementation (Bresnahan et al. 2016) and enhance compliance have been found to be effective (Ickes et al. 2013, 2015); these measures include developing collaborations between state departments of health and college and university systems to effectively implement such policies (Bresnahan et al. 2016); developing tools to assess and improve compliance (Ickes et al. 2013, 2015); and developing communication materials and strategies (e.g., media campaigns) to strengthen tobacco control efforts (Mackert et al. 2019). Some studies suggest that population groups that use tobacco products at disproportionate rates may be more likely than other population groups to support these types of policies (Do et al. 2020; Martin et al. 2020), but that support may not be associated with changes in smoking behavior. These studies have not sufficiently explored possible differential intervention effects for specific population groups or for institutions serving students at tribal colleges or universities, community colleges, or HBCUs.

Summary and Recommendations

Current evidence indicates that tobacco-free campus policies lead to reduced tobacco use and exposure to secondhand tobacco smoke among college students. The evidence is insufficient to infer that tobacco-free policies on college campuses reduce tobacco-related disparities. However, continued adoption and evaluation of these policies is warranted, particularly in settings with a racially, ethnically, and/or socioeconomically diverse intersection of students, such as community colleges, tribal colleges and universities, and HBCUs. It is recommended that these policies comply with the ACHA's tobacco-free policy guidelines, including that the policies be comprehensive and incorporate prevention and cessation programming.

Further examination of policies and policy development, implementation, and enforcement across different campus types is needed, as is research on the impact of these policies on different population groups on those campuses. Research that addresses tobacco use among different population groups on campuses is needed to inform broader policy decisions, including the promotion of and approach to providing campus-based cessation resources. Tools are available to increase engagement with and support for these policies among groups experiencing tobacco-related disparities (Newman Carroll et al. 2021). These tools can also improve enforcement of these policies. Continued development and assessment of these types of interventions to reach people experiencing disparities is important (Loureiro et al. 2021; Pulvers et al. 2022). Further, to maximize the reach of tobacco-free campus policies, additional policies that go beyond the scope of the ACHA's guideline prohibiting the sale of tobacco on campus, such as prohibiting the delivery of tobacco products to students on campus, can be adopted.

Research is needed on the interplay between larger, macro-level factors, such as state tobacco control policies and interventions, tobacco-free college campus policies, and tobacco use behavior. One study (Ciecierski et al. 2011) found evidence that higher state expenditures on tobacco control programs in the prior year were associated with reductions in the prevalence of daily smoking and of 30-day cigar use among college students. Work by state tobacco control programs on policy, systems, and environmental change, including educational campaigns, may influence the adoption of tobacco-free college campus policies. At the same time, tobacco-free college campus policies reduce the social acceptability of tobacco use. It would be helpful to assess whether changes in norms—specifically those associated with college campus policies that are intended to reduce disparities in tobacco use and exposure to secondhand tobacco smoke—influence other community interventions that may reduce tobacco-related disparities.

Finally, as discussed earlier, young adults with fewer years of formal education have the highest rates of tobacco use compared with others in this age group, and many young adults do not attend college. Tobacco-free college campus policies are just one tool to address tobacco use among young adults. Other strategies are needed to prevent and reduce young adult tobacco use, including among people experiencing disparities, such as state and community tobacco control policies and programs, as well as providing both equitable access to secondary and post-secondary education and equitable support to youth and young adults to help them graduate from their educational programs and further advance their education.

Healthcare System Interventions

A primary opportunity to develop and disseminate appropriate, comprehensive, and integrated tobacco cessation treatment exists within healthcare settings. Although encounters with healthcare are important opportunities for individuals to be connected to cessation treatments, population groups experiencing tobacco-related disparities may also have inequitable access to healthcare in general or have differences in patterns of healthcare use that limit interactions with the healthcare system (IOM 2003; Yearby 2018; Agency for Healthcare Research and Quality 2021; Lee et al. 2021). Nonetheless, encounters with the healthcare system present opportunities in which people who use tobacco may be receptive to receiving counseling and making a cessation attempt supported by proven quit aids. Thus, while there are opportunities to provide tobacco cessation counseling and treatment during healthcare encounters, interventions integrated into healthcare delivery require careful design to be effective in reducing disparities.

Annually, most U.S. adults who smoke see a healthcare provider at least once (70%), want to quit smoking (68%), and make one or more quit attempts (55%), thus putting healthcare systems in a position to address tobacco use and dependence across populations (Babb et al. 2017) (population-specific cessation indicators are detailed in Chapter 4). The 2008 U.S. Public Health Service's Clinical Practice Guideline, *Treating Tobacco Use and Dependence: 2008 Update* (Fiore et al. 2008; hereafter referred to as *Clinical Practice Guideline*) calls on healthcare providers to assess and document tobacco use, advise and assist patients to quit with the aid of behavioral and pharmacotherapy supports, and arrange for ongoing support to increase the likelihood of cessation.

Systematically addressing tobacco use across healthcare systems, including through systems-level change strategies such as team-based care and health system policies and protocols, should reduce the prevalence of tobacco use and tobacco-related morbidity on average and within priority populations who bear a disproportionate burden of tobacco-related comorbidity, such as people of lower SES, people with disabilities, and those from certain minoritized racial and ethnic groups (USDHHS 2014, 2020). Studies are needed to determine how well this has been achieved and the systematic approaches that have been taken to address disparities in tobacco use and cessation through healthcare systems.

Various healthcare organizations, including those in ambulatory and inpatient settings, have adopted EHR technology that enables systematic tracking of tobacco use status across populations. In addition, health insurance regulations now require greater coverage for tobacco cessation services and cessation medications (DiGiulio et al. 2020), though some of these regulations are currently being challenged in the courts (Sobel et al. 2023). Despite the potential that exists within healthcare systems to systematically address tobacco use, numerous studies continue to document unequal access to cessation care, particularly for populations at risk for tobacco-related health disparities (Cokkinides et al. 2008; Babb et al. 2017, 2020; Bailey et al. 2018; Tan et al. 2018; USDHHS 2020). Disparities in receipt of health professional cessation advice and utilization of cessation treatments are reviewed in detail in Chapter 4. This section highlights promising strategies within healthcare systems that have demonstrated feasibility for systematically addressing tobacco cessation among adults. Studies reviewed here relate to systems-based strategies; individual-level interventions are reviewed elsewhere in this chapter. Due to limited data, definitive conclusions could not be made about the extent to which these strategies reduce tobacco-related health disparities.

Tobacco Cessation Treatment in Healthcare Settings

Screening and Brief Interventions to Treat Tobacco Dependence

Multiple models of brief tobacco cessation interventions have been researched and used in clinical settings. The 5A's model is outlined in the *Clinical Practice Guideline* and includes five components: (1) Asking patients about tobacco use, (2) Advising them to quit, (3) Assessing their readiness to quit, (4) Assisting in their quit attempt by offering counseling and pharmacotherapy, and (5) Arranging for follow-up (Fiore et al. 2008). Two additional models, the Ask, Advise, Refer (AAR) model and the Ask, Advise, Connect (AAC) model (Vidrine et al. 2013), are similar to the Screening, Brief Intervention, and Referral to Treatment (SBIRT) approach that has been used successfully with people who use alcohol and illicit substances (Saitz 2007). In clinical settings, including those serving priority populations, the AAC and AAR models encourage staff and clinicians to initiate tobacco cessation treatment and connect people who use tobacco with treatment programs that may be either within or outside the clinical setting.

The AAC model, in which patients who use tobacco are proactively connected to an existing program for tobacco cessation treatment, is more effective than the AAR model, which can put the onus for follow-up on the patient (Vidrine et al. 2013). The AAC model has been implemented successfully in busy clinics within a safety-net healthcare system (i.e., a system in the United States obligated to provide healthcare for people regardless of insurance status) and can be employed using a team approach, with multiple staff delivering individual components of the overall intervention (Pineiro et al. 2020). Importantly, the AAC approach can successfully leverage the network of state quitlines to proactively reach referred patients and provide counseling, and sometimes pharmacotherapy, in all 50 states, Washington, D.C., and several U.S. territories.

Quitlines are increasingly offering tailored patient education and counseling protocols for priority populations (North American Quitline Consortium 2018) (see the "Tobacco Quitlines" section in this chapter for more information). Similar opportunities are offered by eReferral to no-cost web-based and texting programs, such as those featured by NCI's Smokefree.gov. Electronic referral to SmokefreeTXT, a text messaging-based smoking cessation program from NCI, has been found to be feasible and acceptable to patients and clinical staff (McCarthy et al. 2019).

Population approaches that employ changes in health systems to address tobacco use represent promising strategies to increase the reach of tobacco cessation treatment. Historically, the default for tobacco cessation intervention has been that people who use tobacco needed to "opt in" to treatment. "Opt-in" services rely on referrals from healthcare providers for treatment, which generally rely on assessments of patient readiness to quit or willingness to engage in cessation services (Richter and Ellerbeck 2015), which limit those who receive cessation treatment. "Opt-out" tobacco consultation services, which offer cessation counseling to all people identified as using tobacco, illustrate the potential for broad reach (Nahhas et al. 2017; Ylioja et al. 2017) and have been proposed as more ethical than opt-in services (Richter and Ellerbeck 2015). Furthermore, opt-out services may more equitably reach population groups such as underserved racial and ethnic groups and individuals enrolled in Medicaid (Faseru et al. 2009; Ylioja et al. 2017). Whether an opt-out or opt-in approach yields superior results was tested in a large clinical trial among hospitalized adults (Faseru et al. 2017; Richter et al. 2023). Data from this trial showed promising results, with opt-out care (vs. opt-in care) achieving better cessation treatment utilization (59.9% vs. 33.8% for medication use and 88.7% vs. 37.1% for engaging in ≥1 postdischarge counseling calls), quit attempts among those who continued to smoke at 1 month (69.2% vs. 59.2%), and 1-month verified abstinence (21.5% vs. 15.9%) (Richter et al. 2023).

Ambulatory Care Settings

Although clinical guidelines for tobacco cessation treatment can be effectively implemented in ambulatory care settings (Quinn et al. 2009), few studies have specifically investigated the degree to which such implementation reduces disparities in tobacco cessation. A large trial examining the impact of implementing guidelines for tobacco cessation treatment in clinics for U.S. veterans found higher rates of documenting tobacco use and the use of medications by patients, but no increases were seen in rates of prescriptions for smoking cessation medication or in overall quit rates among patients (Joseph et al. 2004). Subsequent trials of population-based proactive treatment of smoking among socioeconomically disadvantaged groups resulted in higher self-reported long-term abstinence in veterans (Fu et al. 2014b) and people enrolled in state-administered health insurance (i.e., Medicaid or MinnesotaCare, which is for Minnesota residents who do not have access to affordable healthcare coverage, but who have higher income than people covered by Medicaid or Medical Assistance) (Fu et al. 2016). Proactive interventions included study-facilitated access to counseling and NRT that did not require a dedicated visit with a healthcare provider. A secondary analysis of proactive outreach in U.S. veterans did not demonstrate an interaction between race and intervention condition; in that study, African American veterans (13%) quit at higher rates than White veterans (9%, $p < 0.006$), regardless of receipt of proactive or usual care (Burgess et al. 2014). The authors suggested that the higher quit rates among African American veterans may have been due, in part, to a higher likelihood of use of combined cessation counseling and medication in this group in the study. Collectively, these studies support the role of proactive, population-based treatment for people who smoke in a broad array of priority populations. The Veterans Health Administration and state-administered healthcare programs, such as Medicaid, are uniquely equipped to offer proactive tobacco cessation treatment, and thereby have the potential to reduce tobacco-related health disparities, based on their clinical infrastructure and the population groups they serve.

Community Health Settings

Studies suggest that leveraging community-based settings and outreach, such as community health centers or community health workers, may effectively increase reach of cessation interventions to population groups with high tobacco use prevalence. Community health centers, for example, are uniquely situated to reach lower-income patients who smoke and they serve a patient population with a high proportion of tobacco use; a study of Federally Qualified Health Centers (FQHCs) found the prevalence of tobacco use to be an average of 5.2 percentage points higher among patients at FQHCs compared with the overall population in their states (range -4.9 to 20.9) (Flocke et al. 2017). A study of smoking cessation behaviors among adult patients at federally supported health centers found that most patients received clinical advice to quit (78.7%), but few used cessation treatment when trying to quit (15.2%), suggesting that there are opportunities to increase treatment engagement (Trapl et al. 2021b).

Involving communities in planning interventions in familiar settings and using the principles of CBPR have produced promising results (described later) in smoking cessation outcomes among American Indian population groups; in intersectional groups of African American women living in subsidized housing; and in neighborhoods within geographic regions where the prevalence of tobacco use remains high, such as "Tobacco Nation," the 13-state region in the Midwest and South, which has many rural communities and which has some of the highest rates of smoking among adults in the nation (Truth Initiative 2019c).

A culturally tailored group therapy program using the American Indian "talking circle" format with trained American Indian facilitators found higher self-reported but not cotinine-verified cessation after 6 months (Choi et al. 2016a). Elsewhere, a CBPR approach was used to develop a culturally tailored intervention for African American women residing in subsidized housing. The intervention included NRT and was delivered by community health workers through one-on-one visits at participants' homes or in community settings and reinforced by group therapy led by trained nurses and community health workers. Cessation rates among the population that received the CBPR-developed intervention were higher at 12 months compared to rates among the control group, which received culturally sensitive written materials (12% vs. 5.3%, $p = 0.016$). However, the CBPR-developed intervention had no statistically significant effect on the odds of having quit smoking in multivariate analyses that included covariates that were statistically significant in univariate analyses, such as baseline number of cigarettes smoked (Andrews et al. 2016).

In a study of racially and ethnically diverse people who smoke and were recruited through community health centers in the southern region of the United States, most (71%) embraced novel treatment approaches, such as genetically informed precision treatment of smoking, but favorable attitudes toward such treatments among African American people who smoke was about half that among White people who smoke (aOR = 0.47; 95% CI, 0.27–0.83) (Senft et al. 2019). A follow-up CBPR study, which used a community advisory board that included African American people who smoke, demonstrated the feasibility of this approach to the cultural tailoring of genetically informed precision treatment (Connors et al. 2019). Other research has successfully recruited African American people who smoke from FQHCs (Sanderson Cox et al. 2012; Webb Hooper et al. 2017a; Nollen et al. 2020).

Hospital and Acute Care Settings

Tobacco cessation treatment initiated in the emergency department of a hospital is effective, has been implemented successfully in multiple clinical trials, and was recommended as "an integral component of emergency care" (Bernstein et al. 2006, p. e423) in a joint statement of U.S. emergency medicine organizations (Bernstein et al. 2006; Lemhoefer et al. 2017). Groups who are disproportionately burdened by tobacco use, including African American people, Hispanic people, and people enrolled in Medicaid or who are uninsured have relatively high rates of use of emergency department care (IOM 2003), providing a potential opportunity to increase the reach of cessation interventions to these population groups. The extent to which tobacco cessation treatment initiated in the emergency department reduces tobacco cessation-related disparities is unknown. A systematic review and meta-analysis of RCTs published between October 4, 2010, and May 15, 2015, that considered time points ranging from 1, 3, and 6 months to 12 months after the visit to the emergency department demonstrated higher cumulative odds of cessation for those who received a cessation intervention initiated in the emergency department versus those receiving "usual care" such as self-help materials (pooled risk ratio [RR] = 1.40; 95% CI, 1.06–1.86) (Lemhoefer et al. 2017). However, the meta-analysis did seem to suggest an attenuated effect over time, with significant effect at 1- and 3-months follow-up, but not at 6- and 12-months follow-up.

Hospitalized people who smoke benefit from tobacco cessation treatment that is initiated during their stay. A Cochrane review of 50 hospital-based smoking cessation trials revealed that high-intensity behavioral interventions (but not lower intensity interventions) initiated during a hospitalization, including behavioral counseling support that continued in the month following discharge and NRT, substantially improved tobacco abstinence rates (Rigotti et al. 2012). The benefits of hospital-initiated tobacco cessation treatment were similar in acute care hospitals and rehabilitation hospitals and were optimized if counseling and NRT extended for at least 1 month after discharge. Some evidence subsequent to the Cochrane review supports initiating varenicline before hospital discharge (Eisenberg et al. 2016). In addition, several other studies found continued success from cessation interventions initiated during hospitalization (Rigotti and Stoney 2016), and one study—which highlighted the effectiveness of advice to quit, brief intervention, and arranging for a quitline referral during a tertiary care hospital stay—found no differences by race in long-term abstinence rates (Harrington et al. 2016). These studies illustrate varying degrees of pragmatism, or real-world applicability testing, in addressing tobacco use in clinical populations (Cruvinel et al. 2016) and underscore opportunities to improve rates of cessation at a population level by implementing effective interventions in hospital settings.

Additional tools, such as interactive voice response (IVR) outreach via automated calls (Nahhas et al. 2017) and electronic referral ("eReferral") to state quitlines (Tindle et al. 2016) to augment postdischarge care, can increase reach by engaging more hospitalized people who smoke to use evidence-based treatment. Strategies such as IVR are typically offered in an opt-in fashion, although precedent exists for an opt-out model (Nahhas et al. 2017).

Clinical Oncology Settings

Clinical oncology settings present unique opportunities for effective cessation intervention delivery. Comprehensive cancer care may encompass both ambulatory and hospital settings; promising strategies in each of these settings stand to benefit people who use tobacco and are undergoing cancer screening, diagnosis, or treatment, or are in survivorship after successful treatment. Studies have been conducted to determine how the clinical oncology setting can be used to assist patients with cancer who smoke to quit; however, limited research has focused on cessation among population groups affected by cancer and tobacco-related disparities.

NCI Tobacco Control Monograph 23, *Treating Smoking in Cancer Patients: An Essential Component of Cancer Care* (NCI 2022) reviewed evidence regarding the importance of cessation treatment in oncology settings, including for groups disparately affected by tobacco use. It concluded that "patients with cancer who are also members of medically underserved and vulnerable populations are motivated to quit smoking" but may be less likely to successfully quit than patients with cancer in the overall population. The monograph also called for further research "regarding the effectiveness of smoking cessation treatment among medically underserved and vulnerable groups of cancer patients" as well as "strategies for increasing the reach and cost-effectiveness of such treatment" (NCI 2022, p. 262).

In 2017, as part of its Cancer Moonshot program, NCI launched the Cancer Center Cessation Initiative (C3I), a program designed to help NCI-Designated Cancer Centers build and implement sustainable tobacco cessation treatment programs to routinely address tobacco cessation with patients in clinical oncology settings (Croyle et al. 2019). C3I aims to support the comprehensive treatment of smoking as a "fourth pillar" of cancer care to be added to the standard surgical, radiologic, and chemotherapeutic approaches to cancer treatment (Fiore et al. 2019). As implementation of smoking treatment in 52 NCI-Designated Cancer Centers proceeds, an opportunity exists to study the extent to which C3I efforts may increase tobacco cessation and improve cancer outcomes in patient populations affected by disparities in tobacco use (D'Angelo et al. 2021).

Augmenting the Capacity of Healthcare Providers to Treat Tobacco Dependence

Building provider capacity to address tobacco use is a key component of the successful implementation of tobacco cessation treatment programs in healthcare settings. Some studies have suggested gaps in knowledge among clinicians serving patient populations with lower incomes. For example, a survey of Arkansas primary care physicians caring predominantly for patients who were insured by Medicaid and/or Medicare or were uninsured found that nearly 75% had no training in the treatment of tobacco use and very little knowledge of programs for tobacco cessation treatment provided by the state at no charge (Sheffer et al. 2012a).

Several models of capacity building have been implemented with some success. For example, academic detailing, which involves training providers and clinic staff about tobacco use and its treatment as well as providing technical assistance, increases rates of clinical assessment and treatment of tobacco use (CDC 2014). In one study of primary care clinics in Wisconsin, a combination of enhanced academic detailing (including in-person trainings, technical assistance, and performance feedback to clinic personnel) and a light-touch quitline fax referral implementation program (written implementation guide and clinic-level feedback) increased the average number of quitline referrals per clinician compared with the light-touch program alone (8.5 vs. 1.6 referrals, p <0.001), and also increased the average number of referrals resulting in quitline service enrollment (4.8 vs. 0.86, p <0.001) (Sheffer et al. 2012b).

Learning collaboratives are another example of a capacity-building model in which public health and healthcare collaborate with shared learning and technical assistance to advance health systems change and quality improvement activities for improved integration of tobacco dependence treatment into clinical care (Kaslow et al. 2018). In addition, training in intersectional disparities (the clustering of disparities within an individual person based on belonging to multiple sociocultural population groups) has been suggested as a potential strategy to increase delivery of tobacco cessation treatment that demonstrates sociocultural respect and addresses power imbalances inherent to interactions between providers and patients from marginalized population groups (Sheffer et al. 2018).

Electronic Health Records and Associated Decision Support

As part of the *Health Information Technology for Economic and Clinical Health Act*, health systems received incentives to adopt Meaningful Use[4] strategies for EHRs. One of the requirements of Meaningful Use for providers, eligible hospitals, and critical access hospitals was the documentation of smoking status for patients 13 years of age and older (Centers for Medicare & Medicaid Services [CMS] 2010). Making appropriate modifications to EHRs (e.g., prompts for screening and intervention or automatizing referrals) appears to increase the population rate of screening for tobacco use and the provision of cessation assistance (Boyle et al. 2014). EHR patient portals and mobile applications delivering eHealth interventions are growing in popularity, but their impact on tobacco-related health disparities is unknown. While having home Internet access is associated with successful tobacco cessation among U.S. veterans (Calhoun et al. 2016), differential access to Internet services may limit the reach of Internet-based interventions. African American people, Hispanic people, and people with lower levels of education are less likely to have access to the Internet, particularly broadband internet at home (Atske and Perrin 2021), potentially increasing disparities for these groups for Internet-based interventions.

EHR systems can support both identification of priority populations and delivery of tobacco cessation interventions. Interventions using EHR data to identify lower SES population groups for proactive outreach interventions have been found to increase the use of cessation aids (Vidrine et al. 2013; Haas et al. 2015) and rates of cessation (Haas et al. 2015). Most EHRs allow for documentation of race and ethnicity, sexual orientation and gender identity, and markers of lower SES, such as insurance status (*Federal Register* 2012; Cahill et al. 2016). Electronic clinical decision support tools integrated into the EHR can direct healthcare providers to deliver treatment, increase medication orders or prescriptions, and increase referrals to state quitlines for telephone counseling treatment as part of the clinical encounter (Karn et al. 2016; Bernstein et al. 2017). Computerized patient interactions that are translated into languages beyond English can increase engagement with cessation interventions for underserved population groups (Cupertino et al. 2010). EHRs offer healthcare systems the opportunity to identify and systematically deliver proactive tobacco cessation treatment to patients who use tobacco and to evaluate the impact of interventions on tobacco-related health disparities (Kruse et al. 2012; Satterfield et al. 2018).

Clinical Quality Programs

Strategies that promote the systematic delivery of tobacco cessation treatment services include clinical quality programs. The 2020 Surgeon General's report on smoking cessation concluded that there is sufficient evidence to infer that strategies linking cessation-related quality measures with payment increase delivery of clinical cessation treatment (USDHHS 2020). This conclusion continues to be borne out by recent evidence. In Oregon, implementation of an incentive metric for cigarette smoking in the state's Medicaid coordinated care organization Quality Incentive Program was associated with increases in the percentage of people enrolled in Medicaid who reported receiving clinical advice to quit smoking (Livingston et al. 2020).

Tobacco cessation-related quality programs and related quality measures exist at a variety of system levels, including at the level of the provider, hospital, system, and payer. One example is the inpatient tobacco cessation treatment measures from The Joint Commission, the accrediting body for hospitals (The Joint Commission 2012).

[4]*Meaningful Use* leveraged certified EHR technology to advance multiple objectives, including improving the quality, safety, and efficiency of healthcare and reducing health disparities; engaging patients and families; improving the coordination of care; improving population and public health; and maintaining the privacy and security of patient health information (*Federal Register* 2010; HealthIT.gov 2019). The minimum criteria for Meaningful Use required (1) use of certified EHR technology in a meaningful manner (e.g., electronic prescribing); (2) use of certified EHR technology for electronic exchange of health information to improve healthcare quality; and (3) use of certified EHR technology to submit clinical quality measures and other measures required by USDHHS (*Social Security Act of 1992* 1992; *Social Security Act of 1996* 1996; HITECH Act 2009; Social Security Administration n.d.).

Although currently voluntary, the Joint Commission measures include (1) documenting patients' tobacco use status, albeit not explicitly across all tobacco products (e.g., e-cigarettes), during the hospital stay; (2) documenting the delivery of counseling and pharmacotherapy during the inpatient stay; and (3) documenting provision or offering of outpatient counseling and pharmacotherapy on discharge (The Joint Commission 2012). Inpatient psychiatric facilities have been incentivized to report on the inpatient tobacco-related measures stewarded by the Joint Commission as part of the Inpatient Psychiatric Facility Quality Reporting (IPFQR) Program (CMS 2018). This has led to increases in documentation of the assessment of tobacco use and its treatment since the requirement was first imposed (Scharf et al. 2011; CMS 2014; Carrillo et al. 2017). Recent changes in the IPFQR Program have reduced the tobacco-related measures required for reporting to one measure, the TOB 3/3a measure, beginning with the fiscal year 2025 payment determination year. This measure captures whether referrals to outpatient tobacco cessation counseling and for FDA-approved medications were offered or refused at the time of the patient's discharge (*Federal Register* 2023a). The Medicare Shared Savings Program (Shared Savings Program) is an example of a cessation-related quality program at the systems level. Shared Savings Program Accountable Care Organizations (ACOs) assume responsibility for the quality, cost, and experience of care for a defined group of Medicare beneficiaries. ACO performance is evaluated on a set of clinical quality measures that includes tobacco cessation treatment. ACOs that perform well may be eligible to share in the savings they achieve for the Medicare program (also known as performance payments) (CMS 2020). Although such programs drive increases in the delivery of clinical treatments, it remains unclear what impact they have on disparities in the receipt of cessation treatment services.

Health systems are also increasingly being asked to identify, document, and address health disparities including social and structural barriers to care. For example, new 2023 requirements from The Joint Commission require accredited institutions to assess patients' social needs that impact health (such as transportation, food security, housing security, education and literacy, and ability to pay for medical care) and also provide patients with information about support services (The Joint Commission 2022). The Joint Commission also requires systems to identify healthcare disparities in their patient populations and develop a plan to address at least one of the disparities identified.

Similarly, CMS has added two measures related to social determinants of health to the PPS (prospective payment system)-Exempt Cancer Hospital Quality Reporting (PCHQR) Program (*Federal Register* 2023b). These measures assess screening and screen-positive rates for food insecurity, housing instability, transportation needs, utility difficulties, and interpersonal safety for all admitted adult patients. PPS-exempt cancer hospitals will be required to report these measures starting in the fiscal year 2027 program year. These measures have been adopted into the Hospital Inpatient Quality Reporting program (*Federal Register* 2022a). As efforts to address the social and structural barriers to care are implemented, evaluation regarding their impact on supporting tobacco cessation and cessation-related disparities will be needed.

The *Patient Protection and Affordable Care Act*

Comprehensive insurance coverage of proven cessation treatments, particularly when offered without barriers to access, has the potential to impact disparities in treatment access and utilization. The *Clinical Practice Guideline* concluded that insurance coverage of cessation treatments increases treatment utilization, quit attempts, and successful quitting (Fiore et al. 2008). Similarly, the 2020 Surgeon General's report concluded that, with adequate promotion, comprehensive and barrier-free treatment coverage increases treatment utilization, leads to higher rates of successful quitting, and is cost-effective (USDHHS 2020).

The impact of the *Patient Protection and Affordable Care Act* (ACA) (2010) on the delivery of tobacco cessation treatment services to reduce tobacco use and tobacco-related health disparities is largely understudied (Hawkins and Cohen 2014; Burcu et al. 2016). The ACA requires most private health insurance plans, as well as Medicaid alternative benefit plans, in which members of the ACA Medicaid expansion population must be enrolled, to cover tobacco cessation treatment as recommended by the U.S. Preventive Services Task Force, including at least four counseling sessions (without cost sharing) and FDA-approved pharmacotherapy. Copayments for FDA-approved smoking cessation medication may still apply, and they vary by insurance plan, even for Medicare enrollees with plans that include prescription coverage. Gaps in coverage for cessation treatments also remain in traditional Medicaid programs (i.e., with respect to beneficiaries who are not enrolled in an alternative benefit plan), with varying levels of access barriers such as copayments, duration limits, and limits on the number of covered quit attempts (DiGiulio et al. 2020). As of 2018, only 15 state Medicaid programs provided comprehensive cessation coverage to all enrollees in traditional Medicaid (DiGiulio et al. 2020). The ACA requirement that health plans cover preventive care services recommended by the U.S. Preventive Services Task Force is currently being challenged in the courts (Sobel et al. 2023).

In addition, since 2014, the ACA has given states the option to expand Medicaid using Group XIII eligibility (i.e., income less than or equal to 138% of the federal poverty level). In 2015, an estimated 2.3 million people who smoked became newly eligible for healthcare coverage through the expansion of Medicaid programs in 31 states and Washington, D.C. (DiGiulio et al. 2016). Diverse racial and ethnic groups, adults with lower income (Sommers et al. 2015), and people who identified as LGBT (Skopec and Long 2015) reported increases in access to health insurance after this expansion, although gaps in coverage and disparities in healthcare access persist (Lee et al. 2021). Medicaid expansion increased prescriptions for smoking cessation, use of cessation treatment, and cessation rates among newly insured enrollees who smoked (Koma et al. 2017; Maclean et al. 2017; Richards et al. 2017; Young-Wolff et al. 2017). For example, smoking cessation increased among lower income adults in 39 states and the District of Columbia after they expanded Medicaid coverage (Koma et al. 2017). In another study, patients who used tobacco and had visits in community health centers in 10 expansion states (vs. propensity score-matched patients in non-expansion states) had increased adjusted odds of quitting (aOR = 1.35; 95% CI, 1.28–1.43) and having a cessation medication ordered (aOR = 1.53; 95% CI, 1.44–1.62) (Bailey et al. 2020).

These results are consistent with prior studies showing that expanded coverage for tobacco cessation treatment services decreased the prevalence of smoking (Land et al. 2010). States that expanded Medicaid also observed a trend toward earlier stage cancer diagnoses (Jemal et al. 2017) and increases in the rate of surgery for lung cancers (Eguia et al. 2018). Although more people reported having received advice to quit smoking from a healthcare provider from 2010 to 2015 after the ACA rollout, lower prevalence of receiving advice from providers persisted for lower income and Hispanic populations (Tan et al. 2018). (For more information on disparities in receipt of provider advice, see Chapter 4). Earlier research also found that use of NRT was lower among people with lower incomes and among “non-White” adults in one state when NRT was made available without a prescription (Thorndike et al. 2002) (“non-White” was not further defined in the study); instituting coverage without copayment for all FDA-approved cessation medications is one way to address this disparity (Curry et al. 1998).

Collaboration between Medicaid programs and state quitlines may reduce tobacco-related health disparities by increasing access to treatment. For example, the Medi-Cal Incentives to Quit Smoking trial in California (Anderson et al. 2018) conducted statewide outreach to California Medicaid enrollees via a variety of channels, including direct-to-member and direct-to-provider mailings. These communications encouraged enrollees to call the California quitline and promoted incentives for callers, including free NRT and a $20 financial incentive, which quitline callers had to request (Tong et al. 2018b). Groups that asked for the financial incentive at higher rates than average included callers who were African American; American Indian and Alaska Native; pregnant women; or gay, lesbian, or bisexual and callers with some behavioral health conditions (Tong et al. 2018b). Except for callers who were Spanish-speaking Hispanic people, callers who requested the financial incentive generally had higher engagement with the quitline (Vijayaraghavan et al. 2018b). These findings suggest that population-tailored promotional strategies for evidence-based quitlines can help to address disparities in access to care.

Summary and Recommendations

Healthcare settings are a critical environment for reaching and engaging people in tobacco cessation interventions, including delivery of evidence-based treatments such as behavioral counseling and pharmacotherapy. Such treatments can be delivered successfully in a variety of clinical settings and by a variety of healthcare professionals (Fiore et al. 2008; USDHHS 2020). As outlined in the 2020 Surgeon General’s report, health system-level changes, such as linking quality measures to payments, can increase the delivery of cessation treatments (USDHHS 2020).

What is less well understood is the impact of such health system changes on reducing tobacco use and health outcomes associated with tobacco use among population groups affected by tobacco-related disparities; the lack of data precludes definitive conclusions about the extent to which these strategies reduce tobacco-related health disparities. To improve understanding of the degree to which health systems interventions aimed at increasing reach of and engagement in cessation reduce disparities, researchers should, wherever possible, report impact among key priority populations, including underserved racial and ethnic groups, lower SES groups, and other priority populations (Brown et al. 2014). Continued research is needed in clinical settings to examine the effectiveness and disparity-related impacts of quality improvement strategies, health systems changes, provider behaviors, patient treatment engagement, and systems change maintenance.

Health technology, quality programs, and other policies can be valuable tools for reducing tobacco-related health disparities. EHRs, for example, are a promising tool for providing systems-level support to providers in the delivery of tobacco cessation treatment (including through clinical decision support, assisted documentation, and facilitation of patient referral to additional cessation supports) and as a data source for evaluating both the delivery of treatment as well as systems-level interventions or quality improvement initiatives aimed at enhancing and improving treatment delivery. However, challenges remain related to data quality and availability. EHR data also have the potential to facilitate the identification of barriers to implementing consistent treatment throughout healthcare systems, including potentially identifying whether there are unique or disproportionate treatment barriers, such as social and structural barriers, as more health systems are documenting social determinants of health.

As noted in the 2020 Surgeon General's report, health system regulations that require providers to document the provision of tobacco cessation treatment can increase the clinical delivery of tobacco cessation treatment in healthcare settings, particularly if doing so is tied to reimbursement. Policies that increase access to services, such as those instituted by the ACA and the expansion of Medicaid, are essential to reducing tobacco-related health disparities.

For the healthcare systems' "window of opportunity" to open widest, systematic documentation of tobacco use status, along with delivery and documentation of counseling and pharmacotherapy, are critical. Ensuring the systematic provision of cessation interventions across healthcare settings can reduce existing gaps in the delivery of tobacco cessation treatment to population groups experiencing a high prevalence of tobacco use and poor tobacco-related health outcomes. Continuation of standard practice, which generally relies primarily on providers to deliver advice to stop smoking and make referrals for treatment, is likely to perpetuate tobacco-related disparities. Widespread implementation of proactive, health system-level treatment models is needed, as is better understanding of the impact of systems-level approaches (e.g., systems policies and protocols that routinize and standardize care, team-based care models, and others) on cessation-related disparities. Clinical practice guidelines and recommendations to offer tobacco cessation treatment services to every patient at every encounter in all healthcare settings by any healthcare professional remain paramount (Fiore et al. 2008). Also needed are continued efforts to increase access to healthcare for underserved population groups as well as efforts to expand the reach of cessation interventions by leveraging the full continuum of healthcare settings, including through pharmacists and cancer screening programs.

Implementing these recommendations to reduce tobacco-related health disparities will be further supported by ensuring that provider training includes tobacco cessation treatment (and the role of disparities), leveraging EHR-enabled technological advances to systematize treatment delivery, and using existing and potential regulatory requirements, particularly those that are tied to reimbursement. As integration of tobacco use treatment in healthcare settings continues to proceed, an urgent need exists for research to document the impact of such treatment on tobacco-related health disparities and to guide clinical practice to ensure the consistent and equitable delivery of evidence-based treatment to everyone who uses tobacco. As more health systems work to address social determinants of health, studies are also needed to determine how well social determinants of health are being documented in the medical record, evaluate the impact of social determinants of health interventions, and determine the impact of such interventions on patients' ability to fully benefit from tobacco cessation programs.

Worksite-Based Interventions

The prevalence of smoking, quitting, and relapse differs significantly by occupation (see Chapters 2 and 4 for additional details). Occupation is a critical indicator of SES as it links education and income and reflects a person's place in society related to their social standing as well as their working conditions and relationships (Galobardes et al. 2006). Whether a person is employed or not—and for those who are employed, the nature of one's working conditions—significantly shapes health outcomes, exposure to occupational hazards, and health behaviors like tobacco use (USDHHS 1985; Schnall et al. 2009; Marmot and Bell 2010; Pfeffer 2018). Occupation influences tobacco use patterns through job-specific working conditions, the availability of worksite resources to support cessation and prevent relapse, and tobacco policies that further contribute to the work environment.

This section discusses social, organizational, and healthcare policies and relationships that either facilitate or pose barriers to addressing tobacco-related disparities at worksites, with an emphasis on the implications for lower income and "blue-collar" workers (i.e., manual laborers or other workers who perform work with their hands, physical skill, and energy) (U.S. Department of Labor 2019). This discussion focuses on three major themes related to the work environment: (1) eliminating disparities in access to cessation resources, (2) eliminating disparities in coverage of tobacco-free policies, and (3) improving working conditions to support tobacco control. This section does not address tobacco use among people who are not employed due to disability, retirement, school attendance, or difficulty finding work. Strategies are also needed to (a) prevent and reduce tobacco use and provide cessation services to all people, regardless of employment status, and (b) provide equitable access to safe employment and opportunities for occupational advancement.

Eliminating Disparities in Access to Cessation Resources

Improving Social Policies

Health Plan Coverage. Comprehensive coverage for cessation treatment and barrier-free access to such treatment are associated with higher long-term quit rates and improved health outcomes (Kaper et al. 2005; van den Brand et al. 2012; Ku et al. 2016). Historically, health insurance coverage for smoking cessation has been unequally distributed by occupational class, with health insurance plans for "blue-collar," including physical labor or trade workers, tending not to cover smoking cessation treatments or frequently requiring copayments and prior authorization, all of which pose significant barriers for lower income workers to access cessation treatment (Barbeau et al. 2001a).

As described in prior sections of this chapter, the ACA includes provisions that increase coverage of cessation treatment services. This increase in coverage may reduce disparities in accessing cessation treatment coverage among physical labor and trade workers and lower wage workers. Additionally, the ACA gives states the option to expand Medicaid to lower income workers who were previously ineligible for Medicaid, many of whom are underinsured in part because of their type of employment (such as workers employed in ride sharing, food delivery, and, in some cases, food service). The expansion of Medicaid to this population in some states has increased access to preventive health services, including treatment for smoking cessation, among lower income workers (Williamson et al. 2016). One critical component of the efforts necessary to fully realize the goal of eliminating tobacco-related health disparities in this population is to ensure full compliance with the law among health plans and state Medicaid plans. Continued monitoring of the ACA's impact on increased expansion of access to cessation treatment among physical labor or trade workers and lower income workers is also important, given the higher prevalence of tobacco product use among these groups (see Chapter 2).

One provision of the ACA (2010) allows certain health insurance plans offered by small employers to charge premiums for people who use tobacco that are up to 50% higher than premiums for people who do not use tobacco. These premiums, also known as tobacco surcharges, are to be used only if an employer provides a tobacco cessation program and the employee does not participate in that program. Although intended to motivate employees who currently smoke to quit, Pesko and colleagues (2018) concluded that tobacco surcharges have been misused by 47% of small employers' health plans, which imposed these surcharges without offering a tobacco cessation program to their employees.

Although charging people who use tobacco more for health insurance could motivate them to quit, such charges could also cause people to conceal their smoking status to avoid the additional charges, which would make it harder to identify people who smoke and engage them in cessation treatment (Kaplan et al. 2014; USDHHS 2020). Such surcharges could also disproportionately increase healthcare access barriers for those with higher tobacco use prevalence. A recent study of ACA marketplace plan enrollment suggested an association between tobacco surcharges and reduced health insurance enrollment overall, as well as a reduced share of enrollees reporting tobacco use, particularly among people living in rural areas (Dorilas et al. 2022). Only limited data are available regarding the effect tobacco surcharges have on tobacco cessation and on ways to design price differentials that can minimize their potential negative impacts and promote tobacco cessation (USDHHS 2020). Efforts to ensure that employer-based health plans comply with the provisions of the ACA may help to avoid the negative consequences of these surcharges on workers.

Wage Policies. Occupations with lower wages are closely linked to multiple risk behaviors, including cigarette smoking and such consequent adverse health outcomes as reduced life expectancy and premature mortality. The association between lower wages and cigarette smoking operates through various pathways, including poorer material conditions (such as poorer housing, higher debt load, lack of access to a car) and psychosocial factors (such as lack of social support, lower sense of control) (Sorensen et al. 2004).

Studies have shown that people who smoke cigarettes earn between 2% and 24% lower wages than people who do not smoke, and that this wage gap—or "smoking wage penalty"—may be greater among women than men (Darden et al. 2021). This wage gap could contribute additional stress and impact tobacco use. Studies suggest that when people face multiple forms of stress, including financial stress, they may be more likely to smoke (Slopen et al. 2012, 2013). Financial stress for people who use tobacco may be further affected by increases in tobacco prices or tobacco-related health insurance surcharges.

Increased wages have the potential to directly help lower income workers to improve their material conditions and reduce daily stressors, potentially reducing their reliance on smoking as a form of coping with daily stressors and aiding them with accessing resources for smoking cessation. Emerging, albeit limited, evidence suggests possible benefits of increasing minimum wages on improving health equity and various outcomes, including improved access to healthcare (McCarrier et al. 2011), fewer low birth weight births and post-neonatal deaths in the year following birth (Komro et al. 2016), reduced premature mortality (Tsao et al. 2016), and reduced tobacco consumption (Lenhart 2017).

More research is needed to examine the long-term impact of raising minimum wages on tobacco use, quitting, and tobacco-related health outcomes among lower income workers.

Workplace Access to Cessation Resources

Evidence from a 2014 Cochrane review on workplace interventions for smoking cessation found that group therapy programs, individual counseling, pharmacotherapies, and programs with multiple intervention components aimed at smoking cessation increase cessation rates compared with no treatment or minimal intervention controls (Cahill and Lancaster 2014).

Workplaces are an important setting in which to assist people in quitting smoking, given that they may contain large groups of people who smoke who can be easily reached and given assistance through proven cessation methods (Cahill and Lancaster 2014). Also, a recent study by Rigotti and colleagues (2020) showed that employers can potentially enhance the impact of providing comprehensive health insurance coverage of smoking cessation medication by adding a phone-based worksite cessation program.

Employer support for uniform Availability of, and access to, cessation resources. Input, support, and commitment from employers and management for a comprehensive health and safety program for workers are key to ensuring a supportive work environment where workers can access tobacco cessation resources, quit successfully, and be protected from exposure to secondhand tobacco smoke (Castellan et al. 2015). The delivery of tobacco cessation programs designed to reach lower income workers could be informed by understanding employers' perspectives on workplace health promotion programs, such as tobacco cessation programs; what they perceive to be the barriers and facilitators for implementing such programs; and how to address their concerns about costs, time constraints, and logistical issues.

In one study, Hannon and colleagues (2012a) examined the perceptions of workplace health promotion programs among midsized employers in lower wage industries and found that these employers recognized the benefits of these programs in reducing healthcare costs and improving workers' morale and productivity. Employers expressed concerns about the potential of such programs to intrude into workers' personal lives; the barriers to implementing such programs, including limited budgets and staff time; and limited ability to reach workers who were geographically dispersed in multiple locations (Hannon et al. 2012a,b). Addressing employer and management concerns about the capacity to implement workplace health promotion programs by providing technical assistance for capacity building within the workplace, offering toolkits or "turnkey" materials and resources that can be directly disseminated to workers, and obtaining evidence that programs will have a positive effect are recommended to increase employer support and commitment.

Financial incentives: Implications of approaches derived from behavioral economics. Based on a systematic review completed in 2010 (Leeks et al. 2010), the Community Preventive Services Task Force recommends worksite-based incentives or competitions combined with additional cessation interventions to reduce tobacco use among workers. The review included evidence from 14 studies evaluating worksite incentives (individual rewards and lotteries) implemented with additional cessation supports (such as self-help materials, cessation support groups, and telephone counseling). These studies occurred in a variety of worksite settings with more than 100 employees, including manufacturing plants, healthcare facilities, government offices, and chemical plants, in both urban and suburban settings. Among the studies reviewed, the authors found a median change of 4.3 percentage points in self-reported cessation and a median quit rate of 15%. The authors did note limitations in the reviewed studies, including attrition rates, and called for additional evaluation of the use of worksite interventions when implemented alone without additional cessation supports (Leeks et al. 2010).

A more recent review by Cochrane in 2019 concluded that there is high-certainty evidence that incentives improve smoking cessation rates among adults at long-term follow-up. Ten of the 33 studies included in the review were done at worksites (Notley et al. 2019) where various financial incentives, including lotteries, prize draws, cash rewards, and vouchers for goods were used to increase participation in smoking cessation programs and for smoking abstinence (Notley et al. 2019).

In three large RCTs that were conducted among U.S. workers and included in the 2019 Cochrane review (Notley et al. 2019), financial incentives had positive effects on biochemically verified smoking cessation (Volpp et al. 2009; Halpern et al. 2015, 2018). Most of the participants in these studies were White, had completed relatively high levels of education, held jobs within "white-collar" industries, and had employers who had used a wellness program.

Future research regarding worksite-based financial incentives for cessation could benefit from a focus on lower income workers and workers in industries with higher tobacco use prevalence. As interventions are developed and implemented, caution must be taken to minimize the use of incentives that have the potential to be discriminatory or coercive (Madison et al. 2011, 2013) (e.g., "incentives structured as rewards [becoming] sufficiently like penalties that they undermine voluntariness" [Madison et al. 2011, p. 459]). Evidence pertaining to the use of incentives for cessation among people with lower SES, but not specific to the worksite, is detailed later in the chapter.

Reducing Work-Related Barriers to Accessing Resources

Workers in physical labor, trade, and service occupations often face significant structural barriers that prevent them from fully participating in health promotion programs that include tobacco cessation treatment services (Sorensen et al. 2004). It is critical to understand and reduce such barriers. For example, transit workers' split-shift schedules (i.e., being on duty in the morning and then again in the afternoon or evening rush hours) and early morning shift hours were cited in focus groups as structural barriers to their being able to attend cessation treatment classes or appointments during office hours or in the evenings (Cunradi et al. 2015). In addition, long working hours among these workers contribute to physical and mental fatigue at the end of the workday and may deter them from participating in treatment programs after work (Cunradi et al. 2015).

Physical labor and trade, lower wage, and service workers also face barriers imposed by their supervisors or line managers, who act as gatekeepers to the workers' access to health promotion activities during work hours. Other barriers include working overtime, having multiple jobs, long commuting times, and having competing responsibilities at home (Sorensen et al. 2004). To address these structural barriers and improve support for these workers to participate in tobacco cessation treatment, those who implement tobacco cessation treatment programs need to engage with employers and managers to obtain their buy-in and support for worker health and safety. Contextual factors, on-the-job demands, and work routines that vary across industries (such as transit, manufacturing, construction, extraction, service, and hospitality) should all be recognized and then addressed to structure cessation programs more flexibly around workers' schedules, break times, and locations.

Engaging Labor Unions in Tobacco Control Efforts in the Workplace

Labor unions have played a critical role in public health, including by improving working conditions—such as setting working-hour limits and other protections against workplace hazards—and creating standards for higher wages and benefits (Malinowski et al. 2015; Hagedorn et al. 2016; U.S. Bureau of Labor Statistics 2020b). These benefits not only accrue to workers in unionized settings, but they frequently help set norms for other employers as well (Freund 2022).

Despite resistance from some unions (at times due to tobacco industry influence, including industry attempts to form alliances with unions over topics such as excise taxes and workplace smoking restrictions), other unions have engaged effectively with tobacco control efforts (Barbeau et al. 2005; Malinowski et al. 2015). For example, the flight attendants' union played a crucial role in the adoption of the federal airline smoking ban, discussed earlier in this chapter (Balbach et al. 2005). Other examples include union support for a New York state tobacco tax (Barbeau et al. 2001b) and smoking restrictions in New York City bars and restaurants (Levenstein et al. 2005). More broadly, unions have advocated for the creation of workplace smoking cessation programs and union-based coverage for such programs and have recently advocated for smokefree workplaces (Sorensen 1996; Barbeau et al. 2001b, 2004, 2006, 2007; Ringen et al. 2002; Sorensen et al. 2002, 2004; Osinubi et al. 2003). Given these important past engagements, it is imperative that tobacco control advocates and other stakeholders in public health partner with unions and actively reach out to organized labor to ensure that their input is included in tobacco control policies and related efforts.

Eliminating Disparities in Smokefree Policies in the Workplace

As discussed earlier in this chapter, comprehensive smokefree policies in workplaces are associated with reduced exposure to secondhand tobacco smoke, reduced tobacco use, and improved health outcomes among various occupational groups who are disproportionately affected by exposure to smoke in the workplace, such as bar, restaurant, and casino workers (Evans et al. 1999; Brownson et al. 2002; Fichtenberg and Glantz 2002; Allwright 2008). As of February 2022, it was estimated that only 62.3% of the U.S. population is protected by a 100% smokefree workplace, restaurant, and bar law, owing to gaps in the adoption of smokefree laws (American Nonsmokers' Rights Foundation 2022a).

Service and manual labor workers—such as those who are employed in bars, restaurants, casinos, and construction—are less likely than "white-collar" workers to be protected by smokefree policies in the workplace (NCI 2017a). Given that smokefree policies can support cessation, this gap in smokefree policy coverage among service and manual labor workers may be associated with these workers being more likely than other workers to have ever smoked, to currently smoke daily, to smoke more heavily, and to have less success in quitting (Alexander et al. 2010; NCI 2017a). Consistent with the recommendation earlier in this chapter, greater efforts to enact, implement, and enforce comprehensive smokefree restrictions at state, territorial, tribal, and local levels are needed to reduce tobacco-related disparities among service, physical labor, and trade workers.

Improving Working Conditions to Support Tobacco Control Efforts

With increasing attention over time being given to the organizational structure of work environments and to psychosocial working conditions, new policy and programmatic initiatives are being instituted to promote positive working conditions (International Labour Office 2001; IOM 2005; National Institute for Occupational Safety and Health [NIOSH] 2008, 2016; WHO 2010; McLellan et al. 2012, 2017; University of California–Berkeley 2016; University of Massachusetts–Lowell 2017). Although these initiatives are designed to address the health, safety, and well-being of workers in a broad sense, such efforts are likely to strengthen tobacco control efforts as well. For example, one study documented that an integrated health promotion and health protection intervention combining joint worker-management participation, interventions for management to reduce occupational exposures to hazards, and interventions for individuals to reduce smoking significantly improved tobacco cessation among workers in manufacturing settings compared with an exclusive focus on health promotion (Sorensen et al. 2002).

In 2017, NIOSH created the *Total Worker Health* program, which aims to integrate workplace interventions through policies, programs, and practices to protect workers from workplace hazards and to advance the overall well-being of workers through improvements in working conditions (NIOSH 2017). The *Total Worker Health* program complements similar efforts by other groups, for example, the Robert Wood Johnson Foundation's (2016) Culture of Health initiative and framework. This framework, rooted in equity, covers a broad range of health and safety outcomes for workers and is aimed at providing all individuals, regardless of sociodemographic characteristics, with opportunities to thrive. Many of these strategies are discussed by Quelch and Boudreau (2014) and Flynn and colleagues (2018). Similar recommendations have also been made by WHO and colleagues (2018) and the European Network for Workplace Heath Promotion (European Network for Workplace Health Promotion 1997; WHO 1997, 1999; IOM 2005; Carnethon et al. 2009; Hymel et al. 2011; International Association for Worksite Health Promotion 2012) and in the United Kingdom in the form of standards that support management practices to redress workplace stressors (Cousins et al. 2004; Marmot and Bell 2010).

Continuous improvement systems, which aim to improve efficiencies and quality within organizations (e.g., workplace design, work assignments and processes), have promoted innovations in working conditions through the increased participation of employees (Manuele 2014; von Thiele Schwarz et al. 2015; Benders et al. 2017). The benefits of this systems approach include improved health and wellness behaviors (Bertera 1990, 1993; Maes et al. 1998; Sorensen et al. 1998, 2002, 2005, 2007; Elliot et al. 2007; Okechukwu et al. 2009; Olson et al. 2009), enhanced rates of employee participation in health promotion and wellness programs (Hunt et al. 2005), and reduced costs (Goetzel et al. 2001). These findings are supported by multiple reviews of health promotion interventions integrated into the workplace (IOM 2005; Sorensen et al. 2011; Goetzel 2012; NIOSH 2012; Cherniack 2013; Pronk 2013; Anger et al. 2015; Cooklin et al. 2016; Feltner et al. 2016). These integrated approaches (e.g., smoking cessation as well as safety initiatives and process improvements to reduce or eliminate exposure to other substances that may cause lung disease) may be of particular importance for reducing tobacco-related disparities if they are offered to low-wage workers or workers who work in occupations with high levels of smoking prevalence (Baron et al. 2014; von Thiele Schwarz et al. 2015).

Hiring Policies Based on Tobacco Use

As of October 2022, 29 states and the District of Columbia have laws that preclude employers from making hiring decisions based on whether one uses tobacco products, unless being tobacco-free is a bona fide qualification for the position (Patel and Schmidt 2017; American Lung Association n.d.). Most of these laws were enacted in the late 1980s and early 1990s, often with tobacco industry involvement (Patel and Schmidt 2017). A number of employers—including health organizations and healthcare providers—in states where employers are allowed to make hiring decisions based on one's tobacco use status have established hiring policies that exclude people who use tobacco (Sulzberger 2011; Jones et al. 2014).

As more employers have adopted hiring policies that exclude people who use tobacco products, the issue has become the subject of increased debate in the public health community. The rationale for these hiring policies is that smoking conflicts with the employer's mission to promote personal health and healthcare in general, as well as to increase worker productivity and reduce healthcare costs (Asch et al. 2013; McDaniel and Malone 2014; Legault and Pasternak 2020). Further, some contend that the policies may help to denormalize smoking among job-seekers, current employees, and healthcare patients (Voigt

2012; Olsen 2014). Those opposed to such policies have argued that, because tobacco use prevalence is higher among people of lower SES and other groups experiencing tobacco-related disparities, those people will be most affected in terms of having fewer employment opportunities, less access to employer-based cessation resources for addictive products, and possibly less successful cessation outcomes because of the impact of stigma on the basis of tobacco use (Houle and Siegel 2009; Voigt 2012; Schmidt et al. 2013; Brown-Johnson et al. 2015).

The impact of these hiring policies on the prevalence of tobacco use among the general population or among those who experience tobacco-related disparities has not been evaluated. Future research should assess the impact of organizational hiring policies based on tobacco use across various occupational settings and the reduction or exacerbation of disparities in (1) the prevalence of tobacco use and (2) economic well-being, such as measures of food security, housing, and other factors that impact health.

Summary and Recommendations

Employment status, occupational position, wages, and workplace conditions are linked with tobacco-related health disparities (Marmot et al. 2012). Improving the social, economic, and working conditions of people experiencing disparities is important to successfully reduce and ultimately eliminate tobacco-related and other health disparities. Key steps to reduce tobacco-related disparities include increasing access to comprehensive and barrier-free tobacco cessation services; expanding smokefree and tobacco-free policies to cover all workplaces, with no exemptions for specific industries; and eliminating structural barriers to obtaining cessation treatment services. Critical to achieving these objectives is engaging with and obtaining the support of stakeholders—including employers, managers, employees, and labor unions—and to holistically promote the health, safety, and well-being of all workers.

Interpersonal-Level Interventions

Social influences can include an array of interpersonal factors that consist of social networks or ties, social support, and social norms (Emmons et al. 2007). These interpersonal factors have the potential to influence an individual's health or health behaviors (Emmons et al. 2007), including commercial tobacco use, and may have the potential to increase or decrease tobacco-related health disparities (McLeroy et al. 1988; Emmons et al. 2007). Social factors may function as either modifying conditions or mediating mechanisms in conceptual models elucidating the impact of social context on behaviors (Bandura 2001). Social factors that influence a person's tobacco use may include exposure to tobacco use in various settings, particularly within the home or other personal settings (see Chapter 4); the tobacco use patterns of family members and friends; and cultural norms and beliefs. Interventions involving or addressing social influences may affect tobacco-related health disparities. This section synthesizes promising practices related to creating smokefree rules for households and engaging social support to reduce tobacco-related disparities.

Household Smokefree Rules

Having rules in place for a smokefree home is associated with decreased exposure to secondhand tobacco smoke and increased smoking cessation (Mills et al. 2009; CDC 2010; King et al. 2013b; Haardörfer et al. 2018; Vijayaraghavan et al. 2018a). The prevalence of homes with smokefree rules varies by race and ethnicity, by the presence of a person who smokes tobacco products in the home, and by SES, among other factors (see Chapter 4) (Orton et al. 2014; Kruger et al. 2015; Zhang et al. 2015b; Vu et al. 2020; Rivard et al. 2021). Interventions that promote comprehensive rules for smokefree homes among lower SES households and other population groups living in homes where smoking is not prohibited by an ordinance, public housing regulations, or a property management policy have the potential to reduce disparities related to both exposure to secondhand tobacco smoke and tobacco use.

Interventions to Reduce Exposure to Secondhand Tobacco Smoke in the Home

Although several systematic reviews conducted over the past decade examined intervention studies for smokefree homes, these studies were typically framed as interventions to reduce exposure to secondhand tobacco smoke among young children rather than reducing exposure to secondhand tobacco smoke more broadly through the adoption of smokefree home rules, and they did not address tobacco-related health disparities.

For example, Rosen and colleagues (2015) reviewed controlled trials of interventions designed to reach parents or caregivers of children 0–12 years of age that had objective measures of exposure to secondhand tobacco smoke through measurement of airborne nicotine or particulate matter. Of the seven such studies published between 2009 and 2014, four included children with no health problems, and three included children with asthma or babies in the neonatal intensive care unit with high respiratory risk. Almost all the interventions included 1–10 home visits and a variety of behavior change tools, from cessation counseling to giving feedback on biochemical or air pollution to providing educational materials. The review concluded that all the interventions were effective in reducing, but not eliminating, secondhand tobacco smoke in the home.

Later, a Cochrane review conducted by Behbod and colleagues (2018) examined 78 studies published through early 2017 that aimed to reduce exposure to tobacco smoke among infants and children under age 12 through various mechanisms such as smoking prevention, cessation, health promotion, sociobehavioral therapies, education, clinical interventions, and others. Only 20 studies used objective measures of exposure to secondhand tobacco smoke. This review included controlled trials with or without randomization of parents, family members, teachers, and childcare workers. These studies used various interventions including different types of counseling (in person or via telephone) and educational materials; had different levels of intervention (ranging from brief advice to multicomponent interventions), and were conducted in different populations (community level, school level, ill children, and well children). Only 26 of the 78 studies found evidence of reduced exposure to secondhand tobacco smoke among children as a result of the intervention, with 24 studies reporting statistically significant findings. The intervention most frequently used in these 24 studies was counseling, though heterogeneity in the type and intensity of counseling was observed. Counseling was also the intervention used in 29 of 52 studies that did not find any intervention effects. The authors judged all studies included in the review as being of low or very low quality evidence and having high risk of bias. Additionally, limitations of these studies included variation of study interventions and populations and having insufficient sample sizes leading to low statistical power to detect differences. Thus, the authors were unable to find discernible patterns in the effectiveness of the interventions by intervention type.

Neither of these reviews focused explicitly on interventions developed for populations experiencing tobacco-related health disparities, and few of the interventions were explicit about reaching populations with disparities in exposure to secondhand tobacco smoke or in the prevalence of smokefree home rules. Some of the interventions focused on reducing the number of cigarettes smoked in the presence of children rather than on prohibiting smoking in the home, and others emphasized cessation rather than restrictions on smoking in the home. Overall, the reviews provide limited evidence about the effectiveness of interventions focused on reducing smoking prevalence with respect to reductions in childhood exposure to secondhand tobacco smoke.

Interventions Focused on Creating Smokefree Homes

Because of the potential benefits of smokefree homes for people who smoke as well as those in the home who do not smoke, interventions are available that focus directly on the creation of smokefree homes in a variety of household types. Table 7.6 describes intervention research conducted in the United States that focused on smokefree home rules, including exposure to secondhand tobacco smoke among populations who experience tobacco-related health disparities.

Stotts and colleagues (2020) conducted a RCT that analyzed the effect of an intervention in which mothers, primarily of lower SES and from a minoritized racial or ethnic group, received financial incentives for attending motivational interviewing sessions compared with the effect of usual care (one educational session) on urine cotinine levels postdischarge among infants who had been admitted to the neonatal intensive care unit at a children's hospital. No statistically significant differences were seen between the experimental condition and usual care in the urinary cotinine levels of infants at 2- and 6-month follow-up postdischarge. Reduced infant urinary cotinine levels were observed, however, among participants who completed the experimental intervention as intended (participated in three motivational interviewing sessions, including an initial session at the hospital or in the home and two follow-up sessions in the home, within 6 months of discharge) relative to the usual care condition. In terms of the intervention affecting the prevalence of smokefree rules for the home and car, the exposure to motivational interviewing plus financial incentives was associated with a greater likelihood of reporting a voluntary, total ban on smoking in the home and car as compared with those in the usual care condition at 2 weeks (RR = 1.32; 95% CI, 1.06–1.64) and 2 months (RR = 1.24; 95% CI, 1.01–1.52) after discharge, but not at 6 months after discharge.

Three separate RCTs (Kegler et al. 2015; Mullen et al. 2016; Williams et al. 2016) examined a brief intervention that focused explicitly on creating smokefree homes in lower income households. The intervention, which consisted of one coaching call and three mailings of printed materials among lower income population groups

Table 7.6 Intervention studies to promote smokefree homes among populations with tobacco-related health disparities

Study	Design, population, data collection, and location	Intervention type, contact type, and length	Smokefree homes rate, baseline, and longest follow-up	Primary outcome
Prokhorov et al. (2013)	• RCT • Latino (Mexican American origin) • 91 households: – 70% female – 66% of people smoked • No SES data available • Data collection: 0, 6, and 12 months • Houston, Texas	• Project staff conducted home visits at baseline to deliver culturally appropriate intervention materials (two fotonovelas [novels with photos] for adults and one comic book for children promoting tobacco-free indoor air) • One contact	• Higher rates of smokefree homes in intervention group compared with control group at 12 months ($p < 0.001$) • Intervention: 73% smokefree homes • Control: 56% smokefree homes	• Decreased air nicotine level in intervention condition compared with control condition at 12 months (per air nicotine monitoring over 7 days) • Significantly greater decrease in air nicotine levels in intervention households compared to control ($p < 0.05$)
Eakin et al. (2014)	• RCT • 350 caregivers of children enrolled in Head Start (16 sites in Baltimore): – 92% African American – 50% with annual household income <$20,000 • Data collection: 0, 3, 6, and 12 months • Baltimore, Maryland	• Five phone counseling sessions (initially two home visits but protocol changed) • Four sessions offered over 3 months, plus one booster session after the 3-month assessment • Prioritized smokefree home but addressed cessation	• Smokefree homes increased in both groups: – Intervention = 21% at baseline versus 39% at final follow-up – Control = 29% at baseline versus 41% at final follow-up – Results were not significant	• Reduction of exposure to secondhand tobacco smoke via air nicotine monitoring over 7 days • Significantly lower household air nicotine at 12 months among the intervention versus control group (0.29 mg vs. 0.40 mg, $p < 0.05$)
Kegler et al. (2015)	• RCT • Recruited via 2-1-1 call centers (i.e., 2-1-1 callers) • 498 participants: – 83% African American – 56% with annual household income ≤$10,000 • Data collection: 0, 3, and 6 months • Atlanta, Georgia	• Three mailings and one coaching phone call after the first mailing • 6 weeks	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) showed a significant intervention effect: – Intervention: 0% at baseline versus 40% at final follow-up – Control: 0% at baseline versus. 25% at final follow-up – $p = 0.002$	• Smokefree home rule • Validated with air nicotine monitoring • Significantly lower mean nicotine concentration in homes where participants had reported a complete smokefree home rule (0.75 micrograms/m^3) than homes without a complete rule (3.57 micrograms/m^3; $p < 0.001$)

Table 7.6 Continued

Study	Design, population, data collection, and location	Intervention type, contact type, and length	Smokefree homes rate, baseline, and longest follow-up	Primary outcome
Mullen et al. (2016)	• RCT • 508 English-speaking, 2-1-1 callers: – 65.2% African American – 12.0% Latino – 49.6% with annual household income ≤\$10,000 • Data collection: 0, 3, and 6 months • Houston, Texas	• Three mailings and one coaching phone call after the first mailing • 6 weeks	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) showed a significant intervention effect: – Intervention: 0% at baseline versus 63% at final follow-up – Control: 0% at baseline versus 38% at final follow-up – p <0.0001	• Smokefree home rule
Williams et al. (2016)	• RCT • 500 callers: – 61% African American – 48% with annual household income ≤\$10,000 • Data collection: 0, 3, and 6 months • North Carolina	• Three mailings and one coaching phone call after the first mailing • 6 weeks	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) showed a significant intervention effect: – Intervention: 0% at baseline versus 43% at final follow-up – Control: 0% at baseline versus 33% at final follow-up – p = 0.02	• Smokefree home rule
Stotts et al. (2020)	• RCT • Cotinine levels of mothers (n = 360) and their infant • Mother–infant dyad recruited while the infant was in a NICU; primarily of lower SES and from minoritized racial or ethnic group • Data collection: 0, 2, and 6 months postdischarge • Houston, Texas	• Two motivational interviewing sessions delivered in the hospital, and two additional counseling sessions given at home 2 weeks apart after NICU discharge • Financial incentives for session attendance and negative infant cotinine tests postdischarge • 4 weeks	• Intervention: 29% at baseline versus 57% at final follow-up • Control: 33% at baseline versus 57% at final follow-up • p = 0.97 (not significant)	• Urine cotinine level of infant at follow-up • No significant effect of intervention on level of cotinine in infants, except among mothers who reported high readiness and ability to protect infants at baseline (p ≤0.01) and mothers who completed the study within 6 months postdischarge (p ≤0.05)

Notes: **NICU =** neonatal intensive care unit; **mg =** milligrams; **RCT =** randomized controlled trial; **SES =** socioeconomic status.

recruited through 2-1-1 call centers, resulted in significantly more participants reporting smokefree home rules at 6-month follow-up compared to control participants. (By calling 2-1-1, people can receive information about social services in their area.) None of the participants in these three trials had smokefree home rules at baseline. For all three trials, eligible participants included an adult who smoked with at least one child or other adult in the home who did not smoke, or an adult who did not smoke who lived with at least one adult who smoked. These three studies allowed for inclusion of households with no children in the home to test the intervention with higher generalizability to the general population.

In the trial by Kegler and colleagues (2015), after the 3-month follow-up interview, participants were asked to place monitors in their homes to measure levels of nicotine in the air in order to validate self-reported smokefree home rules. The mean nicotine concentration was significantly lower in homes where participants had reported a complete smokefree home rule (mean = 0.75 micrograms/m^3) than homes without a complete smokefree home rule (mean = 3.57 micrograms/m^3; $p < 0.001$). Moderator analyses of pooled data from the three trials showed that the intervention was equally effective across races and ethnicities, education levels, and income groups—whether or not children were present in the home—and with varying numbers of people in the home who smoked (Kegler et al. 2019). However, the intervention was more effective for study participants who did not smoke (and who lived with someone who smoked) versus participants who smoked, and, among people who smoked, those who did not smoke daily versus people who smoked daily, and people who did not smoke within 30 minutes of waking versus those who did (Kegler et al. 2019). A follow-up study assessed outcome evaluation results from implementation of this intervention through a national grant program (Bundy et al. 2020). The rate of establishing a smokefree home rule was comparable to or higher than the rate in the controlled trials. The intervention was also associated with increased cessation among those who smoked, as well as an ancillary increase in household smokefree vehicle policies.

A study by Eakin and colleagues (2014) also focused on creating smokefree homes rather than on smoking cessation by testing the effectiveness of an intervention that included motivational interviews and education versus education alone (control). Study participants included the caregivers of 350 children enrolled in Head Start programs in Baltimore, Maryland, who reported that a person who smoked lived in the home. All participants earned lower incomes, and participants were predominantly African American. The intervention consisted of up to five counseling sessions over three months that focused on motivating and assisting the participant to reduce the child's exposure to secondhand tobacco smoke through implementing smokefree home rules. Both groups (intervention and control) received general educational materials on smokefree homes from the Environmental Protection Agency. Smokefree home rules increased among both the intervention and control groups. In modeling adjusted for time and to control for correlation of outcomes within individuals and baselines characteristics, participants in the intervention group had significant increases in the prevalence of smokefree home rules, declines in overall air nicotine levels, and declines in smoking among caregivers compared to participants in the control group. Despite the effects of the intervention, no significant differences in children's salivary cotinine levels were observed at 12-month follow-up, but among those creating a smokefree home in both groups, declines in levels of salivary cotinine were significant.

Prokhorov and colleagues (2013) recruited households of Mexican American people with a child under the age of 18 and two adults, one of whom smoked, for a brief educational intervention on smokefree homes. The educational intervention included one culturally appropriate comic book (available in English and Spanish) for children and two *fotonovelas* (stories containing abundant pictures and appropriate for low-literacy individuals) for adults. Both resources were designed to increase awareness of the negative impact of secondhand tobacco smoke. Standard care included a copy of a self-help booklet designed to help people quit cigarette smoking. This randomized controlled trial observed significant effects from baseline to 12 months after the intervention in the creation of homes with smokefree rules and levels of airborne nicotine measured in the home. At 12 months, 73% of households that received culturally relevant educational materials had created smokefree home rules compared with 56% of households that received standard care ($p < 0.001$) (all households in both conditions allowed smoking in the home at baseline). Overall, mean air nicotine levels measured in the home declined during this study period. However, a significant interaction ($p < 0.05$) was observed by intervention condition over time, meaning that declines in mean air nicotine levels from baseline to 12 months were greater in households that received culturally relevant educational materials (from 1.14 $\mu g/m^3$ to 0.20 $\mu g/m^3$; $p < 0.01$) than they were in homes in the standard care condition (from 0.55 $\mu g/m^3$ to 0.17 $\mu g/m^3$; $p = 0.99$).

Reducing Exposure to Secondhand Tobacco Smoke in Private Vehicles

As discussed earlier in this chapter, nearly 25% of U.S. high school and middle school students reported being exposed to secondhand tobacco smoke in vehicles in 2019, and most smoking restrictions in vehicles are established through voluntary household rules (Rees and Connolly 2006; Walton et al. 2020).

Parks and colleagues (2020) studied a pilot intervention focused on the adoption of smokefree home and vehicle rules among people with lower incomes who smoked or lived with someone who smoked, and who had at least one child under 18 years of age in the home. All recruited participants were sent three educational mailings and either a coaching email or letter addressing smokefree rules in both homes and cars, focusing specifically on households with children. Among recruited participants who completed the baseline survey (n = 50) with completed follow-up data at 3 months (n = 39) and 6 months (n = 33), statistically significant increases in smokefree rules in homes (from 12.8% at baseline to 69.2% and 63.2% at 3- and 6-month follow-up, respectively) and vehicles (among recruited participants with vehicles; from 7.9% at baseline to 38.5% and 45.5% at 3- and 6-month follow-up, respectively) were observed.

Although not a focus of their intervention, Bundy and colleagues (2020) reported an increase in the adoption of smokefree vehicle rules to be an ancillary benefit of an intervention related to smokefree home rules. Although there is little research directly evaluating the impact of smokefree vehicle rules on reducing health disparities, a strong theoretical basis exists for concluding that this intervention would help protect people who are disproportionately exposed to secondhand tobacco smoke in vehicles (King et al. 2013b; Parks et al. 2018).

Summary and Recommendations

This section examined a variety of approaches to reduce exposure to secondhand tobacco smoke among households. There is insufficient evidence to infer that interventions that seek to reduce exposure to secondhand tobacco smoke in the home without the adoption of an accompanying smokefree home rule will reduce tobacco-related disparities. Nonetheless, interventions that increase the prevalence of smokefree home rules have been shown to reach people from population groups that experience disparities in tobacco use and exposure to secondhand tobacco smoke (e.g., people from minoritized racial and ethnic groups, people with lower SES) and interventions that increase the prevalence of smokefree vehicle rules also may reach people experiencing disparities in exposure to secondhand tobacco smoke. The smokefree home studies without significant findings still saw increases in the percentage of smokefree homes in both the intervention and control groups.

The interventions that were most effective consisted of educational materials and motivational interviewing or coaching. Comprehensive state or local smokefree policies for public places have also been shown to increase the prevalence of smokefree homes (Guzman et al. 2012; Monson and Arsenault 2017; Hafez et al. 2019) and reduce exposure to secondhand tobacco smoke in the home (Nanninga et al. 2018, 2019).

Future efforts should employ a three-pronged approach aimed at promoting (1) the voluntary adoption of rules for a smokefree home at the household level; (2) smokefree policies in multi-unit housing, as discussed in detail earlier in this chapter; and (3) comprehensive smokefree policies at the tribal, territorial, state, and local levels. Much of the existing research on voluntary interventions focuses on households with children, and continued efforts to reach these households are warranted. Research is also necessary to inform outreach to households without children. Additional studies on how best to promote smokefree home and vehicle rules, specifically among population groups that are marked by tobacco-related health disparities—including sexual orientation and gender identity groups, certain minoritized racial and ethnic groups, and people who have behavioral health conditions—would aid in further implementation of this strategy.

Interventions Engaging Dyadic Support for Smoking Cessation

For the purpose of this review, dyadic support includes, but is not limited to, partner, family, or peer support that involves participation from one or more people in a specific intervention component (or components) for smoking cessation. This section addresses (1) the types of interventions for dyadic support in smoking cessation; (2) the effects of the components of dyadic support interventions on smoking cessation; and (3) recommendations and implications for future interventions and policies to address tobacco-related health disparities. Table 7.7 presents details on the 11 studies included in this discussion, including each study's population, design, location, intervention, and outcomes.

Types of Cessation Interventions with Dyadic Support

The following sections describe the components of the dyadic support interventions in the reviewed studies, including what groups were included, recruitment and engagement strategies, and how the interventions engaged the support person.

Table 7.7 Dyadic support intervention studies

Study	Design, population, and location	Intervention arm(s)	Outcomes[a]
McDonnell et al. (2014)	• Single group • Eight dyads (16 total participants [8 male clinic patients and their 8 female household members]; both persons in dyad smoked • Clinic patients were persons diagnosed with cancer or with a suspicious thoracic mass scheduled for surgery at a thoracic surgery clinic in a university hospital in Central Virginia • All participants were Caucasian, and 13 of 16 had annual income <\$50,000 • Clinic patients had to be willing to consider stopping smoking to participate • Setting: Clinical • Location: Central Virginia	• Duration: 6 months • Intervention: Each dyad received: – Brief smoking cessation counseling (3–5 minutes) – Decision-making tutorial (one page, CD, and CD player for home use) and decision balance sheets – Smoking cessation booklet – Four face-to-face counseling sessions (approximately 45 minutes each) with an oncology-certified nurse who was trained as a tobacco cessation treatment specialist – Up to six optional remote booster sessions (<15 minutes each)	• Primary outcome: Continuous abstinence at 6 months post-surgery: – 63% (five of eight) of patients remained abstinent (CO verified) – 25% (two of eight) of family members were abstinent
Kim et al. (2015)	• Two-arm RCT • 109 Korean American participants (91 men and 18 women) who smoked ≥10 cigarettes per day, as well as family members of participants in the intervention condition who were invited to participate in therapy sessions • Participants were adults who smoked at least 10 cigarettes per day for the past 6 months and were willing to use nicotine patches as directed • Support persons were not required at the time of enrollment. Support persons were family members and could smoke or not smoke. Participants assigned to the intervention were asked to provide permission to contact family members who were invited to participate in all therapy sessions. • Setting: Community • Location: Northeast United States, primarily from such Korean-immigrant-dense areas as Queens, New York, and Palisades Park, New Jersey	• Both control and treatment interventions: – Eight weekly in-person individual counseling sessions – Choice of receiving interventions in Korean or English language – Education on the harms of smoking, nicotine dependence and withdrawal, and NRT treatment – Administration of expired CO test at each session and explanation of results – A 1-week supply of nicotine patches at each session – \$20 gift certificate at baseline and 1-month follow-up – \$40 gift certificate at 3-month, 6-month, and 12-month follow-up • Control intervention: – 10-minute weekly counseling sessions • Treatment intervention: – 40-minute weekly counseling sessions – Receipt of culturally specific components: ○ Use of analogy of gas poisoning from coal briquettes used in pre-1990s Korean heating systems to explain harms of CO ○ Information about smoking-related cancer deaths among celebrities in Korea, high rates of such deaths among Korean men in California, and harms of exposure to secondhand tobacco smoke ○ Coaching family members to provide assistance and support ○ Use of Korean news media in education ○ Behavioral skills training for Korean-specific relapse-prone situations	• Primary outcome: 12-month prolonged abstinence assessed by self-report and biological confirmation (expired-air CO, <6 ppm) and salivary cotinine (<30 ng/mL): – Significantly higher among participants who received the treatment intervention (38.2%) than among those in the control intervention (11.1%) – OR = 4.67; 95% CI, 1.67–12.99, p <0.01

Table 7.7 Continued

Study	Design, population, and location	Intervention arm(s)	Outcomes[a]
LaChance et al. (2015)	• Two-arm RCT • 49 couples consisting of (a) people who smoked >10 cigarettes per day and who wanted help with quitting smoking and (b) their nonsmoking partners (CO <10 ppm) who were recruited from the community • Among those participants who smoked, 88% were White, 67% were male, and 26.5% had a college degree or some graduate school education • People who smoked were willing to use nicotine patches (inclusion criteria) • Support persons were partners who did not smoke (in heterosexual marriage or cohabitating for 1 or more years) • Setting: Community (not specified) • Location: United States, not otherwise specified	• Duration: 7 weeks • Standard condition: – Individually delivered behavior therapy for smoking cessation, self-help materials, and 8 weeks of NRT patches • Treatment condition: – Behavioral couples' therapy: Seven, 60-minute sessions of social support intervention and 8 weeks of NRT patches – Couples completed "I Quit Contract" and both signed a written agreement – Treatment involved role playing and discussing how partners could provide support	• Primary outcome: 7-day point-prevalence self-reported abstinence at 6 months, biochemically verified by urinary cotinine (>8 ppm): – Standard condition: 55% – Treatment condition: 45% – p = 0.35
Pollak et al. (2015)	• Two-arm RCT • 348 dyads: Pregnant Latina women between 13- and 29 weeks gestation who did not smoke and their partners who did smoke – 68% spoke only Spanish at home – 66% had <10 years of education • 39% of people who smoked did so every day, and 61% did so some days • Intention to quit smoking was not assessed or reported • Setting: Nonsmoking mothers were recruited from 10 urban and rural county health departments • Location: North Carolina	• Duration: 6 months or longer, from prenatal (13–29 weeks gestation) to 4 months postpartum • Standard condition: – Written materials and NRT (optional, up to 6 weeks) • Treatment condition: – Community-based partnership with El Centro Hispano to culturally adapt the intervention – Community advisory panel – Conducted focus groups with expectant Latino couples – Written materials, NRT (optional, up to 6 weeks) • Couples-based and individual counseling addressing smoking cessation and communication	• Primary outcome: 7-day point-prevalence abstinence rates at 12 months post-randomization: – Standard condition: 39% – Treatment condition: 38% – No group differences

Table 7.7 Continued

Study	Design, population, and location	Intervention arm(s)	Outcomes[a]
Tsoh et al. (2015)	• Single-group study • 96 Chinese and Vietnamese dyads (males who smoked daily and support persons who were nonsmoking family members) who had to read and speak Cantonese, Mandarin, or Vietnamese – Among males who smoked, 51.1% had annual household incomes <$20,000 and 41.7% had less than a high school education – People who smoked and were any readiness level to quit could participate; 41.7% of males at baseline had no intention to quit smoking within 6 months – Support persons were nonsmoking family members living in the same household as participants who smoked. • Setting: Community; recruited through lay health workers • Location: California	• Duration: 2 months • Intervention: – Dyadic and social network-based intervention consisting of two small-group (ranging from two to four dyads) educational sessions conducted by lay health workers – Two telephone calls made individually to males who smoked and the family members of participants over 2 months • $25 each for completing assessment telephone surveys at baseline and at 3 months	• Primary outcomes: 7-day and 30-day point-prevalence abstinence (intent-to-treat analysis) at 3 months (independently verified by family members): – 7-day point-prevalence abstinence: 30.2% – 30-day point-prevalence abstinence: 24.0%
Dickerson et al. (2016)	• Single-group study • 30 people who smoked daily were recruited from psychiatric rehabilitation programs • Eligibility criteria: – Diagnosis of schizophrenia, schizoaffective disorder, bipolar disorder, or recurrent major depression – Worked <25% of the previous year – Received payment for mental disability – Were ready to quit smoking within the next 6 months • Support persons were eight peer mentors who used to smoke and had received treatment for serious mental illness; each peer mentor worked with two participants in each group • Setting: Clinics and psychiatric rehabilitation programs; research staff recruited people who smoked • Location: Maryland	• Duration: 6 months • Intervention: – Peer mentor program added to a professionally led behavioral group intervention for smoking cessation that was tailored for persons with serious mental illness. – Groups met twice weekly over 3 months (24 meetings, 1 hour each) and were led by a trained interventionist and two peer mentors who participated on a rotating basis – Participants received $3.00 for every session they attended – Nicotine patch was available to interested participants – Participants had expired CO measured with feedback and monetary reinforcement ($1.50–$3.50 for CO <8 ppm) – Peer mentors received 22 hours of training and ongoing group supervision – Peer mentors met one-on-one in person and by telephone for 1–2 hours weekly for 6 months with people who smoked.	• Primary outcomes: – 73% of participants (22 of 30) made a quit attempt – 7-day point-prevalence sustained abstinence was 10% (abstained for at least 7 days and remained quit at the final study visit with biochemical verification [urinary or expired cotinine])

Table 7.7 Continued

Study	Design, population, and location	Intervention arm(s)	Outcomes[a]
Kim (2017)	• Single-group study • 31 Korean American people who smoked ≥10 cigarettes per day and support persons who were family members were invited to participate; 94% of the sample was male – People who smoked were ready to quit smoking within 30 days (inclusion criteria) – Support persons were not required at the time of enrollment; at the first session, people who smoked provided permission to counselors to contact family members and invite them to join subsequent sessions • Setting: Community; people who smoked were recruited through Korean-speaking radio station • Location: New York City	• Duration: 8 weeks • Intervention: – Eight weekly telephone-based cessation counseling sessions and 4 weeks of nicotine patches – First session lasted 30–40 minutes; subsequent sessions lasted 10–15 minutes – Family members were coached to provide assistance and support and were invited or called into counseling sessions (before and after quit day; not specified if this took place with or without participant)	• Primary outcomes (intent-to-treat analysis): – 7-day point-prevalence abstinence at 3 months: 45.2% – 3-month prolonged abstinence: 41.9% – Family members corroborated self-reports, except those from two participants who lived alone
Tsoh et al. (2017)	• Two-arm cluster RCT • 107 Vietnamese dyads consisting of males who smoked and family members who did not smoke – 40.7% of the males who smoked daily had less than a high school education – Males who smoked and were at all levels of readiness for quitting smoking could participate; 26.2% had no intention to quit within 6 months at baseline. – Dyadic pair was family member who did not smoke • Setting: Community; recruited by lay health workers • Location: California	• Duration: 8 weeks • Intervention: – Dyadic and social network-based intervention was delivered by lay health workers and consisted of two small-group educational sessions that focused on tobacco cessation and included two telephone calls made individually to participants (people of who smoked and their family members) over 8 weeks – Participants received information about smoking cessation resources • Comparison: – Same format as intervention but focused on healthy living (nutrition, physical activity) – Participants did not receive information about smoking cessation resources until 6 months after the end of the study	• Primary outcome: 30-day point-prevalence abstinence at 6 months verified by family and salivary cotinine: – Comparison condition: 12.5% – Intervention condition: 33.3% – OR = 3.7; 95% CI, 1.2–11.5

Table 7.7 Continued

Study	Design, population, and location	Intervention arm(s)	Outcomes[a]
Tong et al. (2018a)	• Two-arm RCT • 203 participant pairs (Cantonese-speaking Chinese American males who smoked and family members who did not smoke) • Males who smoked and were at all levels of readiness for quitting smoking could participate; 54.2% intended to quit within 6 months; 23.6% of males did not smoke daily • Support persons did not smoke and were household members of the male participants who did smoke: – 90% of study sample were spouses – 10% were parent–child dyads • Setting: Community; research staff recruited either a partner or a male who smoked, who in turn provided permission for the research staff to contact the other potential family member to form a person who smoked–household member dyad to participate in the study • Location: San Francisco, California	• Duration: 6 months • Brief intensity group: One group educational session (1 hour) • Moderate-intensity group: – Two dyadic educational sessions (90 minutes over 3 months) to discuss exposure to secondhand tobacco smoke and cessation resources and review lab results of baseline exposure to tobacco smoke, plus two or three individual follow-up calls (<15 minutes) over 6 months – Bilingual booklet that summarized educational materials • All received up to $60 for completion of assessments	• Primary outcome: 30-day abstinence at 12 months biochemically verified (urinary NNAL/Cr <40 pg/mg): – Brief condition: 20.0% – Moderate intensity condition: 20.7% – No group differences
Ruebush et al. (2020)	• Single-group pilot study • 532 patients who received tobacco use treatment through the University of North Carolina Tobacco Treatment Program at the North Carolina Cancer Hospital • Most patients were White (69.2%) or African American (22.7%) people • Integrated family members were typically spouses or partners but were occasionally adult children, siblings, parents, or close friends of patients • Program included family members who did and did not use tobacco • Setting: Clinical; recruited through the University of North Carolina Tobacco Treatment Program (referred by medical providers in any department) at the North Carolina Cancer Hospital • Location: North Carolina	• Duration: Study lasted 18 months; on average patients received 1.5 tobacco use treatment sessions • Intervention: Implementation of family counseling for tobacco use treatment included four phases: (1) modifying the electronic health record and its monthly report; (2) training tobacco treatment specialists to provide family counseling; (3) integrating family members into patients' treatment, and (4) conducting 6-month follow-up calls • 221 patients (42%) had family members integrated into their tobacco use treatment; 21 patients (4%) had family members present but not integrated; and family members were not present for the remaining patients	• Primary outcome: Intent-to-treat quit rates at 6 months following their initial session were based on self-reported, 7-day point-prevalence abstinence: – 28% among patients whose family members were integrated – 23% among patients whose family members were not integrated ($p = 0.105$)

Table 7.7 Continued

Study	Design, population, and location	Intervention arm(s)	Outcomes[a]
Haskins et al. (2022)	• Single-group feasibility study • Testing feasibility of adapting a financial incentive treatment to a dyadic context; although not designed to test intervention efficacy, cessation outcomes were examined for descriptive purposes • 28 adults (14 couple dyads) who currently smoked >5 cigarettes per day or >100 cigarettes in the lifetime and were cohabiting for >6 months with a romantic partner who currently smoked • Setting: Community; recruited via flyers and social media ads • Location: Athens, Georgia	• Duration: 4 weeks • Intervention: – Pfizer, Inc's Beat the Pack smoking cessation program – One session per week for 4 weeks – Each participant could receive (a) $100 for attending all four sessions or $75 for attending three of four sessions and (b) $100 for abstinence at 1-month follow-up (7-day point-prevalence with biochemical verification [CO, 5 ppm]) – All had the option to receive free NRT – Received $30 for baseline completion and $25 for follow-up completion – Received a $20 bonus each for both partners completing baseline and follow-up	• Primary outcome: Intent-to-treat, biochemically verified smoking abstinence: – 25% at 1-month follow-up – Six of the seven abstinent participants (86%, OR = 6.14) were members of dyads in which both members were abstinent

Notes: **CD =** compact disc; **CI =** confidence interval; **CO =** carbon monoxide; **mL =** milliliter; **ng =** nanogram; **NNAL/Cr =** 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol/creatinine; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **pg =** picogram; **ppm =** parts per million; **RCT =** randomized controlled trial.

[a]Rates of smoking abstinence were biochemically verified by CO or salivary cotinine or by corroboration of a family member.

Focus Population Groups

A variety of focus population groups were included among the reviewed studies, and most of these studies focused on tobacco use among Asian American adults while one study focused on Mexican American people (Pollak et al. 2015). The Asian American population groups included Korean American (Kim et al. 2015; Kim 2017), Chinese American (Tsoh et al. 2015; Kim 2017; Tong et al. 2018a), and Vietnamese American (Tsoh et al. 2015, 2017) people. Members of these priority populations are sometimes immigrants with limited English proficiency. In addition, the prevalence of smoking is often high among members of these groups, and the acceptability of smoking is often high among men in their countries of origin (see the "Acculturation" section in Chapter 4). For example, U.S. studies designed to reach Korean American or Vietnamese American people have reported high rates of smoking among men when they lived in Korea or Vietnam, respectively (Drope et al. 2018). Many of the interventions included in this review emphasized smoking cessation for the male partner in the dyad; some also addressed the elimination of exposure to secondhand tobacco smoke (Tong et al. 2018a). The studies designed to reach Asian American people were concentrated in areas of the United States with a high proportion of Asian American ethnic population groups—specifically California, New York, and New Jersey.

Recruitment and Engagement

One challenge in addressing tobacco use in priority populations is the recruitment and engagement of people from diverse populations in which access to smoking cessation resources is limited and the prevalence of smoking remains high. Studies of dyadic support interventions have used various recruitment approaches, including a conventional approach in which people who smoke are recruited directly with or without a requirement to include a support person and approaches that target the person who will provide cessation or social support to the person who smokes. In many cases, recruitment or eligibility was also contingent on the participants' willingness to quit smoking, which may affect the outcomes of smoking cessation in dyadic support interventions.

Seven of the reviewed studies recruited participants from community settings (Kim et al. 2015, 2017; Pollak et al. 2015; Tsoh et al. 2015, 2017; Tong et al. 2018a; Haskins et al. 2022). Three studies focused on clinical populations; in one of these studies, adult participants were recruited from psychiatric rehabilitation programs (Dickerson et al. 2016) and two studies recruited participants from oncology clinical settings (McDonnell et al. 2014; Ruebush et al. 2020). Finally, one study recruited adult participants via newspaper and television advertisements (87.8% of enrolled people who smoked were White and 26.5% were college graduates) (LaChance et al. 2015).

Four of the 11 studies reviewed in Table 7.7 used a recruitment strategy that first identified the support person of a person who smokes (Pollak et al. 2015; Tsoh et al. 2015, 2017; Tong et al. 2018a); the person who smokes did not have to be motivated to quit to participate in the trial. The remaining seven studies recruited people who smoke who were willing to quit smoking (McDonnell et al. 2014; Kim et al. 2015, 2017; LaChance et al. 2015; Dickerson et al. 2016; Ruebush et al. 2020; Haskins et al. 2022).

Engagement of the Support Person

The support person in the reviewed studies participated in various ways in the interventions, most often through in-person participation in dyadic sessions with the person who smokes, and/or in individual training or counseling sessions without the person who smokes. In seven of the studies, the support person was required to participate with the person who smokes in dyadic counseling sessions (McDonnell et al. 2014; LaChance et al. 2015; Pollak et al. 2015), educational group meetings (Tsoh et al. 2015, 2017; Tong et al. 2018a), or a combination of group counseling and one-on-one support sessions (Dickerson et al. 2016). Four of the studies invited the family member of the person who smokes to join one or more counseling sessions, but participation was optional (Kim et al. 2015, 2017; Ruebush et al. 2020; Haskins et al. 2022).

Effects of Dyadic Support Intervention Components

The discussion of abstinence outcomes in Table 7.7 is organized by study design and the intention of the people who smoke to quit at pre-intervention. Nine of the 11 studies included in this review reported abstinence rates that were biochemically verified by expired carbon monoxide, salivary cotinine, or independent corroboration by another person (e.g., a family member). For studies with multiple time points, abstinence rates reported in Table 7.7 represent the latest available time point (6, 9, or 12 months) using 30-day point-prevalence abstinence or, if not available, 7-day point-prevalence abstinence as the outcome; data are reported in the summary that follows.

Smoking Abstinence Outcomes by Study Design

The 7-day or 30-day point-prevalence abstinence rates at 6 or 12 months for participants receiving dyadic support interventions ranged from 20.7% among adults who smoke who were at any level of readiness to quit (Tong et al. 2018a) to 63.0% among adults who smoke and had cancer who were recruited through thoracic surgery units and who were willing to stop smoking before surgery (McDonnell et al. 2014).

Among the five RCTs in this review, two trials found significant treatment differences in smoking abstinence at follow-up (Kim et al. 2015; Tsoh et al. 2017; Janice Tsoh, University of California–San Francisco, personal communication, July 11, 2021). Both these trials focused on non-English-speaking Asian American people. In one of these two trials, which reached Korean American men and women who smoke (Kim et al. 2015), the 7-day point-prevalence abstinence rates at 12-month follow-up were 42% (intervention) and 19% (comparison). In the second of these RCTs, which included Vietnamese American people who smoke daily and their family member, the 30-day point-prevalence abstinence rates at 6 months were 33.3% (intervention) and 12.5% (comparison) (Tsoh et al. 2017).

Smoking Abstinence Outcomes by Intention to Quit

Five of the 11 studies in this review—including two RCTs (Kim et al. 2015; LaChance et al. 2015) and three single-group trials (McDonnell et al. 2014; Dickerson et al. 2016; Kim 2017)—required adults who smoke to be willing to quit smoking. The studies generally reported high rates of abstinence among adults who smoke who were ready to quit smoking, except for a study that focused on adults who smoke with serious mental illness, which reported an abstinence rate of just 10% at the 6-month follow-up (Dickerson et al. 2016). One of the two RCTs (Kim et al. 2015) showed a statistically significant dyadic support treatment effect (42% in intervention vs. 19% in comparison) for Korean American adults who smoke, whereas the remaining two single-group trials of men reported abstinence rates of 45% (Kim 2017) and 63% (McDonnell et al. 2014).

The remaining six trials in this review did not require people who smoke to be motivated to quit to enroll in the study (Pollak et al. 2015; Tsoh et al. 2015, 2017; Tong et al. 2018a; Ruebush et al. 2020; Haskins et al. 2022). One of the RCTs examining Vietnamese American dyads (person who smoked with family member) in community settings detected group differences in the 30-day point-prevalence abstinence rate between the intervention and comparison groups (33.0% vs. 12.7%) at 6 months (Tsoh et al. 2017). Notably, two RCTs included people who smoke daily and nondaily; both types of smoking are prevalent in the targeted communities of Latino and Chinese American people (Pollak et al. 2015; Tong et al. 2018a). In these studies, rates of abstinence were similar among both people who smoked daily and nondaily in the intervention and control groups. In the remaining single-group trials, one included Chinese and Vietnamese adults who smoked (Tsoh et al. 2015); the 42% of adults who smoked who were not ready to quit smoking had a 30-day abstinence rate of 24% at the 3-month follow-up. The other two studies did not report abstinence by readiness to quit (Ruebush et al. 2020; Haskins et al. 2022).

Reported abstinence rates were generally higher in studies that focused on people who smoke and were motivated to quit compared with studies in which people who smoke were not ready to quit. In summary, offering a dyadic component in tobacco cessation treatment has the potential to engage people who smoke who are less ready to quit smoking or otherwise would not seek treatment for smoking cessation. Nonetheless, the evidence regarding the potential benefit of dyadic support in enhancing quit rates remains inconclusive when compared with interventions that do not have a dyadic component. Further, there was no evidence that inclusion of a dyadic support component negatively affected abstinence rates despite the relatively low abstinence rates seen in some of these trials.

Summary and Recommendations

The results from the studies in this review suggest wide variability in the effects of dyadic support-based smoking cessation interventions. A 2018 Cochrane review on partner support and smoking cessation included 14 trials from qualified RCTs published between 1986 and 2016 (Faseru et al. 2018) and concluded that the evidence from RCTs to date had failed to show a beneficial impact of partner-support–based interventions on long-term smoking abstinence; however, that review did not report outcomes for groups affected by disparities in tobacco use prevalence or cessation, including minoritized racial and ethnic groups, lower income groups, or members of minoritized sexual orientation and gender identity groups.

The studies reviewed here suggest that dyadic interventions may have a beneficial impact on smoking cessation for Asian American people who smoke, although larger studies are needed to determine program effectiveness. Importantly, Faseru and colleagues (2018) observed that variability in intervention components contributed to the meta-analytic challenges in examining the benefit of partner-support-based tobacco cessation treatment.

The inclusion of a dyadic support intervention component has shown promise in engaging Asian American people who smoke, as well as people who smoke who are not motivated to quit. This may be attributable, in part, to messages regarding family health having potentially increased resonance with some of these population groups. For example, in a focus group study of Chinese American dyads made up of adults who smoke and adults who do not smoke who had participated in a dyadic cessation intervention, participants shared a preference for dyadic and group interventions. The study noted that the inclusion of adults who do not smoke in the dyadic intervention appeared to empower them to support those who smoke in cessation and improve support for smokefree living (Saw et al. 2018a).

To confirm study findings, future research on dyadic interventions and other family systems-oriented approaches for smoking cessation needs to include larger numbers of participants for population groups in which these strategies have already been tested. Dyadic interventions also need to be evaluated for other priority populations who bear disproportionate tobacco-related health disparities, including American Indian and Alaska Native people, Native Hawaiian and Pacific Island people, Black or African American people, people with lower SES, and members of minoritized sexual orientation and gender identity groups. More evaluation is also needed among Hispanic or Latino people because only one study was conducted among this group and Pollak and colleagues (2015) observed no change in cessation rates when a dyadic intervention was added to written materials and NRT. In addition, because dyadic support may take multiple forms, resource availability and the feasibility and cultural sensitivity of such interventions should be considered carefully in intervention design.

Individual-Level Interventions

Individual-level interventions for tobacco cessation are an important component of comprehensive tobacco control efforts. As summarized in the 2020 Surgeon General's report on smoking cessation, current evidence-based treatment approaches to smoking cessation include behavioral treatments—such as individual, group, and telephone counseling—and seven pharmacotherapies approved by the FDA (USDHHS 2020). Although these interventions are effective when used independently, evidence indicates that the combined use of behavioral and pharmacologic treatments produces the largest cessation effects (USDHHS 2020).

Current clinical practice guidelines from the U.S. Public Health Service recommend use of evidence-based treatments "for all individuals who use tobacco, except when medication use is contraindicated or with specific populations [such as pregnant women] in which medication has not been shown to be effective" (Fiore et al. 2008, p. 143). This clinical recommendation was based on three factors: (1) several of the RCTs reviewed for the guideline included diverse samples; (2) studies testing interventions in specific populations demonstrated effectiveness; and (3) the balance of "the relative safety of the tobacco dependence treatments versus the hazards of continued tobacco use" (Fiore et al. 2008, p. 144). More research is needed to identify cessation treatments and treatment components that may be especially effective, or may enhance the effectiveness of treatments, for groups experiencing disparities in tobacco use and cessation. It is important to contextualize individual treatment approaches within social and structural determinants of health, including access to healthcare. Cessation treatment access and healthcare coverage are addressed earlier in this chapter.

This section summarizes and evaluates evidence regarding the effectiveness of individual-level cessation interventions for specific populations, with a particular emphasis on whether tailored or enhanced interventions increase effectiveness compared with usual care for populations that have higher levels of tobacco use, lower levels of tobacco cessation, lower levels of utilization of effective cessation treatments, and/or tobacco-related health disparities. For most of the studies included in this review, "usual care" included proven cessation treatments that were not tailored (Fiore et al. 2008), whereas in some studies "usual care" included self-help materials and information on accessing quitlines and other services.

The scientific review focuses primarily on tailored interventions among U.S. populations that are characterized by SES, race and ethnicity, sexual orientation and gender identity, and geography (such as rural populations). Research regarding individual-level interventions focused on other populations who experience disparities (e.g., adolescents, people with mental health conditions) is detailed in the 2020 Surgeon General's report (USDHHS 2020). Clinical delivery of individual-level interventions is reviewed in the "Healthcare System Interventions" section of this chapter. Cessation interventions delivered via quitlines, including through digital technologies, are reviewed in the "Tobacco Quitlines" section of this chapter.

The present review includes findings from RCTs with sufficient sample sizes to draw population-level inferences about the scalability of the intervention. The primary outcomes related to quitting are reported. If available, abstinence rates are reported based on intent-to-treat analysis, which assumes that those lost to follow-up continued smoking. This section also discusses the implications of the reported findings as they relate to understanding or reducing tobacco-related health disparities for groups marked by disparities. Studies focused on adolescent patient samples were excluded. The section concludes with a discussion about the scalability of the interventions examined, the potential for research on intervention implementation, promising intervention approaches, and gaps in the literature.

Groups with Lower Socioeconomic Status

Levels of income and education are common indicators of SES, and tobacco smoking is inversely associated with both these measures (Creamer et al. 2019). Both the prevalence of past-year quit attempts and successful cessation tend to increase with increasing levels of education (USDHHS 2020). Because the diverse group of people with lower SES may have fewer resources or less access to evidence-based treatments than those with higher SES, interventions should be designed or chosen with careful consideration given to their acceptability, potential reach, and impact. Four meta-analyses examined the effectiveness of individual-level cessation interventions among people with lower SES (Fiore et al. 2008; Bryant et al. 2011; Hill et al. 2014; Kock et al. 2019).

The *Clinical Practice Guideline* included a meta-analysis of five RCTs comparing counseling with usual care or no counseling among people of lower SES and/or with limited formal education (Fiore et al. 2008). Results from the meta-analysis showed that counseling was effective in treating people with lower SES who smoke (OR = 1.42; 95% CI, 1.04–1.92; abstinence rate without counseling = 13.2%, with counseling = 17.7%) (Fiore et al. 2008). Interventions in the five studies included: (1) motivational messages with and without telephone counseling for lower income mothers and lower income African American people; (2) proactive telephone counseling in addition to nicotine patches; and (3) tailored bedside counseling and follow-up for hospitalized African American patients (Fiore et al. 2008).

Bryant and colleagues (2011), in their meta-analysis of three studies among lower income women attending pediatric or Planned Parenthood clinics, found a significant effect of a multicomponent motivational interviewing intervention compared with usual care or brief advice at 6–12 weeks follow-up (relative risk [RR] = 1.68; 95% CI, 1.21–2.33) but not at their longest follow-up point, which varied across the studies (RR = 1.28; 95% CI, 0.96–1.72). In addition, three interventions sought to reach pregnant women with lower incomes; no effect for behavioral cessation interventions compared with usual care or brief intervention was observed at their third trimester or at their 6-month postpartum follow-up.

Bryant and colleagues (2011) also conducted a meta-analysis of four behavioral support cessation interventions designed to reach people with lower incomes who were living in deprived neighborhoods or attending public health clinics and found no significant effects for short-term (RR = 1.87; 95% CI, 0.91–3.83) or long-term (RR = 1.58; 95% CI, 0.79–3.14) cessation outcomes. Two other studies in their review found significant effects of behavioral interventions compared with a control group for people with lower incomes; one study compared a self-help cognitive behavioral therapy (CBT) cessation program with educational materials, and another compared brief advice from dental practitioners using the 5 A's and NRT with usual care.

Hill and colleagues (2014) reviewed 20 studies of combined behavioral counseling and cessation medication interventions that either examined the impact of cessation services by SES or were directed to lower SES population groups; they included both RCTs and observational studies in their review. Among the nine studies using combined behavioral and pharmacologic interventions that examined the impact by SES, lower quit rates were observed among lower SES people who smoke compared with those with higher SES in most studies; however, no differences in quit rates by SES were observed in two inpatient studies. Similarly, their review of cessation programs that contained only behavioral interventions found lower cessation among participants with lower SES compared with those with higher SES. Their review of 11 studies that examined cessation programs designed to reach people with lower SES who smoke found mixed results, with some producing generally low quit rates and others producing higher quit rates (Hill et al. 2014). The authors noted that a small number of studies in their review demonstrated greater effectiveness for lower income populations when cessation support was concentrated in less advantaged communities, suggesting targeted services may have a role to play in reducing cessation-related disparities in this population.

A recent systematic review and meta-regression analysis by Kock and colleagues (2019) assessed whether behavioral smoking cessation interventions tailored for lower SES population groups (defined by income, eligibility for government assistance, occupation, and housing) were more effective for cessation compared with nontailored interventions for people with lower SES. This review included 42 RCTs with smoking cessation outcomes 6 or more months from the start of the intervention, 30 of which were in the United States; 26 of the 42 studies were interventions tailored for people with lower SES and 16 were nontailored interventions. Seventeen of the tailored interventions used in-person or telephone counseling, four were digital, three involved financial incentives, and two were brief interventions. Kock and colleagues' (2019) meta-regression demonstrated a positive pooled effect size for cessation interventions; people with lower SES who participated in an intervention (tailored or not) were more likely to quit smoking than those in the control (or usual care) group (RR = 1.56; 95% CI, 1.39–1.75). A subanalysis for tailored interventions versus the control (or usual care) group had a similarly positive pooled effect size (RR = 1.54; 95% CI, 1.37–1.72). However, Kock and colleagues (2019) found that tailored interventions were not more effective for cessation among people with lower SES compared with nontailored interventions (RR = 1.01; 95% CI, 0.81–1.27). Based on their findings, Kock and colleagues (2019) concluded that, while individual-level interventions are effective at assisting people with lower SES in quitting, current tailored programs have not yet improved cessation effectiveness compared with nontailored programs. The authors further suggested that improvements in tailored interventions for people with lower SES, including multifaceted approaches that address the wider social context of cessation in this population group, should be considered to achieve equity in cessation outcomes.

The current literature review identified three RCTs that examined smoking cessation interventions among adults with lower SES who smoke (Bock et al. 2014; Bernstein et al. 2015; Vidrine et al. 2016) that were not included in the review by Kock and colleagues (2019) because they did not report differential effects by SES. The current review also identified four RCTs (Danan et al. 2018; Alaniz et al. 2019; Dahne et al. 2020b; Rogers et al. 2022a) published after the review by Kock and colleagues (2019) (Table 7.8). Studies focused on testing the effect of financial incentives on cessation are not included here but are summarized later in this section. In addition, some studies summarized in later sections in this chapter on selected racial and ethnic groups also contain primarily lower SES population groups but are not included here (see, in particular, Nollen et al. 2007; Borrelli et al. 2010; Froelicher et al. 2010; Webb et al. 2010a; Cherrington et al. 2015; Rodriguez Esquivel et al. 2015; Webb Hooper et al. 2017a, 2021; Simmons et al. 2022)].

Six of the seven studies included in this review involved patient populations (Rogers and colleagues [2022a] also recruited from the community), and five of the RCTs were delivered in clinics (four were multicomponent and one was a pharmacologic intervention). In one of the five clinic-based studies, Bernstein and colleagues (2015) randomized adults with lower incomes who smoke who came to the emergency department to receive either a self-help quit smoking brochure (i.e., usual care) or a multicomponent intervention (i.e., enhanced care) that included behavioral counseling (i.e., motivational interviewing), 6 weeks of NRT, a proactive referral to a quitline for telephone counseling, and a booster counseling call following discharge. Findings from this study revealed that at 3 months, biochemically verified abstinence was significantly greater in the intervention group than it was in the control group (12.2% vs. 4.9%; OR = 2.72; 95% CI, 1.55–4.75), as was quitline utilization (32.0% vs. 18.7%). Abstinence rates did not differ significantly at 1-year follow-up; however, rates were 16.3% in the intervention group and 11.7% in control group (OR = 1.47; 95% CI, 0.97–2.23). The analysis was not able to detect which intervention components were most effective.

Bock and colleagues (2014) conducted an outpatient cessation trial in southern New England metropolitan areas among racially diverse lower income adults who smoke and found no benefit from adding a motivational enhancement component consisting of individual counseling based on motivational interviewing techniques, compared with usual care. Although multicomponent interventions have feasibility in terms of reaching lower SES people who smoke, they require considerable allocation of clinical resources as well as hiring a dedicated interventionist. Further, the scalability and sustainability of a multicomponent smoking cessation intervention may not be generalizable to the real world of busy, resource-constrained healthcare settings in the United States.

Vidrine and colleagues (2016) recruited adults who smoke via local print media in Houston, Texas; 57% of participants had a total household income of less than $30,000. Participants were randomized to either usual care (four individual sessions based on Fiore et al. 2008), CBT (eight 2-hour in-person group counseling sessions), or mindfulness-based addiction treatment (MBAT) (eight 2-hour in-person group counseling sessions), with all groups given self-help materials and 6 weeks of nicotine patch therapy. The authors observed no treatment effects at 4 or 26 weeks post-quit date. However, MBAT was positively associated with 26-week abstinence among those who were smoking at 4 weeks post-quit date compared with those in usual care (OR = 4.82; 95% CI, 1.25–118.57). The authors concluded that MBAT may promote recovery from early lapses; however, they stated that more research is needed to replicate this finding and to identify underlying mechanisms.

Rogers and colleagues (2022a) randomized adult New York City residents recruited from two safety-net

Table 7.8 Individual-level tobacco cessation treatment trials among people of lower socioeconomic status who smoke

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Bock et al. (2014)	• RCT • Lower income adults who smoked and were on Medicaid or uninsured (n = 846) • Inner-city hospital-based primary care outpatient clinics • Primary quit-smoking outcomes measured: – Biochemically verified 7-day point-prevalence abstinence at 1, 2, 6, and 12 months following baseline • Southern New England	• Condition 1, standard care (n = 440): Brief physician advice (including four of the 5 A's: Ask, Advise, Assess, Assist), NRT (patches, 4 weeks), and self-help brochure on quitting smoking • Condition 2, motivational enhancement (n = 406): All components of standard care group plus 45-minute individual counseling session based on motivational interviewing techniques, the delivery of the fifth "A" (Arrange) at follow-up by a health educator, and two proactive counseling calls	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking): After controlling for selection bias due to high attrition and stratifying participants by last follow-up visit attended, no significant differences were found in the longitudinal trajectories of abstinence rates by condition • 7-day point-prevalence abstinence rates by follow-up: – 1-month follow-up: ○ Condition 1 = 40% quit ○ Condition 2 = 37% quit – 2-month follow-up: ○ Condition 1 = 33% quit ○ Condition 2= 32% quit – 6-month follow-up: ○ Condition 1 = 20% quit ○ Condition 2 = 24% quit – 12-month follow-up: ○ Condition 1 = 28% quit ○ Condition 2 = 29% quit • After accounting for covariates, hazard rate analysis did not show direct benefit of and any statistically significant increase in abstinence rates due to motivational enhancement intervention (OR = 0.97; 95% CI, 0.36–2.64; p = 0.95) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Adding a motivational enhancement component to an intervention with physician advice and free NRT did not improve abstinence rates for people of low income who smoked	• Tailoring: – Equivalent translation of materials for English and Spanish speakers – Counseling available in Spanish and English languages – Acculturation level assessed • Limitations: – Selection bias due to high attrition after randomization – People who smoked and were in minoritized racial and ethnic groups had a significantly higher level of attrition than people who smoked and were not in these groups – Acculturated Hispanic people were the most likely participants to drop out of the study

Table 7.8 Continued

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Bernstein et al. (2015)	• RCT • Adults of lower income who smoked (n = 778) and who had Medicaid or no insurance • Adults who smoked were recruited from an ED at an urban hospital • Primary quit-smoking outcomes measured: – Biochemically verified smoking status at 3 months and 1 year – Quitline use • Connecticut	• Condition 1, usual care: Self-help brochure on quitting and information on how to contact the state quitline for counseling support • Condition 2, enhanced treatment: Motivational interview, a booster call 3 days after ED visit, NRT (6 weeks of patches and gum), proactive referral to quitline, and self-help brochure on quitting • All subjects received a $10 gift card for enrollment and $25 payments at 1-, 3-, and 12-month follow-up; those who reported abstinence at 3-months received $100 for providing biochemical verification of abstinence	• At 3 months, biochemically confirmed abstinence rates were significantly higher in the enhanced treatment group (12.2%) than they were in the usual care group (4.9%) (OR = 2.72; 95% CI, 1.55–4.75; p <0.001) • At 1 year, self-reported abstinence rates in the enhanced treatment (16.3%) and usual care groups (11.7%) were not significantly different (OR = 1.47; 95% CI, 0.97–2.23) • No differences were observed in effects between Hispanic, White, and African American participants in the enhanced treatment group • Quitline use was significantly greater in the enhanced treatment group (32.0%) than it was in the usual care group (18.7%) (OR = 2.04; 95% CI, 1.46–2.84) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Motivational-based behavioral counseling showed short-term benefits on smoking cessation (at 3 months) but did not support longer term cessation	• Tailoring: – No specific tailoring identified • Limitations: – Study was not designed or powered to detect a difference in tobacco use at 1-year follow-up – Study was implemented at a single site; findings might not generalize to other settings – Used dedicated non-clinical personnel, which may not be feasible in real-world EDs

Table 7.8 Continued

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Vidrine et al. (2016)	• RCT • Adults who currently smoked (>5 cigarettes per day, expired air CO level >8 ppm) were recruited from Houston via local print media (n = 412) • Diverse population by socioeconomic status: 57.6% had a yearly income <\$30,000 • Primary quit-smoking outcomes measured: – 7-day point-prevalence abstinence was assessed at 4 weeks (biochemically confirmed by CO <6 ppm) and 26 weeks after the quit day (CO <6 ppm or salivary cotinine <20 ng/ml) – Recovery from a lapse among those smoking at 4 weeks: 7-day point-prevalence at 26 weeks (CO <6 ppm) • Houston, Texas	• Condition 1, usual care: Four, 5- to 10-minute individual counseling sessions based on Fiore and colleagues (2008) • Condition 2: CBT delivered in eight, 2-hour, in-person group counseling sessions • Condition 3: MBAT delivered in eight, 2-hour, in-person group counseling sessions • All groups received self-help materials and 6 weeks of nicotine patch therapy	• Intent-to-treat analysis • 7-day point-prevalence abstinence at 4 weeks: – Usual care: 24.3% – CBT: 32.3% – MBAT: 34.4% • 7-day point-prevalence abstinence at 26 weeks: – Usual care: 11.7% – CBT: 15.5% – MBAT: 13.0% • Logistic random effects model analysis that compared the efficacy of usual care, CBT, and MBAT over time yielded no significant treatment effects (p = 0.407) • Analyses comparing usual care and MBAT over time indicated no difference (OR = 1.58; 95% CI, 0.84–2.99; p = 0.159) • Among those smoking at 4 weeks, 0% in usual care, 5.0% in CBT, and 10.3% in MBAT were abstinent at 26 weeks • MBAT facilitated recovery from lapse better than usual care (OR = 4.82; 95% CI, 1.25–118.57; p = 0.023) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Despite no overall significant effects of treatment on abstinence, MBAT may be more effective than usual care in promoting recovery from lapses	• Tailoring: – MBAT • Limitations: – MBAT requires specialized and intensive training on the part of therapists and high levels of individual engagement; therefore, it is not likely to be broadly disseminated in the tested form – Treatment diffusion bias might have occurred in that two therapists differed both treatments – Data on intervention fidelity was not collected – Rates of meditation practice as part of MBAT were low – Information on patch use was not collected – Definition of lapse recovery included those who may have never quit and those who achieved some period of abstinence – Participant attrition was significant

Table 7.8 Continued

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Danan et al. (2018)	• Secondary analysis of RCT • 5,123 participants were eligible and randomized: – Adults who currently smoked were identified using electronic medical records from the VA – 2,565 reported their level of education – 2,430 reported their level of income • Primary quit-smoking outcomes measured: – Self-reported, 6-month prolonged abstinence at 1-year follow-up	• Usual care: Access to smoking cessation service through their local VA and state telephone quitline • Proactive care: Active recruitment strategy included proactive outreach (mailed materials followed by telephone outreach) with an offer of telephone smoking cessation counseling or referral to in-person counseling	• No interaction between education (p = 0.07) or income (p = 0.74) and treatment arm for 6-month prolonged abstinence • People who smoked at each level of education and income had higher observed abstinence rates in the proactive care versus usual care • In individual population group analyses, proactive care had the largest effect size among people who smoked in (a) the lowest education category (<11th grade), with a quit rate of 17.3% compared with 5.7% among those receiving usual care (OR = 3.5; 95% CI, 1.4–8.6); and (b) the lowest income category (<$10,000), with a quit rate of 18.7% compared with 9.4% among those receiving usual care (OR = 2.2; 95% CI, 1.2–4.0) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Compared with usual care, proactive outreach was associated with higher rates of prolonged abstinence for all levels of socioeconomic status – Proactive outreach interventions that integrate telephone-based care and facilitate cessation medication access have the potential to reduce socioeconomic disparities in quitting smoking	• Tailoring: – No specific tailoring identified • Limitations: – Self-reported measure of prolonged abstinence may be subject to social desirability bias – Interaction tests may be underpowered, and the original trial was not designed to detect population group effects by level of socioeconomic status – Population of mostly male U.S. veterans limits generalizability to female veterans and non-veterans

Table 7.8 Continued

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Alaniz et al. (2019)	• RCT • Lower income pregnant women, ≥13 years of age (n = 185) • Programs, typically county-level health departments, that provide healthcare services to lower income pregnant women • Primary quit-smoking outcomes measured: – Biochemically confirmed smoking cessation (i.e., breath CO level <6 ppm) at about 6 months postpartum and self-reported nonsmoking in the previous 7 days (point-prevalence abstinence) • Wisconsin	• Control/Condition 1 (original First Breath program) (n = 94): Cessation counseling during at least two prenatal visits and one postpartum visit, link to Wisconsin Tobacco Quit Line, optional enrollment in a program to receive motivational text messages, one 6-month postpartum in-home abstinence evaluation visit, and the potential to earn $40 in gift cards • Condition 2 (same as Condition 1 plus additional components) (n = 91): Additional components included one prenatal and three postpartum in-home counseling visits, three postpartum counseling phone calls, and the potential to earn $140 in gift cards	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking): Abstinence rate was 15.5% for women who received postpartum help and 7.4% for women in the control group (p = 0.07) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – The program design benefited from a patient-centric approach, whereby the target population participated in program development, implementation, and redesign	• Tailoring: – Postpartum support services, such as cessation counseling and guidance about how to be supportive of a new mother, were also provided to others in the household – Monetary incentives were provided for accepting the postpartum services and for abstinence for the mother • Limitations: – Intervention was conducted in community health clinics and may not be generalizable to other clinical settings – Only 37% of women referred for the program ultimately enrolled – Abstinence rates fell about 50% from prenatal to 1 month postpartum, with no additional decline through 6 months postpartum, indicating that additional clinical intervention may be necessary to address early relapse

Table 7.8 Continued

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Dahne et al. (2020b)	• Secondary analysis of RCT (randomization was at the clinic level) • 1,245 adults enrolled at 22 primary care clinics • Recruited English-speaking adults who smoked ≥5 cigarettes per day on ≥25 of the previous 30 days; adults were excluded for FDA contraindications for NRT use (e.g., pregnancy or breast feeding, recent acute cardiovascular event) • Primary quit-smoking outcomes measured: – Self-reported at 1, 3, and 6-months poststudy • South Carolina	• Condition 1 (standard care) (n = 652): Take-home bag with basic information about smoking cessation and a brochure with referral to the state quitline • Condition 2 (standard care and NRT sampling) (n = 593): Same as Condition 1 but take-home bags also included 2-week supplies of nicotine patches (14 mg) and lozenges (4 mg)	• Any medication use: – The effect of NRT sampling was larger for lower income (<$50,000/year) adults (OR = 7.03; 95% CI, 4.98–9.91) than it was for higher income (>$50,000/year) adults (OR = 3.36; 95% CI, 1.80–6.26) (p = 0.04 for interaction) – NRT sampling increased medication use among adults with at least a high school diploma (OR = 6.61; 95% CI, 4.65–9.36) and those without a high school diploma (OR = 4.66; 95% CI, 3.02–7.18) (p = 0.2 for interaction) • 24-hour quit attempts: The effect of NRT sampling varied by level of income (p = 0.7): Lower income (OR = 1.34; 95% CI, 0.89–2.04) and higher income (OR=0.71; 95% CI, 0.36–1.40) • Any 7-day abstinence: The effect of NRT sampling varied by level of income (p = 0.1): Lower income (OR = 1.59; 95% CI, 0.97–2.59) and higher income (OR = 0.87; 95% CI, 0.39–1.94) • 7-day point-prevalence abstinence at 6-months: – NRT sampling was associated with cessation among people with lower incomes (OR = 1.97; 95% CI, 1.13–3.42) but not among those with higher income (OR = 0.87; 95% CI, 0.39–1.94) (p = 0.2 for interaction) – NRT sampling increased cessation among those with lower education (OR = 2.23; 95% CI, 1.30–3.82) but not among those with higher education (OR = 0.89; 95% CI, 1.23–3.50) (p = 0.02) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – NRT sampling could narrow cessation disparities by increasing access to medications for people in groups that may have limited access to cessation support	• Tailoring: – NRT sampling • Limitations: – Potential for response bias in results for income because (a) data were missing for 266 participants and (b) other demographics (age, race, and education) of those missing income differed by cessation outcome – This was a secondary analysis so it was not designed a priori, and it may also be underpowered

Table 7.8 Continued

Study	Design, population, and location	Intervention	Smoking cessation outcomes	Tailoring to the population and study limitations
Rogers et al. (2022a)	• Randomized waitlist controlled trial • Adults who had income below 200% of the federal poverty level, spoke English or Spanish, and managed their own funds were recruited from two medical centers and the community (n = 410) • Primary quit-smoking outcomes measured: – Self-reported 7-day abstinence at 6 months • New York City	• Control: Up to nine sessions of individual counseling (first two onsite and the remaining sessions either onsite or by telephone), cards to travel by subway to in-person counseling sessions, and a free 4-week supply of NRT • Intervention: Same as the control group plus financial coaching components were integrated into the cessation coaching sessions, and included screening and referral for financial benefits and empowerment programs and money management coaching	• Intent-to-treat analysis • At 6 months, abstinence rates were higher among intervention participants than they were among those in the control group (17% vs. 9%; OR = 2.0; 95% CI, 1.1–3.6; p = 0.03) • Abstinence outcomes were stronger among participants recruited from medical centers (20% in intervention and 8% in control) (p = 0.01) than outcomes among those recruited from the community (no treatment difference p >0.05) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Addressing socioeconomic determinants of smoking and integrating social needs screening and referrals into smoking cessation programs may be a promising approach for increasing cessation	• Tailoring: – Intervened on socioeconomic challenges faced by people who smoked and had lower incomes – Among participants who began the intervention, money management coaching was the most popular financial component of the intervention and the most feasible to integrate with the cessation coaching process • Limitations: – Abstinence was not biochemically verified – Study occurred in a high-cost city with robust social services, and there was a considerable drop-off from screening to eligibility and completion, thus limiting generalizability – Could not identify impacts of individual intervention components

Notes: **CBT =** cognitive behavioral therapy; **CI =** confidence interval; **CO =** carbon monoxide; **ED =** emergency department; **FDA =** U.S. Food and Drug Administration; **MBAT =** mindfulness-based addiction treatment; **mg =** milligram; **mL =** milliliter; **ng =** nanogram; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **ppm =** parts per million; **RCT =** randomized controlled trial; **VA =** U.S. Department of Veterans Affairs.

medical centers or the community to either the control intervention of up to nine sessions of individual counseling (first two completed in clinic, the remainder in clinic or at home) and 4 weeks of free NRT or the treatment intervention, which included the control treatment plus financial coaching components integrated into the cessation coaching sessions. At 6-month follow-up, self-reported 7-day point-prevalence abstinence was higher in the intervention group (17%) than in the control group (9.0%) (OR = 2.0; 95% CI, 1.1–3.6), indicating that intervening on the socioeconomic challenges—that is, adding a financial coaching component to individual counseling—may improve smoking cessation outcomes for adults with lower incomes.

Finally, Dahne and colleagues (2020b) performed a secondary analysis of an RCT that compared providing NRT samples (2-week supplies of nicotine patches and lozenges) with standard care among adults who smoked from 22 primary care clinics in South Carolina. The provision of NRT samples was associated with 7-day point-prevalence abstinence at 6 months post-intervention among participants with lower incomes (<$50,000 per year) (OR = 1.97; 95% CI, 1.13–3.42) but not among those with higher incomes (>$50,000 per year) (OR = 0.87; 95% CI, 0.39–1.94). Similar results were observed for education: the provision of NRT samples increased cessation among those with a high school diploma or less (OR = 2.23; 95% CI, 1.30–3.82) but not among those with higher educational attainment (OR = 0.89; 95% CI, 1.23–3.50).

Two of the six studies identified in the literature delivered out-of-clinic interventions; one study was among lower income pregnant women (Alaniz et al. 2019) and the other was among U.S. veterans and examined whether intervention effects differed by SES (Danan et al. 2018). Alaniz and colleagues (2019) tested whether adding one prenatal and three postpartum in-home counseling visits, three postpartum counseling phone calls, and up to $140.00 in gift cards to the First Breath cessation program was associated with greater biochemically confirmed smoking abstinence at 6 months postpartum compared with the original First Breath program (counseling in at least two prenatal visits and one postpartum visit, linkage to the Wisconsin quitline and texting program, one 6-month postpartum evaluation visit, and $40.00 in gift cards). Abstinence rates were 15.5% for women who received the postpartum intervention versus 7.4% for women in the control group (p = 0.07). The other RCT identified U.S. veterans from Veterans Administration electronic medical records and compared an active recruitment strategy (mailed materials followed by telephone outreach) that offered telephone smoking cessation counseling or referral to in-person counseling with usual care (Danan et al. 2018). The authors observed no statistically significant interaction between treatment arm and education (p = 0.07) or income (p = 0.74) for self-reported 6-month abstinence at 1-year follow-up. Participants at each education and income level had higher observed abstinence rates among those who were actively recruited to cessation treatment than among those in usual care.

Incentives

Interventions providing incentives (money, gift cards, and other tangible goods) are another approach that can engage lower SES people who smoke (USDHHS 2020). Evidence from a 2019 Cochrane review by Notley and colleagues (2019) estimated that a pooled RR from 31 RCTs for quitting with incentives at longest follow-up (6 months or more) compared with controls was 1.49 (95% CI, 1.28–1.73; adjusted N = 20,097). Excluding studies that took place in worksites (n = 10), the authors reported that 10 of the remaining 21 studies included in the meta-analysis included participants with diverse education and income levels and one additional study was among a lower SES population. Their review also estimated a pooled RR of 2.38 (95% CI, 1.54–3.69; N = 2,273) for cessation for pregnant women at longest follow (up to 24 weeks postpartum) from nine studies comparing incentives with controls. Among these nine studies, five studies were among lower SES women and one study comprised of women of diverse SES. Another meta-analysis of 22 RCTs among pregnant women concluded that when comparing treatment types, effects of contingency management interventions (i.e., providing financial incentives contingent upon biochemically verified smoking abstinence) for increasing smoking cessation were significantly greater than those of psychotherapeutic interventions (Wilson et al. 2018).

Three additional review articles examining incentives have been published since the 2019 Cochrane review (Getty et al. 2019; Breen et al. 2020; Hartmann-Boyce et al. 2021). One of these reviews, a 2021 Cochrane review of behavioral interventions for smoking cessation, concluded that there was high certainty evidence that guaranteed financial incentives increased smoking cessation at 6 months or longer compared with controls (OR = 1.46; 95% CI, 1.15–1.85; 19 studies, n = 8,877) (Hartmann-Boyce et al. 2021). A second review of 26 studies examined whether higher incentive amounts produced larger quit rates and found no correlation between the amount of the incentive and quit rates (Breen et al. 2020). Finally, a meta-analysis of seven RCTs concluded that interventions using contingency management delivered via mobile telephone performed significantly better than control conditions in increasing smoking cessation among adults with substance use disorders who were not in treatment (Getty et al. 2019).

The current literature review identified five studies examining the effect of incentives on cessation that were published since the 2019 Cochrane review of incentives for smoking cessation (Notley et al. 2019) and Kock and colleagues' (2019) meta-analysis; these five studies are summarized in Table 7.9. Witman and colleagues (2018) performed a secondary analysis of data from the Medicaid Incentives for Prevention of Chronic Disease grant program and Medicaid claims and encounter data from five states (California, Connecticut, New York, Wisconsin, and New Hampshire). The authors observed that the receipt of incentives was positively associated with self-reported quit attempts, self-reported quits, or passing cotinine tests of smoking cessation in most programs, although the results were statistically significant in only a subset. The authors concluded that financial incentives are a promising policy lever to motivate behavioral change in those enrolled in Medicaid, but more evidence is needed regarding optimal incentive size, effectiveness of process- versus outcome-based incentives (i.e., participation in treatment versus cessation outcomes), targeting of incentives to populations of interest, and long-run cost-effectiveness (Witman et al. 2018).

Anderson and colleagues (2018) conducted an RCT of adult Medicaid beneficiaries enrolled in the California Smokers' Helpline in which participants were randomized to one of three groups: usual care, nicotine patches, and nicotine patches plus a financial incentive of up to $60 for completing quitline counseling calls. A larger percentage of participants who received nicotine patches and incentives achieved 6-month prolonged abstinence (13.2%) compared with participants in usual care (9.0%; $p = 0.001$). However, no differences in most cessation outcomes were observed between participants who received the nicotine patches and participants who received usual care. The authors concluded that modest, noncontingent financial incentives increased smoking cessation among Medicaid enrollees and that such incentives could feasibly be integrated into existing quitline services.

Another RCT of adults enrolled in Medicaid from 12 health clinics in Connecticut randomly assigned participants to usual care or one of three incentive arms (financial incentives for 2 months; financial incentives plus a deposit contract with the incentive earnings after the 2 months, in which earnings would be lost if cessation is not achieved; and financial incentives plus a precommitment of incentives earnings into a deposit contract after the 2 months) (Anderson et al. 2021). No statistically significant differences in quit rates were observed when comparing each of the treatment groups with usual care at 2- or 6-months post-enrollment.

A recent RCT examined financial incentives for smoking cessation in a lower income population of 182 hospitalized adults (Ladapo et al. 2020). Participants were randomized to either enhanced usual care, which included hospital-directed cessation care and a quitline referral, or enhanced usual care plus up to $550 for participation in quitline counseling, community-based cessation programs, use of pharmacotherapy, and biochemically confirmed smoking cessation at 2 months and 6 months. The 6-month rate of biochemically confirmed smoking cessation was 19.6% in the incentive group and 8.9% in the enhanced usual care group (OR = 2.56; 95% CI, 0.84–7.83). The authors concluded that further research on the effectiveness of financial incentives that are sufficiently large to overcome barriers to the use of evidence-based therapy, is needed, as the total mean payment in their study was only $84 in the incentive group.

An RCT of pregnant and newly postpartum women with lower SES in Vermont also found that, compared with women who received best practice cessation interventions, those who received best practices plus financial incentives (vouchers redeemable for retail items, which were contingent on biochemically verified abstinence at clinic visits, of up to $865–$1,730 antepartum and $360–$720 postpartum, depending on initial amount of cigarette smoking) were more likely to quit during pregnancy and through 12 weeks postpartum but not at 24 or 48 weeks postpartum (Higgins et al. 2022b).

Summary

In summary, research indicates that behavioral interventions such as in-person and telephone counseling, digital support, and brief clinical interventions are effective for smoking cessation among lower SES population groups as summarized in the largest meta-analysis conducted to date (Kock et al. 2019) and the *Clinical Practice Guideline* (Fiore et al. 2008). However, it is important to note that two smaller review articles had mixed findings for the effectiveness of behavioral interventions or a combination of behavioral and pharmacologic interventions on smoking cessation among people with lower SES (Bryant et al. 2011; Hill et al. 2014). Kock and colleagues (2019) also concluded that tailored programs were not more effective for cessation among lower SES people compared with nontailored programs.

Seven additional RCTs identified in this literature review also reported mostly positive results for cessation interventions, although two studies observed no intervention effect (Bock et al. 2014; Alaniz et al. 2019). Among the five studies that found positive treatment effects, findings varied by whether the effect size varied by SES and by length of follow-up. Specifically, Danan and colleagues (2018) found no difference by SES, but Dahne and colleagues (2020b) found a larger effect among those with

Table 7.9 Individual-level tobacco cessation treatment trials of incentives for smoking cessation among people of lower socioeconomic status who smoke

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Anderson et al. (2018)	• Three group RCT • Adult Medicaid beneficiaries calling the California Smokers' Helpline in 2012–2013 (n = 3,816) • Primary quit smoking outcomes measured: – 6-month prolonged abstinence • California	• Usual care: Quitline counseling, cessation medication (NRT, bupropion, or varenicline) via a doctor's prescription, and proof of enrollment in counseling to access free quitting aids at the local pharmacy • Nicotine patch: Same as usual care plus NRT sent by the quitline via express mail in 4-week supplies with unlimited refills as long as the person was engaged in counseling and quitting • Nicotine patch and financial incentives: Usual care and nicotine patch plus a $20 gift card for completing a pre-quit counseling call and a second gift card based on the number of completed follow-up counseling calls ($10 per call, up to $40)	• In the intent-to-treat analysis, members in the group receiving the nicotine patch and financial incentives were more likely to achieve 6-month prolonged abstinence than those in the usual care group (13.2% vs. 9.0%; $p = 0.0001$) and those in the nicotine patch group (10.3%; $p = 0.02$) • Abstinence of more than 6 months did not differ between members in the nicotine patch group and those in the usual care group ($p = 0.27$)	• Tailoring: – Removed a treatment barrier by mailing nicotine patches to participants, eliminating the need for a prescription and a trip to a pharmacy • Limitations: – The incentives tested were adjuncts to a telephone counseling program so the results do not address the value of incentives as standalone interventions – Could not determine the effect of the incentives without the use of a nicotine patch – Widespread promotion of incentives through the quitline in all participant groups reduced the study's power to detect a difference in the incentive comparison – Evaluation staff were not blinded to group assignments – Outcomes were not biochemically verified

Table 7.9 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Witman et al. (2018)	• RCT • Secondary analysis of data from the Medicaid Incentives for Prevention of Chronic Disease program • Primary quit-smoking outcomes measured: – Outcomes varied by state and included self-reported quit attempts, self-reported quits, and biochemically verified cessation (cotinine <80 ng/ml or a negative CO test after a baseline test) – Data from each state were analyzed separately • Logit models adjusted for sex, age, race, ethnicity, education level, and program time • Five states, California, Connecticut, New Hampshire, New York, and Wisconsin	• Each state designed and implemented its own program • Each program included multiple incentive arms • Of the 12 incentive groups, many had behavioral counseling and some had NRT	• Incentive recipients in all program arms, except Connecticut's program, were more likely to exhibit behavioral changes (self-reported quit attempts, self-reported quits, and/or passing CO/cotinine test between baseline and final measurement) than participants in control groups; the difference in cessation outcomes between participants in the incentive and control groups were statistically significant in 5 of the 12 programs	• Tailoring: – California: Incentives included free NRT and incentives to participate in quitline calls – Connecticut: Incentives for receiving in-person or telephone counseling and/or passing tobacco-free cotinine tests – New Hampshire: Incentives for obtaining an NRT prescription and passing cotinine tests – New York: Incentives for counseling or for passing cotinine tests – Wisconsin: Engaged both pregnant and nonpregnant women who smoked • Limitations: – The number of participants may have been too small to detect statistically significant differences in outcomes – Self-reported quit attempts and smoking cessation are subject to bias because a beneficiary's response may have been related to having received a financial incentive

Table 7.9 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Ladapo et al. (2020)	• RCT • Lower income adults (n = 182) who were hospitalized in Veterans Affairs hospitals • Primary quit smoking outcomes measured: – Tobacco abstinence—defined as self-reported, 7-day point-prevalence and biochemical confirmation with salivary cotinine (<10 ng/ml)—6 months after hospital discharge • Other outcome: 2-month follow-up abstinence (CO <6 ppm) • Manhattan, New York	• Enhanced usual care: Hospital-directed tobacco-use screening, counseling, education, and pharmacotherapy and referral to state quitline • Enhanced usual care and financial incentives: Enhanced usual care plus up to $550 (secure prepaid debit card) for participating in counseling (community-based and quitline), using smoking cessation pharmacotherapy, and achieving biochemically confirmed smoking cessation at 2 and 6 months	• Intent-to-treat analysis. • 6-month rate of smoking cessation, based on biochemical confirmation: – 19.6% in the enhanced usual care and financial incentives group: – 8.9% in the enhanced usual care group – OR = 2.56; 95% CI, 0.84–7.83; p = 0.10 • Financial incentives increased self-reported smoking cessation and the rate of early NRT use • Financial incentives did not significantly increase the rates of other activities linked to incentives, including quitline participation	• Tailoring: – Study designed to improve health through smoking cessation and to improve economic well-being through substantial cash payments for achieving healthy goals • Limitations: – Although patients could earn up to $550 in incentive payments over a 6-month period, the mean payment in the financial incentive arm was modest ($84) and fewer than 1 in 10 patients earned at least $400 – Financial stress was unchanged among those earning higher incentives but increased among those earning lower or no incentives – Low power to detect a significant effect of incentives on cessation – Population was limited to veterans and was more than 90% male – Patients in the Veterans Affairs hospitals experience high levels of mood disorders, which may decrease the likelihood of cessation

Table 7.9 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Anderson et al. (2021)	• RCT • Adult Medicaid beneficiaries (n = 311) at 12 health clinics • Primary quit smoking outcomes measured: – Smoking cessation confirmed biochemically at 2, 6, and 12 months (CO <8 ppm as a screener and urine cotinine <20 ng/mL) • Participants without biochemical verification from a urine cotinine test were recorded as still smoking • Connecticut	• Usual care: Encouraged participants to use the clinic's usual care cessation support services, including group counseling and NRT, and the state's quitline • Treatment Arm 1: Usual care and opportunity to earn incentives for 2 months (total possible reward of $300 in gift cards) • Treatment Arm 2: Usual care and opportunity to earn incentives for 2 months and start a 4-month deposit contract (where participants forfeit money if a cessation target is not met) after incentives ended (total possible reward of $300 in gift cards) • Treatment Arm 3: Usual care and opportunity to earn incentives for 2 months and option to precommit incentive earnings into a 4-month deposit contract after incentives ended (total possible reward of $300 in gift cards) • All treatment arms were registered to a study-specific web-based portal that (a) provided goal monitoring, online contracts, connections to anyone to support participants' cessation efforts, and a journal for participants to log entries about their cessation progress and (b) offered a tool for participants to sign up for usual care	• Differences in quit rates did not differ significantly between those receiving usual care and those in any of the treatment groups • Controlling for age, sex, education level, and income level at 2 months: – Treatment Arm 1: OR = 1.71; 95% CI, 0.53–5.51; p = 0.37 – Treatment Arm 2: OR = 3.24; 95% CI, 0.86–12.25; p = 0.08 – Treatment Arm 3: OR = 3.03; 95% CI, 0.85–10.79; p = 0.09 • Controlling for age, sex, education level, and income level at 6 months: – Treatment Arm 1: OR = 0.89; 95% CI, 0.13–6.03; p = 0.90 – Treatment Arm 2: OR = 0.84; 95% CI, 0.06–11.07; p = 0.89 – Treatment Arm 3: OR = 4.08; 95% CI, 0.70–23.90; p = 0.12 • Analysis of any treatment versus usual care also yielded nonsignificant ORs • Only three participants were measured as not smoking at 12 months, so ORs were not modeled • Usefulness of findings to understanding or reducing tobacco-related health disparities: – The relatively high uptake of commitment contracts in the precommitment arm (Treatment Arm 3) suggests creative deposit contracts are feasible additions to financial incentive programs	• Tailoring: – Deposit contracts (forfeit own money if cessation target is not met) usually have low uptake, but this program tried to increase uptake by combining financial incentives for cessation with the opportunity to commit incentive earnings to a deposit contract • Limitations: – Financial incentives did not induce cessation during the initial 2-month period, so most precommitment contracts were not funded, thereby limiting the ability to evaluate the precommitment treatment arm (Treatment Arm 3) – Small numbers due to lower than planned enrollments yielded imprecise estimates – Lack of internet access or literacy may have been a barrier to engagement with the web-based portal

Table 7.9 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Higgins et al. (2022b)	• RCT • Pregnant and newly postpartum women, ≥18 years of age (n = 249) • Mostly lower socioeconomic status, and 76–80% had less than 12 years of education • Primary quit smoking outcomes measured: – 7-day point-prevalence abstinence antepartum and postpartum • Burlington, Vermont	• Control: Best practices for smoking cessation, including referral to the Vermont quitline for perinatal-specific counseling—with the quitline offering up to $65 in incentives for completing calls—and brief counseling from research staff at all assessments • Financial Incentives: Best practices for smoking cessation plus voucher-based financial incentives from quit data through 12-weeks postpartum; vouchers (maximum $1,225–$2,450) were redeemable for retail items and earned contingent on CO <6 ppm during the initial 5 days of cessation, then contingent on urine cotinine levels <80 ng/ml	• Intent-to-treat analysis • Compared with only best practices, best practices and financial incentives increased abstinence in early pregnancy (aOR = 9.97; 95% CI, 3.32–29.93) and late pregnancy (aOR = 2.46; 95% CI, 1.05–5.75) but not at 24-weeks (aOR = 1.31; 95% CI, 0.54–3.17) and 48-weeks postpartum (aOR = 1.33; 95% CI, 0.55–3.25) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Suggests a benefit of intervention beyond discontinuation of incentives	• Tailoring: – No specific tailoring identified • Limitations: – Small sample size reduced statistical power to detect an effect – Study population is from one state and may not be generalizable

Notes: **aOR =** adjusted odds ratio; **CI =** confidence interval; **CO =** carbon monoxide; **mL =** milliliter; **ng =** nanogram; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **ppm =** parts per million; **RCT =** randomized controlled trial.

lower SES. With respect to follow-up length, Bernstein and colleagues (2015) observed a positive effect at short-term, but not long-term, follow-up; Rogers and colleagues (2022a) observed a positive effect on cessation at 6 months; and Vidrine and colleagues (2016) found a positive treatment effect only for abstinence at 26 weeks among those who were still smoking 4 weeks post-quit date.

Regarding incentives, four meta-analyses consistently concluded that incentives increase cessation among lower SES population groups (Wilson et al. 2018; Getty et al. 2019; Notley et al. 2019; Hartmann-Boyce et al. 2021), although the one meta-analysis that sought to assess the optimal financial incentive amount for cessation could not determine the optimal amount (Breen et al. 2020). Five additional studies found mixed results for incentives, with two showing positive effects (Anderson et al. 2018; Witman et al. 2018), two showing no effect (Ladapo et al. 2020; Anderson et al. 2021), and one showing a short-term positive effect but no long-term effect (Higgins et al. 2022b). This evidence suggests that, when coupled with cessation treatments, incentives may increase successful cessation in this population group.

The most common approaches in designing cessation interventions for lower SES population groups to date include multicomponent interventions delivered in medical settings and incentive-based interventions. Further research is needed to identify the components of behavioral interventions that are most effective for lower SES population groups. Furthermore, as current tailoring strategies generally do not appear to be more effective at increasing cessation than nontailored strategies for lower SES population groups, additional research is needed to further the understanding of tailoring strategies that could be effective, including what types of interventions and the "dose" of tailoring that may be needed. In addition, future research studies could examine preferences for cessation medications among lower SES people who smoke, identify innovative strategies to increase medication use, and identify approaches to ensure equitable access to counseling and pharmacotherapy, particularly in lower resource settings.

Black or African American People

Tobacco use is a major contributor to the three leading causes of death among African American people—heart disease, cancer, and stroke (USDHHS 1998; Heron 2013; Kochanek et al. 2016). Although African American or Black people usually smoke fewer cigarettes and start smoking cigarettes at an older age, they are more likely to die from smoking-related diseases than White people (USDHHS 1998, 2004; Heron 2013; Schoenborn et al. 2013; Kochanek et al. 2016). Among African American adults (≥18 years of age) who currently smoke cigarettes daily, 63.4% reported attempting to quit in the past year compared with 56.2% of Hispanic adults and 53.3% of White adults (USDHHS 2020). Despite a higher proportion of African American adults making quit attempts each year, they are less successful at quitting smoking than their White and Hispanic counterparts, possibly in part because of lower access to and/or utilization of cessation treatments, such as counseling and medication (USDHHS 2020), targeted tobacco industry marketing, elevated distress, and perceived racial discrimination (see Chapters 4 and 5). Three meta-analyses and an additional five trials (Table 7.10, meta-analyses not included) have examined the effectiveness of individual-level cessation intervention components among Black or African American people who smoke.

The *Clinical Practice Guideline* examined the effectiveness of cessation interventions for cigarette smoking among specific racial and ethnic groups and identified eight RCTs among African American adults (Fiore et al. 2008). The review found that medication (including bupropion sustained release and the nicotine patch in particular), counseling (including in-person motivational counseling, telephone counseling, and clinician advice), biomedical feedback, and tailored self-help manuals or materials have been shown in various RCTs to be effective in helping African American adults quit smoking.

Another 2008 meta-analysis of cessation interventions among African American adults was not limited to RCTs and comprised 20 studies (including six studies identified by the *Clinical Practice Guideline* [Fiore et al. 2008]) with 12,743 participants (Webb 2008b). Meta-analysis of cessation at the first follow-up assessment (follow-up times varied by study) in 12 studies found that cessation interventions were effective among African American adults (OR = 1.31; 95% CI, 1.02–1.69). Interventions tested in the included studies included medication (NRT, bupropion), counseling (individual, group, and telephone counseling), targeted or tailored print materials, community outreach, video and radio media, or some combination.

Webb (2008b) also observed that the effects of interventions with a culturally specific adaption and interventions without a culturally specific adaption on cessation varied over time. The authors examined smoking abstinence at first posttreatment assessment and found that studies testing a culturally specific smoking cessation intervention had significantly higher odds of cessation (OR = 1.47; 95% CI, 1.12–1.91) compared with control conditions; the odds of cessation for studies not testing a culturally specific intervention at first posttreatment assessment were not statistically significantly higher than control conditions (OR = 1.34; 95% CI, 0.99–1.82). However, at

Table 7.10 Individual-level tobacco cessation treatment trials among Black or African American people who smoke

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Nollen et al. (2007)	• RCT • African American adults (n = 500) • Participants wanted to quit smoking in next 30 days or next 6 months and smoked >10 cigarettes per day. They also had to have access to a telephone and a VCR • Primary quit-smoking outcomes measured: Biochemically verified 7-day smoking status at 6 months • Secondary cessation outcomes included biochemically verified 7-day smoking status at 4 weeks, change in the number of cigarettes smoked, and readiness to quit at 4 weeks and 6 months • Recruited through a large urban hospital in Atlanta, Georgia, where half of facility visits are provided to persons who are medically indigent	• Condition 1: Smoking cessation videotape (*The Harlem Health Connections' Kick-It*) and guide (*Pathways to Freedom: Winning the Fight Against Tobacco*), both tailored for African American people • Condition 2: Standard (untailored) videotape (American Medical Association's *How to Quit*) and guide (ALA's *Freedom from Smoking*) • Both conditions received 8 weeks of NRT (patches), a follow-up visit at Week 4, and reminder phone calls at Weeks 1 and 3	• Intent-to-treat analysis • No differences in 7-day abstinence at 6 months: Condition 2 (14.4%) compared with Condition 1 (18.0%) (p = 0.27) • No differences in 7-day abstinence at 4 weeks, change in the number of cigarettes smoked, or readiness to quit at 4 weeks and 6 months • In Condition 2, participants with a low (vs. high) Afrocentric identity were significantly more likely to be abstinent at 6 months (21% vs. 8%, p = 0.02) • In Condition 1, no significant differences by Afrocentric identity were observed for abstinence at 6 months • Usefulness of findings to understanding or reducing tobacco-related health disparities: – The depth of tailoring may have been inadequate – Nontailored materials were less effective for those with a high Afrocentric identity, suggesting there may be limited benefit from nontailored approaches among individuals strongly connected to their racial or ethnic identity – It may be important to match interventions to participants' racial or ethnic identity, not only their membership in a particular group. – Participants were more likely to use the tailored guide, suggesting tailoring was effective for increasing attention and use. However, they did not report the deep structures as personally salient, suggesting heterogeneity among African American people	• Tailoring: – Tailored materials were developed with input from African American people – *The Harlem Health Connections' Kick-IT* video addressed multiple deep structures, including storytelling, drivers of smoking (e.g., stress, racism, poverty), references to slavery, and additional cultural values – *Pathways to Freedom* included depiction of African American people and addressed population-specific issues, including industry targeting; historical, cultural, and socioeconomic influences; and specific barriers and cultural strengths for cessation • Limitations: – Assessment of differences in the conditions may have been hampered by the success of the nicotine patch – Participants were motivated to quit and had access to a telephone and VCR. It is unclear if findings would apply to people not motivated to make a quit attempt or without access to technologies – The study was not blinded to investigators

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Webb (2008a, 2009)	• RCT • African American adults, 18–65 years of age, (n = 261) who smoked ≥5 cigarettes per day • Participants who smoked were recruited through newspapers, urban radio stations, community-based organizations, hospitals, health clinics, and a focus group • Primary quit-smoking outcomes were measured at 3 months after mailing of a smoking cessation booklet: – Readiness to quit smoking – 24-hour quit attempt – 24-hour and 7-day point-prevalence abstinence	• Condition 1: Self-help smoking cessation booklet, *Pathways to Freedom*, tailored for African American people (culturally specific booklet) • Condition 2: Standard self-help smoking cessation booklet for people who smoked in the general population (i.e., not culturally specific)	• Intent-to-treat analysis • Greater readiness to quit scores and 24-hour quit attempts were found in Condition 2 (45%) compared with Condition 1 (31%) ($p = 0.05$) • Abstinence rates did not differ between conditions: – 24-hour abstinence: Condition 2 (14.7%) compared with Condition 1 (13.7%) – 7-day point prevalence abstinence: Condition 2 (9.3%) compared with Condition 1 (10.7%) ($p = 0.05$) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Culturally specific material was more encouraging, informative, helpful, and able to capture attention; the standard booklet was seen as more credible or trustworthy – Acculturation modified the relationship between treatment condition and readiness to quit and 24-hour point-prevalence abstinence – Readiness to quit increased with increasing levels of traditional African American values in the culturally specific condition and decreased in the standard condition; however, the opposite relationship was found for 24-hour abstinence, wherein abstinence decreased with increasing levels of traditional values in the culturally specific condition but increased in the standard condition	• Tailoring: – *Pathways to Freedom* included known African American values, communication patterns, familial roles, history, religion and spirituality, statistics, and targeting of advertising for menthol cigarettes to mobilize the community to work against the tobacco industry—stating that materials were written for African American people to include pictures of only African American people, testimonials; stereotypical African American names, and established Pan-African colors • Limitations: – No biochemical verification of self-reported smoking status

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Froelicher et al. (2010)	• RCT, community-based participatory research • African American adults (n = 60), ≥21 years of age, who used tobacco in the past month, were willing to quit, and could read and speak English • Primary cessation outcomes measured: Biochemically or family or friend-verified 7-day point prevalence smoking status at 6 and 12 months • Recruited from a predominantly African American lower income neighborhood in San Francisco, California	• Condition 1: Condition 2 intervention plus: (a) tailoring of the CBT to include components related to social justice and industry targeting; (b) an unmodified *Pathways to Freedom* guide • Condition 2 (control): 1-hour pre-class orientation session followed by a 5-week group CBT smoking cessation intervention, including a modified *Pathways to Freedom* guide where sections on social justice messages were removed • For both conditions, participants reporting severe withdrawal or smoking >25 cigarettes per day were offered free NRT (patches or lozenges); all participants were referred to the state quitline	• Intent-to-treat analysis • No significant difference in 7-day abstinence at 6 months between Condition 1 and 2 (13.6% vs 11.5%; $p > 0.05$) • No significant difference in 7-day abstinence at 12 months between Condition 1 and 2 (15.8% vs 5.3%; $p > 0.05$) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Knowledge about the harms of smoking and belief in the benefits of quitting were substantial, yet smoking histories indicated very low levels of self-efficacy for resisting the urge to smoke in high-risk situations. This finding may indicate that people who smoke are vulnerable to denial of risk and that information alone is not sufficient to fully inform people who smoke – The level of addiction of people who smoke in socioeconomically marginalized circumstances may require more aggressive cessation interventions	• Tailoring: – Tailored intervention was co-developed with community partners – Included key messages about tobacco industry targeting, community empowerment, and social justice – Internal tobacco industry documents were shown to participants and revealed the industry's targeting and psychographic studies of African American people. – Included discussion of how African American people are disproportionately harmed by tobacco and provided exposure to community members who had successfully quit smoking. • Limitations: – Study underpowered due to recruitment difficulties – Recruitment included a brief social justice "teaser," which could have made it difficult to find a difference between the groups – Standard intervention included a modified *Pathways to Freedom* guide, which also included cultural tailoring

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Webb et al. (2010a)	• RCT • African American adults who smoked (n = 154); 36% of whom had a household income <$10,000 per year • Primary quit-smoking outcomes measured: – Biochemically verified smoking status at 3- and 6-month follow-up • Recruited from medium-size city in the northeastern United States	• Condition 1: Group CBT • Condition 2: GHE • Both conditions received six CBT sessions and 8 weeks of NRT (patches)	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking): – CO-verified 7-day point-prevalence abstinence was significantly greater in the CBT condition than it was in the GHE condition: ○ At end of counseling, 50.7% in CBT versus 27.3% in GHE (OR = 2.74; 95% CI, 1.40–5.36; p = 0.003) ○ At 3-month follow-up, 33.8% in CBT versus 19.5% in GHE (OR = 2.11; 95% CI, 1.01–4.40; p = 0.047) ○ At 6-month follow-up, 31.2% in CBT versus 14.3% in GHE (OR = 2.72; 95% CI, 1.22–6.05; p = 0.014) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Group smoking cessation interventions can help motivated African American people to quit smoking	• Tailoring: – Proactive recruitment strategy at community events frequented by African American people; no cultural tailoring of intervention materials • Limitations: – Sample was motivated to quit smoking – Intervention effects may not generalize to unmotivated African American people who smoke – No testing of culturally specific components
Nollen et al. (2011)	• Pilot RCT • Black adults, ≥18 years of age, who smoked >10 cigarettes per day and had an intention to quit (n = 72) • Most participants were female (62.5%), had low income (58.2% with family income <$1,800 per month), and smoked menthol cigarettes (81.7%) • Primary quit smoking outcomes measured: – Salivary cotinine-verified 7-day abstinence at Month 3 (<20 ng/mL) – Carbon monoxide-verified abstinence at Months 1 and 2 (<10 ppm) – Reduction in the number of self-reported cigarettes smoked per day from baseline to Month 3 • Community-based clinic in Kansas	• Condition 1: varenicline plus standard care • Condition 2: varenicline plus five adherence counseling sessions on Days 8, 12, 20, 30, and 60 • Both conditions received standard counseling during randomization to develop a quit plan on Day 8	• No significant difference in cotinine-verified abstinence at Month 3 between Conditions 2 and 1 (22.2% vs 25.0%, p = 0.78) • No significant difference in reduction in the number of cigarettes smoked per day between Conditions 2 and 1 (5.7% vs 7.4%, p = 0.31) • Overall association between medication adherence in both groups and smoking abstinence: mean adherence rates among participants who quit at Months 1 and 3 were 95.5% and 95.8% vs 85.6% and 80.8% among those who did not quit (p <0.05) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Quit rates in this sample of Black adults treated with varenicline were lower than those reported in clinical trials for White adults – Although medication adherence rates were relatively high, adherence-based counseling did not affect overall quit rates at Month 3	• Tailoring: – All participants received a culturally tailored guide that addressed smoking cessation and abstinence and contained information about varenicline • Limitations: – Pilot study with small sample size – Possible cointervention effect because of method of tracking medication adherence (use of pill boxes and pill counts) – Findings may not be generalizable to other populations of Black adults who smoke

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Sanderson Cox et al. (2012)	• Randomized, double-blind, placebo-controlled trial • African American adults who smoked lightly (i.e., 1–10 cigarettes per day) (n = 540) • Primary quit-smoking outcomes measured: – Biochemically verified smoking status at 7 weeks (end of medication treatment) and 26 weeks • Kansas City, Missouri	• Condition 1: 300 mg bupropion for 7 weeks (150 mg once daily for 3 days and then 150 mg twice daily) • Condition 2: Placebo for 7 weeks • Both conditions had six scheduled health education counseling sessions that were delivered in person and by phone using the *Kick It at Swope: Stop Smoking Guide*	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking): – Cotinine-verified 7-week point-prevalence abstinence at end of medication was significantly higher in the bupropion condition (23.7%) than it was in the placebo condition (9.6%) (OR = 2.92; 95% CI, 1.78–4.77; $p < 0.001$) – No statistically significant difference occurred in 26-week point-prevalence abstinence for bupropion (13.3%) versus placebo (10.0%) (OR = 1.39; 95% CI, 0.82–2.35; $p = 0.23$) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Bupropion was effective in promoting smoking cessation among African American people who smoked lightly in the short term (7 weeks) and while taking medication, but bupropion showed no effect on long-term (26 weeks) abstinence	• Tailoring: – *Kick It at Swope: Stop Smoking Guide* was culturally tailored for African American people who smoked lightly • Limitations: – Generalizability of findings to other people who smoke may be limited due to study inclusion criteria – Lack of assessment between follow-up points limited the ability to characterize the process of relapse among people who smoked and initially took bupropion and achieved initial abstinence

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Webb Hooper et al. (2014)	• RCT • African American adults, 18–65 years of age, who smoked ≥5 cigarettes per day and had access to a DVD player (n = 140) • Participants were recruited through community flyers and word of mouth • Primary quit-smoking outcomes measured: – Readiness to quit at post-DVD viewing and 1-month follow-up • Secondary outcomes at 1-month follow-up were 24-hour quit attempts or quitting smoking completely (yes or no) • South Florida	• Condition 1: *Pathways to Freedom* 60-minute, culturally tailored smoking cessation DVD • Condition 2: 60-minute, standard smoking cessation DVD	• Participants in Condition 1 had greater readiness to quit smoking at 1-month follow-up than did participants in Condition 2 (p = 0.02) • 24-hour quit attempts and complete cessation during the previous 4 weeks varied by condition • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Compared with participants in Condition 2, participants in Condition 1 preferred the content of the culturally specific intervention—finding it more appealing and perceiving it to be more credible—and were more likely to share or recommend the DVD and recalled its content at follow-up – The culturally specific, quit smoking video was identified as useful in increasing readiness to quit but not abstinence – The DVD format is no longer widely used; instead, digital content can be easily streamed via the Internet	• Tailoring: – *Pathways to Freedom* DVD was culturally tailored for African American people who smoked (see Webb 2009) • Limitations: – Sample consisted mostly of people who smoked and had lower incomes, so findings may not be applicable to those with higher incomes – People who smoked in the sample were not necessarily interested in smoking cessation, so the impact is unknown among people who are seeking help to quit smoking – The sample from South Florida might not generalize to African American adults in other areas of the United States – Study was not powered to detect smoking cessation – Findings were based on self-reports

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Cherrington et al. (2015)	• RCT • Lower income African American adults, ≥19 years of age, who smoked and were in an inpatient ward with chronic illnesses (n = 300), 79% of whom reported that their income was not adequate to meet their basic needs • Primary quit smoking outcomes measured: – 7-day point-prevalence smoking status at 2 weeks – Biochemically verified, continuous abstinence at 6 months • Urban safety-net hospital in southern United States	• Condition 1 (intervention): Brief cessation counseling plus culturally tailored smoking cessation DVD • Condition 2 (control): Brief cessation counseling plus nontailored DVD with a non-tobacco-related health message	• Intent-to-treat analysis • Abstinence did not differ significantly between conditions at 2 weeks and at 6 months: – 7-day point-prevalence abstinence at 2-week follow-up was 43.3% in the intervention group and 36.7% in the control group (p = 0.24) – Biochemically verified abstinence at 6 months was 15.3% in the intervention group and 11.3% in the control group (p = 0.16) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Narrative communication via culturally tailored storytelling to promote smoking cessation among African American people is insufficient as a standalone intervention	• Tailoring: – Narrative communication via storytelling-based DVD developed for lower income, low-literacy African American people who smoked and had chronic illnesses • Limitations: – Findings and results are limited to African American people who smoke and are hospitalized in the southern United States and might not generalize to non-hospitalized African American people who smoke

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Webb Hooper et al. (2017a)	• RCT • Lower income African American adults, 18–65 years of age, who smoked (n = 342), 60.8% of whom reported an annual household income ≤$10,000 • Primary quit-smoking outcomes measured: – Biochemically verified 7-day point-prevalence abstinence at the end of therapy and at 3-, 6- and 12-month follow-up – Longitudinal intervention effect over the 12-month follow-up period was assessed by logistic regression analyses of condition on biochemically verified smoking outcomes • South Florida	• Condition 1: Culturally tailored CBT group (8 sessions) • Condition 2: Standard CBT group (8 sessions) • Both conditions received 8 weeks of NRT (patches)	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • 7-day point-prevalence abstinence: – Significant overall longitudinal effect (OR = 2.0; 95% CI, 1.11–3.58; p = 0.02) – End of therapy: 62.3% for the culturally tailored CBT group versus 51.5% for the standard CBT group (OR = 1.56; 95% CI, 1.00–2.42; p = 0.050) – 3-month follow-up: 36.4% for the culturally tailored CBT group versus 22.9% for the standard CBT group (OR = 1.92; 95% CI, 1.19–3.10; p = 0.007) – 6-month follow-up: 26.2% for the culturally tailored CBT group versus 22.0% for the standard CBT group (OR = 1.26; 95% CI, 0.76–2.08; p = 0.37) – 12-month follow-up: 23.2% for the culturally tailored CBT group versus 20.0% for standard CBT group (OR = 1.21; 95% CI, 0.71–2.04; p = 0.49) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – The effects of this culturally tailored behavioral intervention for smoking cessation appear to be short term. This may suggest that extended treatment is warranted.	• Tailoring: – Surface- and deep-level structure elements relevant to African American culture—including matching race of clinicians to participants and addressing such topics as race and smoking, history of research distrust, concerns about NRT, meaning of being an African American, tobacco and African American people, menthol, spirituality and religion in the African American community, stressors unique to African American people, discrimination and racism, comorbid addiction, little cigars and blunt use, traditional African American values, and the buddy system—were added to evidence-based CBT techniques • Limitations: – Findings and results are limited to African American people who smoke in South Florida and might not generalize to African American adults in other areas of the United States

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Chen et al. (2020)	• RCT • n = 822; separate analyses for 270 African American adults who smoked, 306 adults of non-European ancestry who smoked (including the 270 African American adults in the analysis above), and 516 adults of European ancestry adults who smoked, ≥21 years of age • Primary quit-smoking outcomes measured: – Biochemically verified (CO <8 ppm) 7-day point-prevalence at the end of treatment (Week 12) • Secondary endpoints: – 7-day point-prevalence abstinence with CO verification at 6 months – 7-day point-prevalence abstinence at 1 year by self-report • St. Louis, Missouri	• Participants were randomly assigned by CHRNA5rs16969968 genotypes to one of three treatments for 12 weeks: – Varenicline tartrate – cNRT – Placebo varenicline tartrate or placebo nicotine patches and lozenges • All treatment conditions received cessation counseling	• Among non-European ancestry group, both cNRT and varenicline were effective at the end of treatment: – cNRT (17.8%) versus placebo (6.4%) abstinence; p = 0.019 – Varenicline (19.0%) versus placebo (6.4%); p = 0.021 • Among the non-European ancestry group, cNRT and varenicline were not effective at 6 months: – cNRT (7.5%) versus placebo (10.6%) abstinence; p = 0.44 – Varenicline (17.1%) versus placebo (10.6%); p = 0.19 – Varenicline was effective at 6-months for the entire population, and cNRT was not effective • The genotype-by-treatment interaction among African American people who smoked was significant for abstinence at the end of treatment but not at 6 and 12 months • Compared with people in the placebo group, cNRT was more effective in people who smoked and had rs16969968 guanine-guanine genotypes, and varenicline was more effective in people who smoked and had guanine-adenine/adenine-adenine (or GA/AA) genotypes • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Genetic information may further enhance the effectiveness of cessation medications	• Tailoring: – No specific tailoring identified • Limitations: – Small sample size of adults of non-European ancestry who smoked – Variants were examined for one gene only; genome-wide polygenic scores have become an increasingly useful tool when predicting responses to medication

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Nollen et al. (2020)	• RCT (two-arm, parallel-group individually randomized with allocation of 2:1 intervention to control) • Non-Hispanic Black adults who smoked but not daily (n = 278) • Primary quit-smoking outcomes measured: – Biochemically verified, 30-day point-prevalence abstinence at the end of treatment (12 weeks) and at 26-week follow-up – Self-reported days abstinent from all tobacco and reductions in the number of cigarettes smoked in the past 30 days • Academic medical and federally qualified health centers in Kansas City, Missouri; Wichita, Kansas; and Nashville, Tennessee	• Condition 1: 12 weeks of in-person and telephone smoking cessation counseling plus NRT (either nicotine gum, patch, and/or lozenge) • Condition 2: 12 weeks of counseling	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) revealed no significant differences in abstinence between conditions: – Quit at Week 12: 11.4% for counseling plus NRT group and 8.6% for counseling only group (OR = 1.4, 95% CI, 0.6–3.2; p = 0.48) – Quit at Week 26: 7.0% for counseling plus NRT group and 6.5% for counseling only group (OR = 1.1, 95% CI, 0.4–3.0; p = 0.86) • Self-reported outcomes: – The counseling plus NRT group reported a greater number of days abstinent (p <0.001) from all tobacco use and fewer numbers of cigarettes smoked (p = 0.002) in the past 30 days (measured at 12 and 26 weeks) than that reported by the counseling-only group • Usefulness of findings to understanding or reducing tobacco-related health disparities: – NRT delivered as an adjunct to smoking cessation behavioral counseling (a) did not improve abstinence relative to counseling alone for Non-Hispanic Black adults who smoked but not daily but (b) was associated with more days abstinent and a reduction in the number of cigarettes smoked in the past 30 days, with no evidence of compensatory behavior with non-cigarette tobacco products	• Tailoring: – Intervention materials were tailored to nondaily smoking patterns and focused on managing smoking cues, triggers, and the positive reinforcement effects of smoking and addressing nicotine withdrawal and craving • Limitations: – Focused on only non-Hispanic Black adults who smoked cigarettes; therefore, findings may not generalize to people of other races and ethnicities who do not smoke daily or to Black people who smoke but not daily, who smoke infrequently, or smoke lightly – Did not include Black adults who used alternative tobacco products (e.g., cigarillos or little cigars) – Did not provide placebo NRT – Renumeration was provided for visit completion, which may limit generalizability – Rates of NRT use were low – Study was underpowered to detect a smaller effect size

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Nollen et al. (2021)	• Secondary analysis of a four-arm RCT • Black (n = 1,065) and White (n = 3,044) adults, 18–74 years of age, who smoked ≥10 cigarettes per day and were U.S. participants in EAGLES • Primary quit-smoking outcomes measured: – Biochemically verified continuous abstinence from Week 9 to Week 24. • RCT in clinical trial centers, academic centers, and outpatient clinics in 29 states	• Condition 1: Varenicline (1 mg twice daily) for 12 weeks • Condition 2: Bupropion (150 mg twice daily) for 12 weeks • Condition 3: NRT (21 mg per day) with taper for 12 weeks (active control) • Condition 4: Placebo for 12 weeks • All participants visited clinics weekly during Weeks 1–6 then biweekly during Weeks 7–12; up to 10 minutes of smoking cessation counseling was provided at each visit • Smoking cessation counseling was also provided during follow-up at Weeks 13, 16, 20, and 24	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Secondary, post hoc analysis revealed significant differences in biochemically confirmed continuous abstinence from Week 9 to Week 26 among Black adults in the varenicline group compared with the placebo group: OR = 2.63; 95% CI, 1.26–5.48 • No significant differences were seen in the relative efficacy of varenicline versus. bupropion or NRT, bupropion and NRT versus placebo, and bupropion versus NRT • All treatments had greater efficacy than placebo among White adults who smoked. • Black adults who smoked were less likely than White adults who smoked to quit across all treatment groups and among those with and without a psychiatric diagnosis; these racial differences remained after controlling for age, number of cigarettes smoked per day, cigarette dependence, lifetime quit attempts, discontinuation of the study drug, changes in depression or anxiety, and treatment for adverse events	• Tailoring: – Secondary analyses controlled for differences between Black and White participants; compared with White participants, Black participants were older, smoked fewer cigarettes, were more dependent on nicotine, had a lower percentage of lifetime quit attempts, had lower rates of discontinuing treatment, had more positive changes in depression during the study, had higher levels of anxiety, and were less likely to be treated for an adverse event • Limitations: – Did not control for socioeconomic variables that are related to racial differences in abstinence – Did not assess menthol use, nicotine metabolism, and social and environmental contexts associated with racism, discrimination, and increased stress – EAGLES was not designed or powered to examine racial differences in abstinence. – Follow-up was limited to 24 weeks. – Study contained only adults with moderate to heavy smoking, so results may not be generalizable to the general population of people who smoke

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Webb Hooper et al. (2021)	• Two-arm pilot RCT • African American adults (n = 119) who smoked; reported having low household income; smoked ≥1 cigarette per day or had CO of ≥5 ppm; had a mobile phone with a data plan; and were willing to set a quit date within the next 14 days • Primary quit-smoking outcomes measured: – Biochemically verified, 7-day point-prevalence abstinence at the 6-week follow-up (end of intervention) • Mid-sized Midwestern city	• Condition 1: Six-week Path2Quit mobile health intervention that included the delivery of text messages with links to video segments from *Pathways to Freedom*; starter pack (i.e., 2 weeks supply) of nicotine patch or nicotine gum; and a brief behavioral counseling session • Condition 2: Six- to eight-week SmokefreeTXT, a fully automated text-based cessation intervention; starter pack (i.e., 2 weeks supply) of nicotine patch or nicotine gum; and a brief behavioral counseling session	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) revealed significant differences in biochemically confirmed 7-day point prevalence at 6-week follow-up (end of intervention) • Quit outcomes: 48% for Path2Quit group and 26% for SmokefreeTXT group (age-adjusted OR = 3.55; 95% CI, 1.32–9.54)	• Tailoring: – Path2Quit mobile health intervention incorporated culturally specific content from *Pathways to Freedom*, a 60-minute video that includes surface elements (e.g., race-matched host, experts, and families; music; colors; and images) and deep structure elements (e.g., content focused on menthol cigarettes and alternative tobacco products, the health and financial costs of smoking, tobacco cessation pharmacotherapy, psychosocial stressors, and culturally relevant coping strategies to manage smoking urges) • Limitations: – The small sample size, single geographic location, and short-term follow-up may limit the generalizability of the findings to other population groups and settings

Table 7.10 Continued

Study	Design, population, and recruitment location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Sanderson Cox et al. (2022)	• RCT (individually randomized with allocation of 3:2 intervention to control; randomization was stratified by level of smoking and sex) • African American adults who smoked ≥1 cigarette per day for at least 25 of the past 30 days (n = 500) • Primary quit-smoking outcomes measured: – Biochemically verified, 7-day point-prevalence abstinence at the end of treatment (12 weeks) and at 26-week follow-up. – Week 12 abstinence was also evaluated for light smoking (1–10 cigarettes per day) and moderate to heavy smoking (>10 cigarettes per /day) • Kansas City, Missouri	• Condition 1: Six sessions of counseling and 12 weeks of varenicline • Condition 2: Six sessions of counseling and 12 weeks of placebo. • All participants received the *Kick It at Swope: Stop Smoking Guide*, a culturally tailored educational guide	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) revealed significant differences in 7-day point prevalence: – Quit at Week 12: 18.7% for counseling plus varenicline group and 7.0% for counseling plus placebo group (OR = 3.0; 95% CI, 1.7–5.6; p <0.001) – Light smoking at Week 12: 22.1% for counseling plus varenicline group and 8.5% for counseling plus placebo group (OR = 3.0; 95% CI, 1.4–6.7; p = 0.004) – Moderate to heavy smoking at Week 12: 15.1% for counseling plus varenicline group and 5.3% for counseling plus placebo group (OR = 3.1; 95% CI, 1.1–8.6; p = 0.02) – Quit at Week 26: 15.7% for counseling plus varenicline group and 6.5% for counseling plus placebo group (OR = 2.7; 95% CI, 1.4–5.1; p = 0.002)	• Tailoring: – Counseling incorporated content from the *Kick It at Swope: Stop Smoking Guide* and reviewed the disproportional risks of smoking for African American people • Limitations: – The generalizability of findings may be limited due to (a) inclusion criteria, as participants were restricted to those who were interested in stopping smoking and to those without major psychiatric comorbidities, and (b) renumeration for visit completion – Study lacked the power to assess differences among subsets of light and heavy smoking at Week 26

Notes: **CBT =** cognitive behavioral therapy; **CI =** confidence interval; **cNRT =** combination nicotine patches and nicotine lozenges; **CO =** carbon monoxide; **DVD =** digital video disk; **EAGLES =** Evaluating Adverse Events in a Global Smoking Cessation Study; **GHE =** general health education; **mg =** milligram; **MI =** motivational interviewing; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **ppm =** parts per million; **RCT =** randomized controlled trial.

the first subsequent follow-up assessment, the cessation interventions that were not culturally specific had significantly higher odds of cessation (OR = 1.35; 95% CI, 1.02–1.78) compared to control conditions, whereas the effect for culturally specific interventions was not statistically significant compared to the control conditions. The author concluded that African American adults who smoke appear to respond to culturally specific cessation interventions during and at the end of treatment, which may be important for encouraging enrollment, reducing attrition, and completing treatment. However, the benefits of culturally tailored interventions may decline over time, and nontailored treatments have shown the greatest impact at follow-up (Webb 2008b).

Finally, in a meta-analysis of 15 RCTs (of which 4 were included in Webb [2008b] and 11 were published after Webb [2008b]), Montgomery and colleagues (2017) examined psychosocial and pharmacologic treatments for tobacco use among African American adults. Across all studies, they found higher odds of smoking abstinence among African American adults in the treatment condition (OR = 1.41; 95% CI, 1.11–1.78) compared with those in the control condition. In addition, cessation treatments increased both short-term (<4 months; OR = 1.39; 95% CI, 1.05–1.85) and long-term (>4 months; OR = 1.52; 95% CI, 1.22–1.89) cessation at follow-up. The authors also found no significant differences in the rate of smoking abstinence between culturally tailored treatments and non-culturally tailored control conditions (OR = 1.09; 95% CI, 0.76–1.55).

RCTs published since the 2008 review and meta-analysis (n=14) (Fiore et al. 2008; Webb 2008b) included studies that tested behavioral counseling modalities with varying levels of cultural tailoring for African American or Black adults who smoke (Table 7.10). Although nine of these studies were included in the review by Montgomery and colleagues (2017), they are also discussed here to provide more detail. Among the 11 studies published after Webb (2008b) and included in the meta-analysis by Montgomery and colleagues (2017), a cessation medication study by Ahluwalia and colleagues (2006) was also included in a cessation medication meta-analysis by Robles and colleagues (2008), so it was not included in Table 7.10.

Two RCTs tested the efficacy of group CBT plus 8 weeks of nicotine patch therapy among African American adults. One trial tested the generalizability of nonculturally tailored treatment (Webb et al. 2010a); the other trial tested the incremental benefit of culturally tailored intervention components (Webb Hooper et al. 2017a). Webb and colleagues (2010a) compared the effects of six sessions of standard CBT with the effects of attention-matched group health education. The study found that 7-day point-prevalence abstinence was greater after standard CBT than it was after group education at three time points: at the end of treatment (50.7% vs. 27.3%), 3 months after treatment (33.8% vs. 19.5%), and 6 months after treatment (31.2% vs. 14.3%). A subsequent trial compared eight sessions of standard (nontailored) group CBT with an attention-matched culturally specific adaptation (Webb Hooper et al. 2017a). Longitudinal intent-to-treat analysis using all study endpoints (end of therapy and 3, 6, and 12 months) demonstrated increased cessation (7-day point-prevalence abstinence) for the culturally specific intervention compared with the standard intervention (OR = 2.0; 95% CI, 1.11–3.58). However, when intervention effects were tested at individual time points, significantly greater odds of 7-day point-prevalence abstinence were observed in the culturally specific condition only at the end of therapy (OR = 1.56; 95% CI, 1.00–2.42) and 3-month follow-up (OR = 1.92; 95% CI, 1.19–3.10).

Froelicher and colleagues (2010) also tested the incremental benefit of adding culturally tailored intervention components to a 5-week CBT intervention. No significant differences in 7-day abstinence were observed between the culturally specific intervention focused on the tobacco industry's targeting of African American people and media messages compared to the control group intervention at 6 or 12 months. However, the control group intervention included a modified *Pathways to Freedom* guide, which may have decreased the differences between the interventions.

Low-intensity behavioral interventions are less effective for tobacco cessation but demonstrate promise for increasing the antecedents of behavior change (i.e., readiness to quit and quit attempts) and for broadening reach. Webb (2009) randomly assigned African American adults who smoke to receive a stand-alone, culturally specific cessation booklet (*Pathways to Freedom*) or a standard booklet (an adapted version of *Pathways to Freedom* that replaced culturally specific content with generic content) that was the same length and included the same content as the culturally specific cessation booklet. Although the culturally specific materials were rated as more encouraging, informative, helpful, and able to capture attention, the standard booklet was seen as more credible and trustworthy. In addition, those assigned to the standard booklet had higher readiness-to-quit scores and were more likely to make a quit attempt (45%) than those who received the culturally specific booklet (31%; p = 0.05). Both 24-hour and 7-day point-prevalence abstinence at 3 months did not vary between the conditions. The study concluded that few studies have examined participants' expectations for culturally specific interventions, that African American adults may have mixed expectancies for culturally specific interventions, and that some may be concerned that interventions targeting African American people may be of low quality. The study also concluded that more research is needed to understand how culturally specific approaches operate, including how factors such as racial and ethnic identity or level of acculturation may act as moderators of the effects of such interventions.

Webb (2008a) examined whether level of acculturation moderated the efficacy of smoking cessation interventions among lower income African American adults. The study found that those who were less acculturated (i.e., held more traditional African American cultural values, beliefs, and practices) had higher ratings for the culturally specific intervention, but those who were more acculturated (i.e., fewer traditional beliefs and practices) preferred the standard materials. The effect of the cessation interventions on readiness to quit also varied by acculturation. Among adults with a more traditional African American cultural orientation, the culturally specific intervention was related to greater readiness-to-quit smoking, whereas readiness decreased among those in the standard condition. In contrast, the opposite relationship was found for 24-hour point-prevalence abstinence. Specifically, a more traditional African American cultural orientation was related to lower odds of 24-hour quitting among those who received the culturally specific intervention and greater odds in the standard condition. The study concluded that readiness to quit can be increased by matching the type of intervention with individual levels of acculturation but also noted that the elements of cultural specificity in the culturally tailored intervention may have evoked an emotional response (e.g., mentioning slavery), which may have reduced attention to the content and distracted from the advice on quitting, ultimately reducing abstinence outcomes.

In another study that assessed a culturally specific video-based intervention, Webb Hooper and colleagues (2014) randomized African American adults who smoke to receive a *Pathways to Freedom* smoking cessation DVD or a time-matched standard smoking cessation DVD (60 minutes). Participants in the culturally specific condition had greater readiness to quit at 1-month follow-up than those in the standard DVD cessation condition ($p = 0.02$). However, 24-hour quit attempts and complete cessation during the preceding 4 weeks did not vary by condition.

Nollen and colleagues (2007) assessed the effect of a culturally tailored intervention that included a video (*The Harlem Health Connections' Kick-It Video*) and the *Pathways to Freedom* guide. No differences were observed in biochemically confirmed abstinence at 4 weeks or 6 months between the culturally tailored intervention and the nontailored cessation video and guide intervention. In addition, no differences were observed in the number of cigarettes smoked or in readiness to quit at 4 weeks and 6 months. Similar to Webb (2008a), Nollen and colleagues (2007) observed differences in cessation by level of Afrocentric identity; however, this was statistically significant only among those receiving the nontailored intervention. Among the participants receiving the nontailored intervention, those with a low Afrocentric identity were significantly more likely to be abstinent at 6 months than those with a high Afrocentric identity (Nollen et al. 2007).

In contrast, Webb Hooper and colleagues (2021) observed that African American adults randomized to a culturally specific mobile health intervention (*Path2Quit*), which translated Pathways to Freedom into a video-text format, were more likely to have biochemically confirmed abstinence at 6-week follow-up than those randomized to receive the NCI's text message-based cessation support program SmokefreeTXT (both groups also received a brief behavioral counseling session plus 2 weeks of NRT).

Finally, Cherrington and colleagues (2015) found greater intentions to quit among lower income African American adults who smoked who were randomly assigned to brief cessation counseling plus a video of narrative stories related to cessation compared with those assigned to brief counseling plus a video unrelated to tobacco. However, no significant differences in cessation outcomes at 2 weeks or 6 months were detected.

In sum, this body of research has demonstrated that there is a subset of African American or Black adults who smoke who prefer culturally tailored cessation materials, and these materials may enhance intermediate markers of movement toward cessation, including readiness to quit and quit intentions. However, tailored interventions to date have generally not been associated with increased successful cessation in this population group. Further research to determine whether culturally specific cessation interventions can result in greater reach or effectiveness among African American or Black people is warranted.

A somewhat limited body of research has focused on pharmacotherapy interventions specifically in samples of African American or Black adults who smoke. Robles and colleagues (2008), in reviewing the efficacy of smoking cessation pharmacotherapies in non-White populations, identified six studies in Black adults who smoked, including three RCTs (one on the nicotine patch, one on bupropion sustained release, and one on nicotine gum) and three secondary analyses of these original trials, focusing on the outcomes among those who smoked mentholated cigarettes versus those who smoked nonmentholated cigarettes. Based on their review, the authors concluded that nicotine patches and bupropion sustained release increased smoking cessation compared with placebo; however, no effect was observed among the subset of

Black adults who smoked less than 10 cigarettes per day who received 2-milligram (mg) nicotine gum. The authors also noted that Black patients in these trials who smoked within 30 minutes of awakening, smoked mentholated cigarettes, and had high salivary cotinine levels were less likely to quit than those who had a longer time to smoking upon awakening, smoked nonmentholated cigarettes, and had lower cotinine levels. Similarly, another meta-analysis by Montgomery and colleagues (2017) found higher odds of smoking abstinence among African American adults using cessation pharmacotherapy than those using placebo controls (OR 1.69; 95% CI, 1.15–2.49).

Six studies on the effects of cessation medications have been published since Robles and colleagues' (2008) review. Sanderson Cox and colleagues (2012) conducted a double-blind RCT comparing 7 weeks of bupropion (300 mg) with placebo among African American adults who smoked 10 or fewer cigarettes per day and were provided up to six sessions of health education counseling. The study found that those who received bupropion had significantly greater biochemically verified point-prevalence abstinence at the end of the 7-week medication phase compared with those who received placebo (23.7% vs. 9.6%, respectively; OR = 2.92; 95% CI, 1.78–4.77) but not at 26 weeks (13.3% vs. 10.0%, respectively; OR = 1.39; 95% CI, 0.82–2.35). The authors suggested medication adherence may have played a role in these findings, noting that individuals in the bupropion group who remained quit at Week 26 demonstrated higher medication adherence early in treatment than those in the bupropion group who continued smoking at Week 26. In addition, the authors called for further studies on the benefit of pharmacotherapy for adults who smoke fewer than 10 cigarettes per day with particular attention to increasing long-term abstinence among African American adults who fit this definition.

A subsequent study by Nollen and colleagues (2020) assessed the effectiveness of NRT plus counseling versus counseling alone among Black adults who smoked cigarettes 4–27 of the last 30 days and smoked at this rate for at least 3 months. Abstinence at 12-week follow-up was 11.4% in the NRT (choice of patch, gum, and/or lozenge) plus counseling condition and 8.6% in the counseling-only condition (p = 0.48). At 26-week follow-up, abstinence was 7.0% in the NRT plus counseling condition and 6.5% in the counseling-only condition (p = 0.86).

Chen and colleagues (2020) examined whether a genetic variant in the cholinergic receptor nicotinic alpha 5 subunit (or CHRNA5) affected the response to cessation medication. In the non-European American ancestry group as termed in the study (n = 306, which included 270 African American adults), combined use of nicotine patches and nicotine lozenges (vs. placebo) was effective at the end of treatment (12 weeks) but not at 6 months; similar findings were observed for varenicline. Among African American adults, the genotype by treatment interaction was significant at the end of treatment but not at 6 months. The authors concluded that genetic information may be useful as a clinical decision aid for the selection of cessation medications. More studies are needed to assess the potential utility of this approach to treatment. Additionally, as described in Chapters 1 and 3, race is a social construct and is best understood as a form of stratification rather than a distinct group of genetic dispositions (National Human Genome Research Institute 2023); further, there is greater genetic variance within versus between racial and ethnic population groups (Jorde and Wooding 2004; Mersha and Beck 2020).

In a pilot study by Nollen and colleagues (2011) comparing the effectiveness of varenicline plus standard care versus varenicline plus five additional adherence counseling sessions in 72 Black adults who smoked more than 10 cigarettes per day, the authors found no statistically significant differences between groups. At month 3, cotinine-verified abstinence rates were 22.2% for the group that received additional adherence support versus 25.0% for those who received standard care (p = 0.78). While not different between groups, there was an overall association between medication adherence and smoking abstinence; adherence rates at months 1 and 3 were 95.5% and 95.8%, respectively, among participants who quit smoking compared with 85.6% and 80.8% among participants who did not quit (p ≤0.05).

A recent trial by Sanderson Cox and colleagues (2022) of varenicline among 500 African American adults who smoked daily observed that participants receiving varenicline were significantly more likely than those receiving placebo to be abstinent at both the end of treatment Week 12 (18.7% vs. 7.0%, respectively; OR= 3.0; 95% CI, 1.7–5.6) and at Week 26 (15.7% vs. 6.5%, respectively; OR= 2.7; 95% CI, 1.4–5.1).

A secondary post hoc analysis of the Evaluating Adverse Events in Global Smoke Cessation Study (or EAGLES) RCT by Nollen and colleagues (2021) also observed among Black adults who smoked 10 or more cigarettes per day that varenicline had greater efficacy for biochemically verified continuous abstinence from Weeks 9 to 24 than placebo (OR= 2.63; 95% CI, 1.26–5.48). This study observed no significant differences in abstinence among Black adults treated with bupropion or NRT compared with placebo.

Nollen and colleagues (2021) also observed that Black participants were less likely than White participants to quit across all treatment groups including the group receiving the placebo. These differences remained after controlling for age, smoking amount, cigarette dependence, lifetime quit attempts, drug discontinuation, change in depression, higher baseline anxiety, and treatment adverse events (Nollen et al. 2021). The authors noted that among Black adults without a psychiatric diagnosis, both bupropion and NRT had higher efficacy than placebo during active treatment (Weeks 9–12). The authors concluded that long-term pharmacotherapy (>12 weeks) may be important for increasing abstinence for these medications given that their effects diminished at the end of treatment. They further concluded that future studies should explore pharmacotherapy efficacy for cessation among Black adults who smoke and have psychiatric comorbidities as this group may be particularly challenging to treat.

Summary

In summary, RCTs focused on Black or African American adults who smoke have found that behavioral cessation interventions, including in-person, group, and telephone counseling, are effective in this population (Fiore et al. 2008; Robles et al. 2008; Webb 2008b, 2010a; Montgomery et al. 2017). RCTs of culturally specific interventions for Black or African American adults have demonstrated the appeal of culturally specific materials for some population groups and that these interventions are associated with increased levels of readiness to quit (Webb 2008a, 2009; Webb Hooper et al. 2014; Cherrington et al. 2015). However, the culturally specific cessation interventions developed to date have generally not been associated with improved cessation outcomes compared with nontailored interventions, particularly in long-term follow-up.

Studies of pharmacotherapies (NRT, bupropion, and varenicline) among Black or African American adults who smoke have generally demonstrated efficacy of these treatments, particularly for varenicline (Nollen et al. 2011, 2021; Sanderson Cox et al. 2022). However, some recent studies have found an association between pharmacotherapy and short-term, but not long-term, cessation in this population (Sanderson Cox et al. 2012; Chen et al. 2020; Nollen et al. 2021) and two studies demonstrated no increase in cessation with either nicotine gum or self-selected NRT (gum, patch, and/or lozenge) among African American adults with light or nondaily smoking (Nollen et al. 2020).

Among Black or African American people, additional research is needed on culturally specific smoking cessation interventions (particularly because some strategies have been associated with intermediate cessation outcomes but not long-term cessation at follow-up), the barriers to and facilitators of the use of FDA-approved cessation medications, cessation interventions for people with mental health conditions or other substance use disorders, cessation interventions for those with a low frequency of smoking (intermittent [also called nondaily] or light daily smoking), and interventions for those who use flavored, including mentholated, tobacco products.

American Indian and Alaska Native People

Among all racial and ethnic groups, the prevalence of commercial tobacco use is highest among American Indian and Alaska Native people, but relatively few intervention trials have focused on this population. The *Clinical Practice Guideline* examined the effectiveness of cessation interventions for cigarette smoking among specific racial and ethnic groups and identified one RCT that found that screening for tobacco use, clinician advice, clinic staff reinforcement, and follow-up materials were effective in four urban Indian Health clinics (Fiore et al. 2008).

Published trials have tested a combination of behavioral counseling and pharmacotherapy. Table 7.11 includes findings from three RCTs focused on American Indian and Alaska Native adults published since the *Clinical Practice Guideline* (Fiore et al. 2008). In one, Smith and colleagues (2014) conducted a two-arm RCT that compared culturally tailored individual counseling plus 12 weeks of varenicline with nontailored individual counseling plus the same pharmacotherapy in a sample of adults who smoked who were primarily from the Menominee Indian Tribe of Wisconsin. Across conditions, the overall biochemically verified 7-day point-prevalence intent-to-treat abstinence rate was 20% at 6 months, with no statistically detectable differences found between conditions ($p > 0.05$). This study was limited by its small sample size, high attrition in the culturally tailored group, and possible contamination of the intervention due to the fact that all participants received a t-shirt with the study logo, enabling them to identify each other and potentially share information about the interventions.

Choi and colleagues (2016a) conducted a multisite RCT that compared the incremental efficacy of All Nations Breath of Life (ANBL)—a CBPR-informed culturally tailored smoking cessation intervention—with the incremental efficacy of a nontailored care approach among rural or reservation-based American Indian adults. Both interventions were comprehensive and included intensive education and group sessions. All participants, regardless of assigned intervention arm, had the option of choosing any or no pharmacotherapy. Using intent-to-treat analyses, self-reported 7-day point-prevalence abstinence rates at 6 months were 20.1% for the ANBL intervention

Table 7.11 Individual-level tobacco cessation treatment trials among American Indian and Alaska Native people who smoke

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Smith et al. (2014)	• RCT • American Indian adults who smoked (n = 103), 80% of whom were from the Menominee Indian Tribe • Primary quit smoking outcomes measured: – Biochemically verified 7-day point-prevalence abstinence at 6 months • Wisconsin	• Condition 1: Culturally tailored treatment intervention group developed through a multistep, community-engaged process • Condition 2: Usual care group receiving the general cessation treatment approach used in clinical services at the tribal clinic • Both conditions received four sessions of individual smoking cessation counseling and 12 weeks of varenicline	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking): – 14.0% abstinence in the culturally tailored treatment group versus 22.6% abstinence in the usual care group at 6-month follow-up (OR = 0.56; 95% CI, = 0.20–1.55; p = 0.26) – 20% quit smoking across conditions • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Supports the feasibility of partnerships between tribal community healthcare providers and academic partners to address commercial tobacco use – Study did not find clear evidence that cultural tailoring yields higher abstinence rates	• Tailoring: – Multistep process that engaged the target population in the development of the intervention; approach was based on the Indigenist Stress-Coping model • Limitations: – Small sample, high and differential attrition, and possible intervention contamination – Missing data were attributable to high attrition in the culturally tailored treatment group

Table 7.11 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Choi et al. (2016a)	• RCT • American Indian and Alaska Native adults who smoked and lived on reservations or in rural areas (n = 463) • Primary quit smoking outcomes measured: – Biochemically verified (salivary cotinine) 7-day point-prevalence abstinence at 12 weeks and 6 months • U.S. Southern Plains and Northern Plains regions	• Condition 1: ANBL, a culturally tailored smoking cessation intervention that included: – In-person group counseling (nine sessions over 6 months) led by a facilitator who was American Indian – Individual telephone counseling (four calls) • Condition 2: Usual care that included: – Individual counseling (nine sessions over 6 months) led by a facilitator who was not American Indian – Individual telephone counseling (four calls) – Nontailored, health education-based curriculum • Both groups offered NRT (gum, patch, or lozenge), varenicline, or bupropion and minimal incentives that were tailored in Condition 1 and nontailored in Condition 2 (DVDs, CD, snacks, water bottles, and other novelties)	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Self-reported 7-day point-prevalence abstinence rates were statistically different between conditions: – At 12 weeks: 27.9% in ANBL versus 17.4% in usual care (OR = 1.87; 95% CI, 1.07–3.26; p = 0.028) – At 6 months: 20.1% in ANBL versus 12.0% in usual care (OR = 1.91; 95% CI, 1.07–3.42; p = 0.029) • Cotinine-verified 7-day point-prevalence abstinence rates were not statistically different between conditions: – At 12 weeks: 11.2% in ANBL versus 8.8% in usual care (OR = 1.31; 95% CI, 0.64–2.73; p = 0.46) – At 6 months: 10.8% in ANBL versus 6.9% in usual care (OR = 1.65; 95% CI, 0.80–3.43; p = 0.18) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Findings support potential effectiveness of ANBL for smoking abstinence	• Tailoring: – ANBL intervention was developed using principles of CBPR that involved the target community (e.g., a facilitator who was American Indian delivered tailored intervention components, and a facilitator who was not American Indian delivered the usual care intervention components) – High level of engagement and participation from American Indian adults who smoked and represented several different tribes from various regions • Limitations: – High attrition and lower than expected biochemical collection rates

Table 7.11 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Dignan et al. (2019)	• RCT • American Indian adults who smoked and resided in three sites in South Dakota: Pine Ridge (Oglala Sioux Tribe) and Rosebud Reservations (Rosebud Sioux Tribe) and Rapid City (n = 254) • Primary quit smoking outcomes measured: – Biochemically verified (CO <10 ppm) at 18-month follow-up visit • Northern Plains	• Multicomponent intervention that included combinations of minimal or intense levels of four interventions: NRT, pre-cessation counseling, post-cessation counseling, and mHealth text messages • A community research representative conducted all intervention visits in person or by telephone • Participants were randomized to one of 15 groups.	• Multivariate logistic regression was used to evaluate main effects and interactions on the primary outcome of smoking cessation using an intent-to-treat analysis: – At the 18-month follow-up visit—and after adjusting for age, education level, and ethnicity—receiving NRT was associated with increased odds of having stopped smoking ($p = 0.05$) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Use of NRT, as assessed at the 18-month follow-up visit, increased the odds of quitting smoking – Additional research is needed to improve understanding of factors that influence enrollment and retention in smoking cessation interventions by American Indian adults	• Tailoring: – Program guided by Theory of Planned Behavior – Model used to identify American Indian-specific variables that contribute to explaining smoking and challenges to smoking cessation – Cultural modifications to survey items, mHealth text, and counseling – Community advisory committees provided program guidance – Usability testing to ensure cultural relevance • Limitations: – Some subjects were more motivated to participate in the study in order to obtain a free cell phone than to stop smoking, which may have limited the rates of smoking abstinence and caused uncertainty about when NRT was used or started among subjects – High rate of attrition from enrollment (n = 254) to quit date visit (n = 108) raises concerns that selection bias may have influenced the study outcomes

Notes: **ANBL =** All Nations Breath of Life; **CBPR =** community-based participatory research; **CD =** compact disc; **CI =** confidence interval; **CO =** carbon monoxide; **DVD =** digital video disk; **mHealth =** mobile health; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **ppm =** parts per million; **RCT =** randomized controlled trial.

and 12.0% for the nontailored care approach (p = 0.029). However, the cotinine-verified abstinence rates between the ANBL and nontailored care approach were not statistically significant, potentially because of high attrition and lower-than-expected biochemical collection rates.

Finally, Dignan and colleagues (2019) randomized American Indian adults who smoked and resided in three South Dakota sites to 1 of 15 groups that included combinations of minimal or intense levels of each of four interventions: NRT, pre-cessation counseling, post-cessation counseling, and text message-based support. In multivariate logistic regression models controlling for age, education, and ethnicity, receiving NRT was associated with increased odds of having stopped smoking (self-reported smoking on day of visit biochemically verified by carbon monoxide <10 parts per million [ppm]) at the 18-month follow-up visit (p = 0.05) among those who continued participation throughout the study. This study was limited by substantial participant attrition.

Recent and ongoing research includes a pilot test of two versions of the All Nations Snuff Out Smokeless program, which is based on the ANBL smoking cessation program (Hale et al. 2020; Daley et al. 2021c) and two ongoing RCTs, including a culturally tailored text message intervention for smoking cessation among American Indian and Alaska Native adults recruited through five state quitlines (Alaska, Minnesota, New Mexico, Oklahoma, and Wisconsin) (Orr et al. 2019) and the Healthy Pregnancies Project for Alaska Native pregnant women (Patten et al. 2019). Additional research that tests the efficacy of commercial tobacco cessation interventions among American Indian and Alaska Native people is warranted and should address expectancies about the smoking cessation process and desirable program components identified using community-engaged principles (Fu et al. 2014a; Hendricks et al. 2014).

Asian American People

As is the case with all racial groups in the United States, Asian American people are a heterogenous population group with heritage from many countries and multiple languages spoken. The primary focus of the tobacco cessation literature is on culturally and linguistically tailored behavioral treatments that are delivered in a variety of formats. Multiple studies have demonstrated efficacy for dyadic-based smoking cessation interventions for Asian American population groups; findings from dyadic interventions for this population are discussed elsewhere in this chapter (also see Table 7.7).

Table 7.12 details four individual-level RCTs focused on Asian American adults who smoke. In one, Wu and colleagues (2009) randomized a sample of lower income Chinese American adults who smoke in which the intervention group received a culturally tailored and language-matched intervention consisting of four individual motivational interviewing sessions plus 8 weeks of NRT (patches), and the comparison group received a language-matched nontailored intervention that consisted of four general health education sessions, self-help cessation materials, and the same pharmacotherapy. Compared with participants who received the control intervention, biochemically verified abstinence rates were significantly greater in those who received the culturally tailored condition both at 3 months (66.1% vs. 32.3%) and 6 months (66.7% vs. 31.7%; aOR = 7.60; 95% CI, 1.33–43.37).

Kim and colleagues (2015) conducted an RCT of eight sessions of culturally specific, language-matched individual CBT plus nicotine patch therapy compared with eight sessions of brief, nontailored, language-matched counseling plus nicotine patches among Korean American immigrants. At 12 months, biochemically verified abstinence was significantly greater in the culturally specific CBT group (38.2%) than in the nontailored brief counseling group (11.1%; OR = 4.67; 95% CI, 1.67–12.99). This study was limited by its small sample size and unmatched intensity of the interventions. Taken together, the RCTs reported by Wu and colleagues (2009) and Kim and colleagues (2015) highlight the promise of culturally specific, individual-level behavioral treatments (combined with NRT) for Chinese and Korean American adults who smoke.

Zhu and colleagues (2012) conducted an RCT among 2,227 Asian American adults in California who smoked to investigate the efficacy of telephone-based counseling among this group. An English-language counseling program was translated into Chinese, Korean, and Vietnamese, with additional culturally tailored elements integrated and delivered through the California quitline. Following stratification by language, participants were randomized into two groups to receive either six telephone counseling sessions plus printed self-help materials or self-help materials only. At 6 months, the self-reported intent-to-treat abstinence rate was significantly greater in the culturally tailored phone counseling group (16.4%) than in the self-help-only group (8.0%; p <0.001). Statistically significant differences in abstinence rates by treatment condition were also found for all three language groups. The study was limited by the self-help-only condition being a less intense intervention without an equivalent level of counseling support and by a reliance on self-reported abstinence without biochemical verification.

Table 7.12 Individual-level tobacco cessation treatment trials among Asian American people who smoke

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Wu et al. (2009)	• RCT • Chinese American adults who smoked (n = 139), the majority of whom were male • Recruited through community-based organization serving Chinese American people • Primary quit smoking outcomes measured (longest endpoint): – Biochemically verified 7-day point-prevalence abstinence at 6-month follow-up • New York City	• Condition 1: Culturally tailored Chinese quit smoking cessation program and adapted motivational interviewing-based behavioral counseling (four sessions); intervention was adjusted according to readiness to quit smoking • Condition 2: Usual care smoking cessation program that included four sessions in Chinese language focused on general health education, and provided self-help smoking cessation materials • Both groups were offered 8 weeks of NRT (patches)	• Differences in biochemically verified abstinence at the 6-month follow-up were statistically significant by condition (aOR = 7.60; 95% CI, 1.33–43.37; $p < 0.05$): – Culturally tailored group: 66.7% – Usual care group: 31.7% • Usefulness of findings to understand or reduce tobacco-related health disparities: – Compared with results from the usual care program, cessation results were promising for the culturally tailored, evidence-based tobacco cessation treatment approach; findings support the feasibility of culturally tailored smoking cessation intervention for Chinese American males who smoke	• Tailoring: – Adapted version of motivational interviewing techniques was translated into Chinese – Program was culturally and linguistically tailored with materials that incorporated social and cultural factors that would resonate with Chinese people who smoked • Limitations: – Most participants were male, which reduces the generalizability of findings for females – ORs had wide CIs
McDonnell et al. (2011)	• RCT • Korean American adults who smoked (n = 1,112) and lived in the United States • Primary quit smoking outcomes measured (longest endpoint): – 30-day continuous abstinence at 50 weeks post-enrollment • United States	• Condition 1: Internet version of the Quitting is Winning self-help smoking cessation program was culturally tailored for Korean American people who smoked • Condition 2: Printed version of Quitting is Winning self-help materials was mailed to the homes of participants	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Differences in abstinence rates were not statistically significant by condition (OR = 0.9; 95% CI, 0.6–1.2; $p = 0.38$): – Internet version: 10.9% – Printed version: 12.5% • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Although an online culturally tailored smoking cessation intervention for Korean American people who smoke has the potential for high reach in the community, it did not result in higher quit rates compared with a printed self-help version of the program	• Tailoring: – Development of the Quitting is Winning smoking cessation program used principles of community-based participatory research that engaged an advisory board in the Korean American community – Materials were translated into Korean and underwent a linguistic equivalency process • Limitations: – Internet intervention was underused – Smoking abstinence was based on self-reports; no biochemical verification

Table 7.12 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Zhu et al. (2012)	• RCT • Asian American (Chinese, Korean, Vietnamese) adults who smoked, lived in California (n = 2,227), and were seeking quitline support for quitting • Primary quit smoking outcomes measured (longest endpoint): – 6-month continuous abstinence • California	• Condition 1: Six sessions of culturally tailored quitline counseling plus self-help materials on quitting smoking in preferred language • Condition 2: Callers provided with written self-help materials on quitting smoking in their preferred language	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Differences in abstinence rates were statistically significant for the full sample and Chinese, Korean, and Vietnamese American participants by condition: – Counseling: 16.4% – Self-help: 8.0% – Difference = 8.4% (95% CI, 5.7–11.1; p <0.001) • Differences in abstinence rates were statistically significant for all three language subgroups by condition: – Chinese participants: ○ Counseling: 14.8% ○ Self-help: 6.0% ○ Difference = 8.8% (95% CI, 4.4–13.2; p <0.001) – Korean participants: ○ Counseling: 14.9% ○ Self-help: 5.2% ○ Difference = 9.7% (95% CI, 5.8–13.8; p <0.001) – Vietnamese participants: ○ Counseling: 19.8% ○ Self-help: 13.5% ○ Difference = 6.3% (95% CI, 0.9–11.9; p = 0.023) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Findings support the efficacy of culturally tailored telephone counseling for smoking cessation among Chinese, Korean, and Vietnamese American people who smoke	• Tailoring: – Culturally tailored counseling protocol was developed in English and translated into Chinese, Korean, and Vietnamese • Limitations: – No nontailored language-congruent self-help condition – Unmatched intervention intensity between conditions – Self-reported smoking cessation; no biochemical verification of abstinence – Excluded people who smoked and had current psychiatric conditions, which limits the generalizability of findings for Asian American people who smoke and have mental illness

Table 7.12 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Kim et al. (2015)	• RCT • Korean American adult immigrants who smoked (n = 109), the majority of whom were male • Primary quit smoking outcomes measured (longest endpoint): – Biochemically verified 12-month continuous abstinence • Northeastern United States	• Condition 1: Culturally tailored, CBT-based individual counseling for smoking cessation (8 sessions, 40 minutes per session) • Condition 2: Usual care, which included individual counseling for smoking cessation that was not culturally tailored (8 sessions, 10 minutes per session) • Both groups were offered NRT (patches); all participants except for one received counseling in Korean language	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • The difference in abstinence rates was statistically significant by condition (OR = 4.67; 95% CI, 1.67–12.99; $p < 0.01$): – Culturally tailored: 38.2% – Usual care: 11.1% • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Findings support the feasibility of conducting larger efficacy trials of culturally adapted, CBT-based smoking cessation interventions among Korean American people who smoke, particularly among those with a strong orientation to Korean culture	• Tailoring: – Cessation intervention was culturally tailored; participant acculturation level was assessed; majority endorsed a stronger orientation to Korean culture than to American culture • Limitations: – Small sample pilot trial with mostly male participants, which reduces the generalizability of findings for Korean American females who smoke; unmatched intervention intensity between conditions

Notes: **aOR =** adjusted odds ratio; **CBT =** cognitive behavioral therapy; **CI =** confidence interval; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **RCT =** randomized controlled trial.

McDonnell and colleagues (2011) used principles of CBPR in an RCT that compared an Internet-based self-help cessation intervention culturally tailored for Korean American adults who smoke with a written version of the intervention that was mailed to participants. Fifty weeks after enrollment, self-reported 30-day continuous abstinence was comparable between the two conditions (10.9% for Internet self-help vs. 12.5% for written self-help); quit rates were higher among participants in the Internet intervention who completed the program (26% vs. 10% in non-completers). This study was limited by overall low utilization of the Internet program and a reliance on self-reports.

Summary

Overall, Asian American people represent a diverse racial and national heritage group with varied rates and patterns of tobacco use and varied tobacco cessation treatment needs. Although few studies have examined the effects of evidence-based interventions among different Asian American population groups, interventions to date that have focused on these population groups have included cultural and language adaptations of interventions with primary components of behavioral counseling, counseling plus pharmacotherapy, or online self-help materials. In two small RCTs reviewed here, these culturally and linguistically specific interventions show promising results for enhanced efficacy compared with nontailored interventions. Future research is needed to strengthen the existing evidence base by addressing the methodologic limitations of the existing studies, exploring tailoring for an increased diversity of Asian population groups, and increasing understanding of pharmacotherapy outcomes in this heterogeneous group.

Hispanic or Latino People

Hispanic or Latino people living in the United States are a heterogeneous population with a relatively low overall prevalence of smoking, but their smoking rates vary by nationality (Babb et al. 2020). The evidence shows that Hispanic or Latino American people often have a low frequency of smoking (a light daily and intermittent smoking pattern); however, the leading causes of mortality among Hispanic people are tobacco related (CDC n.d.b) and some Hispanic population groups (e.g., those living in poverty) exhibit higher risk smoking behaviors such as regular smoking over multiple years (Kristman-Valente and Flaherty 2016).

The *Clinical Practice Guideline* examined the effectiveness of cessation interventions for cigarette smoking among specific racial and ethnic groups and identified four RCTs among Hispanic people (Fiore et al. 2008). The review found that the nicotine patch; telephone counseling; self-help materials, including a mood management component; and tailoring have been shown to be effective in helping Hispanic people quit smoking. A subsequent meta-analysis of five studies by Webb and colleagues (2010b) (including three of the four studies in the *Clinical Practice Guideline* review by Fiore and colleagues [2008]) concluded that tobacco cessation interventions (including self-help materials; individual, group, and telephone counseling; and nicotine patch) increased cessation at the end of treatment (OR = 1.54; 95% CI, 1.09–2.16), but the effect of the interventions at first follow-up was not significant (OR = 1.46; 95% CI, 0.96–2.23) among three of the five studies. Additional trials published after that meta-analysis have investigated the effects of multiple treatment types in this population. Table 7.13 details five RCTs published after Webb and colleagues' (2010b) meta-analysis that focused on cessation treatment among Hispanic adults who smoke.

Individual-level counseling interventions among Hispanic or Latino adults in the United States have been examined in several studies. For example, three RCTs included comparisons of culturally specific and nontailored interventions delivered during home visits (Borrelli et al. 2010), brief motivational enhancement versus a delayed intervention control (Cabriales et al. 2012), and intensive culturally tailored counseling versus two sessions of brief advice (Stanton et al. 2015). Findings from these three RCTs all showed low quit rates and no significant difference between treatment conditions. Each study considered the potential cultural needs of the focus population within the context of the intervention. What remains unclear are the factors that may affect quitting, such as the dose of the cultural tailoring—that is, whether the intervention components incorporated cultural tailoring at a "surface structure" level (incorporation of superficial target population characteristics that enhance intervention acceptability) or a "deep structure" level (incorporation of unique population-specific factors that influence health behaviors and outcomes) (Resnicow et al. 1999; Castro et al. 2015)—as well as study attrition and underpowered analyses.

Low-intensity self-help interventions have also been evaluated among Hispanic adults who smoke. Rodriguez-Esquivel and colleagues (2015) conducted a 2 x 2 factorial randomized experiment of self-help interventions that varied based on cultural specificity (culturally specific written educational materials vs. nontailored written educational materials) and preferred language (English vs. Spanish). Smoking cessation was significantly greater

Table 7.13 Individual-level tobacco cessation treatment trials among Hispanic or Latino people who smoke

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Borrelli et al. (2010)	• RCT nested within a home-based asthma intervention program • Latino adults who smoked and were caregivers (n=133), the majority of whom were female and lower income; 41.3% graduated from high school • Latino ethnic groups represented in the trial: – 52.2% Puerto Rican – 22.7% Dominican American – 10.6% Central American – 6.0% South American – 2.2% Mexican American – 0.8% Cuban American – 3.7% Other Latino ethnic group • Primary quit smoking outcomes measured: – Biochemically verified continuous abstinence at 2 and 3 months after treatment • Rhode Island	• Condition 1: BAM, an intervention focused clinical guidelines for smoking cessation • Condition 2: PAM, an intervention focused on the carbon monoxide levels of caregivers and on behavioral counseling to raise awareness of children's exposure to secondhand tobacco smoke; materials were culturally tailored • Both conditions received three home visits, a brief follow-up call, and a self-help manual (components in English and Spanish languages)	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Differences in continuous abstinence rates were not statistically significant by condition: – 2 months (OR = 2.54; 95% CI, 0.91–7.10; p >0.05): ○ BAM: 9.2% ○ PAM: 20.5% – 3 months (OR = 1.68; 95% CI, 0.64–4.37; p >0.05): ○ BAM: 12.3% ○ PAM: 19.1% • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Trial included a variety of Latino ethnic groups, which is uncommon in smoking cessation trials – Findings, although not statistically significant, supported the benefits of culturally tailoring a quit smoking intervention for Latino caregivers who smoke	• Tailoring: – PAM was tailored to be consistent with core values of many Latino cultures such as personalismo, familismo, and simpatia – Behavioral counseling was delivered by a Latina health educator who was bilingual • Limitations: – Small sample – Surface-level tailoring; benefits from deeper tailoring unknown – Participants from one Northeastern state may limit generalizability to other people and settings

Table 7.13 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Cabriales et al. (2012)	• RCT • Hispanic adults who smoked ≤10 cigarettes per day (“light smoking”) or non-daily (“intermittent smoking”) (n = 214); 88% identified as Mexican or Mexican American • Primary quit smoking outcomes measured (longest endpoint): – 30-day continuous abstinence at 3-month follow-up • El Paso, Texas	• Condition 1: Individual-level behavioral counseling delivered by a health educator immediately at the time of recruitment • Condition 2: Delayed intervention group	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Results showed no statistically significant differences in 30-day continuous abstinence (p >0.05) by condition: – Immediate intervention: 5.6% – Delayed intervention: 4.7% • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Low rates of cessation may be related to challenges faced by Hispanic adults residing in a U.S.-Mexico border region – Quitting did not differ by intervention group – Participants reported increased motivation to quit after the intervention	• Tailoring: – Considered Hispanic culture in intervention development – Spanish language materials and a bilingual interventionist were available • Limitations: – High attrition, as 107 participants in the delayed intervention group agreed to complete the 3-month follow-up assessment, but only 10 participants agreed to receive the intervention – Reliance on self-report; no biochemical verification – Effects may not generalize to other Latino ethnic groups – No pharmacotherapy offered
Rodriguez-Esquivel et al. (2015)	• 2 x 2 factorial randomized experiment testing self-help materials • Community sample of Hispanic adults who smoked and were bilingual (English and Spanish) (n = 222) • Primary quit smoking outcomes measured (longest endpoint): – Self-reported smoking cessation at 2-week follow-up • Florida	• Factor 1 (tailoring): Culturally tailored or standard self-help written materials on quitting smoking • Factor 2 (preferred language): Self-help materials in English or Spanish	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Main effect of language preference: Self-reported abstinence was statistically significantly greater when materials were delivered in the preferred language (OR = 5.36; 95% CI, 1.11–25.95; p = 0.037) • No significant differences were seen in abstinence rates for the main effect of cultural specificity (OR = 3.07; 95% CI, 0.78–12.06; p = 0.109) or the interaction term (tailoring x preferred language) (OR = 4.24; 95% CI, 0.17–107.67; p = 0.381) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Hispanic adults who smoked increased smoking cessation success if they were provided with materials on quitting smoking in their preferred language; however, culturally tailored materials were not associated with increased abstinence	• Tailoring: – Included eight dimensions of Cultural Enhancement Model that includes cultural values, beliefs, and practices shared by many Hispanic people in the United States • Limitations: – Short follow-up (2 weeks) – Standalone written materials – Self-reported cessation; no biochemical verification

Table 7.13 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Stanton et al. (2015)	• RCT • Latino adults who smoked and had HIV/AIDS (n = 302); 56% identified as Puerto Rican • Primary quit smoking outcomes measured (longest endpoint): – Biochemically verified 7-day point-prevalence abstinence at 12-month follow-up • Northeastern United States	• Condition 1 (enhanced usual care): Behavioral counseling in person (2 visits) and by phone (1 call) plus self-help materials • Condition 2 (Project Aurora): Enhanced usual care plus culturally tailored behavioral counseling, tailored self-help materials and videos, two additional in-person sessions, two booster phone calls, and optional buddy support • Both groups were offered 8 weeks of NRT (patches) • All materials and interventions were available in both Spanish and English languages	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Abstinence rates at the 12-month follow-up did not differ significantly by condition (p = 0.93): – Project Aurora: 6% – Enhanced usual care: 7% • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Latino adults who smoke and have HIV/AIDS could benefit equally from the enhanced standard care and culturally tailored interventions; culturally tailored tobacco cessation treatment components did not contribute to better cessation outcomes	• Tailoring: – Project Aurora included multiple layers of cultural tailoring; for example, it hired Latino staff to deliver the intervention, and intervention materials incorporated the roles of culture, family, and values related to the country of origin • Limitations: – Conditions were not matched in terms of treatment intensity – NRT use was poorly documented

Table 7.13 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Simmons et al. (2022) Study design described in Medina-Ramirez et al. (2019)	• Two-arm, parallel RCT • Hispanic adults who smoked ≥5 cigarettes per week and preferred educational health materials in Spanish (n = 1,417) • Latino ethnic groups represented in the trial: – 33.7% Mexican American – 22.3% Cuban – 16.6% Puerto Rican – 8.9% South American – 6.1% Central American – 2.6% Dominican – 1.9% Other Latino ethnic group – 7.9% More than one ethnic group • Primary quit smoking outcomes measured: – 7-day point-prevalence abstinence at four assessment points – 30- and 90-day point-prevalence abstinence were secondary smoking outcomes • United States and Puerto Rico	• Condition 1 (usual care): Spanish-language booklet developed by NCI • Condition 2 (LDC): Spanish language translation and cultural adaptation of *Forever Free: Stop Smoking for Good*, a self-help intervention comprised of 11 booklets and 9 pamphlets mailed over 18 months (initial mailing upon randomization) • Intervention materials were distributed by postal mail, with the option of receiving additional electronic versions via email • Assessments for both arms were conducted every 6 months for 2 years	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Overall, abstinence rates were higher in the LDC group than they were in the usual care group (p <0.001): – Logistic regression analysis revealed that abstinence rates in the LDC group were higher than in the usual care group at 24 months (OR = 1.54; 95% CI, 1.18–2.02; p = 0.002) and at 6, 12, and 18 months (all p values <0.001) – Logistic regression analysis revealed that 30- and 90-day abstinence rates at 24 months were higher in the LDC group than the usual care group • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Sex was a significant moderator of 7-day abstinence – Higher abstinence rates for LDC were observed for men at all follow-up points and for women at only 6- and 12-months follow-up	• Tailoring: – A booklet was included for family and friends to address familism (i.e., the importance of family support) – Added a phone call to address a desire for personal contact • Limitations: – Used self-reported information about smoking status – Participants responded to recruitment efforts that advertised smoking cessation materials, so it is unclear how people unmotivated to quit smoking may have responded – Because LDC was delivered in monthly installments and included a 10-minute telephone call, the impact of more frequent contacts (vs. the intervention content) is unclear

Notes: **BAM =** Behavioral Activation Model; **CI =** confidence interval; **LDC =** Libre del Cigarillo; **NCI =** National Cancer Institute; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **PAM =** Precaution Adoption Model; **RCT =** randomized controlled trial.

among participants who received written materials in their preferred language than it was among participants who received materials in their less preferred language. Receiving culturally tailored quit smoking materials (materials that incorporated Hispanic smoking patterns, cultural values, and norms) was not associated with increased abstinence. This study was limited by its short follow-up and a reliance on self-reports.

In contrast, Simmons and colleagues (2022) found that the culturally tailored Spanish-language Libre del Cigarrillo (LDC) self-help intervention, which consisted of 11 booklets and 9 pamphlets mailed over 18 months, was associated with greater 7-day point-prevalence abstinence at 24 months (OR = 1.54; 95% CI, 1.18–2.02) compared with a 40-page Spanish-language self-help booklet developed by NCI, which was mailed upon randomization (Medina-Ramírez et al. 2019). Interestingly, sex was a significant moderator of 7-day abstinence. Higher LDC abstinence rates were observed for men at all follow-up points (6, 12, 18, and 24 months) and for women only at 6 and 12 months. The authors noted that they could not disaggregate the potential effect of frequent contacts for LDC (mailed in nine separate installments) and its intervention content.

Summary

In summary, based on the few studies conducted to date, it remains generally unclear whether tailored tobacco cessation interventions for U.S. Hispanic or Latino adults are more effective than nontailored interventions. While the evidence suggests that self-help materials for Hispanic or Latino adults are more effective when they are in an individual's preferred language, only one study specifically tested preferred language materials (Rodriguez Esquivel et al. 2015). Moreover, with some exceptions, the samples in the reviewed studies generally did not account for the wide diversity of smoking patterns and nationalities represented within this ethnic group. Culturally tailored intervention approaches among Hispanic or Latino adults who smoke have emphasized individual cultural values—for example, familismo (dedication, commitment, and loyalty to family) and respeto (respect) (Wetter et al. 2007; Borrelli et al. 2010; Simmons et al. 2022)—and may have paid less attention to other potentially influential factors, such as culturally congruent recruitment and retention strategies, access to care, different communication patterns across Hispanic or Latino nationalities, acculturation, stress related to being a member of a minoritized racial and ethnic group, discrimination, underemployment, insurance status, immigration status, and fear of deportation.

Additional research is also needed on programs and interventions, such as contingency management, that could increase the usage of cessation medication among Hispanic or Latino adults who smoke (CMS 2017). In addition, rigorous research is warranted to better address the needs of this priority population who, in general, have lower rates of being advised by a healthcare professional to quit and less use of cessation treatment than non-Hispanic White adults (Babb et al. 2020). Finally, research is warranted among specific population groups of Hispanic adults, such as Puerto Rican people who have a higher prevalence of cigarette smoking and daily smoking than other Hispanic population groups and those who self-identify as Mexican who have a lower prevalence of cessation treatment use than non-Hispanic White adults (Babb et al. 2020).

Minoritized Sexual Orientation and Gender Identity Groups

Minoritized sexual orientation and gender identity groups are highly diverse population groups with different identities. Three recent reviews of tobacco cessation treatments among minoritized sexual orientation and gender identity population groups that included both peer-reviewed and gray literature concluded that interventions to date have shown evidence of effectiveness. However, most of the studies did not have a control group or biochemically validated smoking status, which may limit the validity of the review articles' findings (Lee et al. 2014; Baskerville et al. 2017; Berger and Mooney-Somers 2017).

Lee and colleagues (2014) found that 9 of the 14 clinical interventions they reviewed were cessation groups (with or without NRT) and concluded that group cessation curricula tailored to LGBT communities showed evidence of effectiveness for cessation but cautioned that the reach of these programs was very limited. They also concluded that the evidence suggests that evidence-based, nontailored tobacco cessation treatments work as well at increasing successful quitting among LGBT people as heterosexual people (Lee et al. 2014). Two recent studies also observed no differences in cessation outcomes between LGBT and non-LGBT adults for nontailored cessation programs (Table 7.14). One study was among young adults enrolled in either a nontailored 90-day Facebook group intervention or referred to NCI's Smokefree.gov (Vogel et al. 2019). The other study was among adults enrolled in either a nontailored web-based cessation intervention grounded in acceptance and commitment therapy or NCI's Smokefree.gov (Heffner et al. 2020).

All three review articles concluded that more research on the effectiveness of cessation treatments tailored for minoritized sexual orientation and gender

Table 7.14 Individual-level tobacco cessation treatment trials among people from minoritized sexual orientation and gender identity groups who smoke

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Matthews et al. (2019)	• Two-group randomized trial • Adults, 18–65 years of age, who smoked ≥4 days per week, had CO levels of >8 ppm, scored >5 on a 10-point Likert scale for desire to quit, and self-identified as LGBT (n = 345) • Participants were recruited from bars, community events, festivals, street-intercepts, flyers, electronic health records, and provider and participant referrals • Primary quit-smoking outcomes measured: – Biochemically verified 7-day point-prevalence abstinence at 1, 3, 6, and 12 months following baseline • Lakeview site of Howard Brown Health, which is an LGBT-serving federally qualified healthcare center in Chicago, Illinois	• Condition 1, Courage to Quit treatment (n = 173): – A semi-structured and manualized smoking cessation intervention of six weekly sessions starting 2 weeks before the designated quit date and proceeding 4 weeks after the quit date. – Treatment modules included a progression of topics incorporating evidence-based behavioral, cognitive, and motivational smoking cessation strategies, as outlined in the U.S. Public Health Service's *Clinical Practice Guidelines for Treating Tobacco Use and Dependence* • Condition 2, Courage to Quit treatment culturally tailored for people who are LGBT (n =172): – Cultural tailoring was based on an iterative process of literature reviews, community engagement (focus groups), and pilot testing to adapt the Courage to Quit intervention • All participants were offered NRT	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Analyses adjusted for race and ethnicity, age, gender identity, sexual orientation, level of readiness to quit, and use of menthol cigarettes • Rates of quitting smoking did not differ significantly between treatment groups in unadjusted and adjusted analyses for all time points (e.g., 12-month follow-up: adjusted OR = 0.70; 95% CI, 0.26–1.91; p = 0.484) • Biochemically verified 7-day point-prevalence reported abstinence rates by follow-up: – 1-month follow-up: ○ Condition 1 = 33.5% quit ○ Condition 2 = 30.2% quit – 3-month follow-up: ○ Condition 1 = 23.1% quit ○ Condition 2 = 19.2% quit – 6-month follow-up: ○ Condition 1 = 30.1% quit ○ Condition 2 = 21.5% quit – 12-month follow-up: ○ Condition 1 = 24.3% quit ○ Condition 2 = 20.3% quit	• Tailoring: – Culturally tailored elements included culturally specific determinants of smoking (e.g., beliefs, norms); culturally informed and relevant advice and support; and use of images, color, pictures, evidence, and language that were relevant to the group and their cultural values, beliefs, and behaviors • Limitations: – Treatment facilitators were not blinded to treatment conditions, and intervention fidelity was not independently assessed – 6- and 12-month abstinence were biochemically verified for only a few participants – Generalizability may be limited to LGBT-serving federally qualified healthcare centers

Table 7.14 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Vogel et al. (2019)	• RCT • Young adults, 18–25 years of age, who smoked ≥3 days per week and used Facebook ≥4 days per week) (n = 500) • Participants were recruited from Facebook using a paid ad campaign that was conducted between October 2014 and July 2015 • Primary quit-smoking outcomes measured: – 7-day point-prevalence abstinence at 3, 6, and 12 months following baseline • Nationwide (United States) recruitment	• Condition 1 (control): Referral (n = 249) to Smokefree.gov, which was developed and is managed by NCI • Condition 2 (treatment): Participation in the Tobacco Status Project, a 90-day intervention conducted for young adults on Facebook (n = 251): – Participants were assigned to private Facebook groups that were tailored to their readiness to quit smoking – Facebook posts were designed based on the U.S. Clinical Practice Guidelines and the Transtheoretical Model skills for smoking cessation and were posted once a day for 90 days – Participants had the opportunity to participate in live, online counseling sessions. – Facebook groups were randomly assigned to receive a monetary incentive for commenting on posts (daily, weekly, monthly, or no incentive, for a maximum of $90) • All participants were compensated with a $20 gift card for completing each survey (baseline and 3, 6, and 12 months)	• Secondary analyses compared outcomes between young adults with SGM identities and young adults with non-SGM identities • After controlling for study condition, abstinence from smoking over the 12-month follow-up period did not differ significantly between SGM and non-SGM groups (OR = 0.95; 95% CI, 0.59–1.52; p = 0.83) • Seven-day point-prevalence abstinence rates by follow-up: – 3-month follow-up: ○ SGM = 8.6% quit ○ Non-SGM = 11.2% quit – 6-month follow-up: ○ SGM = 18.8% quit ○ Non-SGM = 15.4% quit – 12-month follow-up: ○ SGM = 20.0% quit ○ Non-SGM = 21.6% quit	• Tailoring: – No specific tailoring; however, using a digital intervention may address the participant's comfort level with interactions, privacy concerns, and reach to geographically underserved areas • Limitations: – Results may not generalize to age groups other than young adults

Table 7.14 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Heffner et al. (2020)	• RCT • Adults, ≥18 years of age, who smoked ≥5 cigarettes per day, were motivated to quit within the next 30 days, had access to the Internet and e-mail, and had never used the control and treatment interventions (n = 2,637) • Participants were recruited from diverse sources, both online (ads, survey panels, and search engine results) and offline (earned media, referrals from family members and friends, mailings to members of Kaiser Permanente Washington); targeted recruitment sought 25% representation from minoritized racial and ethnic populations • Primary quit-smoking outcomes measured: – 30-day point prevalence abstinence (PPA) at 12 months	• Condition 1 (control): Referral (n = 173) to Smokefree.gov, which was developed and is managed by NCI • Condition 2: Web-based cessation intervention grounded in acceptance and commitment therapy • All participants had access to their assigned intervention for 12 months and received up to four intervention text messages per day for 28 days; content of the messages differed by condition but the intent was the same: to push key intervention content to participants and encourage them to use their respective web-based program • Participants received $25 to complete surveys at 3, 6, and 12 months, with a $10 bonus if the survey was completed within 24 hours	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Secondary analysis examined differences in abstinence by SM status and across groups (bisexual, lesbian, and gay); analyses adjusted for treatment group, gender, education level, amount of smoking, depression, anxiety, any mental health condition, and number of adults in the home who smoked • 30-day PPA did not differ significantly between SM people (19.8%) and non-SM people (22.4%) at 12 months (OR = 0.86; 95% CI, 0.62–1.20; p = 0.39). • Quit rates did not differ across SM groups (20.6% for bisexual people and 18.9% for lesbian or gay people: OR = 1.02; 95% CI, 0.52–1.97; p = 0.96)	• Tailoring: – No specific tailoring (although online programs may have advantages in overcoming barriers to cessation treatment among LGBT populations (see Vogel et al. (2019)) • Limitations: – Study did not assess gender minority status (e.g., transgender, nonbinary) – Sexual orientation was assessed by a limited number of descriptors – No biochemical verification of cessation outcomes – Most participants were women (83%) • Generalizability may be limited to people seeking treatment and willing to use an online program

Table 7.14 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Vogel et al. (2020)	• Pilot RCT • Young adults, 18–25 years of age, who smoked ≥1 cigarette per day ≥4 days per week, used Facebook ≥4 days per week, and self-identified as an SGM (n = 165) • Participants were recruited from Facebook using an ad campaign directed at SGM people who smoked • Primary quit-smoking outcomes measured: – Biochemically verified 7-day point-prevalence abstinence at 3 and 6 months following baseline • Nationwide (United States) recruitment	• Condition 1: Participation in the Tobacco Status Project, a 90-day Facebook intervention for young adults (n = 81) • Condition 2: Participation in the Put It Out Project, a 90-day smoking cessation intervention conducted on Facebook and culturally tailored to young adults with SGM identities (n = 84); the project was developed through formative work, including online focus groups and usability testing • For both conditions: – Participants were assigned to private Facebook groups that were tailored to their readiness to quit smoking – Facebook posts were designed based on the U.S. Clinical Practice Guidelines and the Transtheoretical Model skills for smoking cessation and were posted once a day for 90 days – "The Doctor Is In"—which were weekly, 1-hour, live group chat sessions—were also included – Participants received a monetary incentive for commenting on all or nearly all Facebook posts each month (up to $90) – Participants were compensated with a $20 gift card for completing each survey and a $20 bonus for completing all three surveys (baseline and 3 and 6 months)	• Abstinence from smoking did not differ significantly between the treatment conditions at 3 months (OR = 2.00; 95% CI, 0.48–8.28; p = 0.33) and at 6 months (OR = 3.12; 95% CI, 0.81–11.97; p = 0.08) • 7-day point-prevalence reported abstinence rates at: – 3-month follow-up: ○ Condition 1 = 3.7% ○ Condition 2 = 7.1% – 6-month follow-up: ○ Condition 1 = 3.7% ○ Condition 2 = 10.7%	• Tailoring: – Included pictures of people and couples with SGM identities and symbols and terms that were meaningful to the SGM community – Involved discussions of smoking-related topics relevant to the SGM community (e.g., targeted advertising, coping with prejudice and discrimination, and prevalence of smoking in social spaces) – The counselor introduced herself as a member of the SGM community • Limitations: – Abstinence could not be biochemically verified in a large portion of the participants reporting abstinence (cotinine testing did not allow for differentiation of smoking from other nicotine sources) – The sample was geographically diverse, but most participants were non-Hispanic White people, limiting generalizability to other racial and ethnic groups – The small sample size may have limited the study's power to detect differences in outcomes

Notes: **LGBT =** lesbian, gay, bisexual, and transgender; **NCI =** National Cancer Institute; **NRT =** nicotine replacement therapy; **RCT =** randomized controlled trial; **SGM =** sexual and gender minority; **SM =** sexual minority.

identity groups is needed (Lee et al. 2014; Baskerville et al. 2017; Berger and Mooney-Somers 2017). For example, some studies that measure LGBTQI+ disparities do not include gender identity, and gaps exist in research about tailoring treatments for specific segments of the LGBTQI+ community despite ample evidence of intra-community disparities. Also, Baskerville and colleagues (2017) noted that most studies in both their and Berger and Mooney-Somers (2017) reviews were culturally tailored. Berger and Mooney-Somers (2017) stated that the most effective cultural modifications may be employing LGBT facilitators, discussion of LGBT-specific triggers, and discussion of hormone replacement therapy and smoking.

A recent study by Matthews and colleagues (2019) randomized LGBT adults to either a nontailored 6-week group treatment (Courage to Quit) or a culturally targeted LGBT version of the same treatment and observed no difference in abstinence between the treatments (12-month abstinence: 20.3% tailored, 24.3% control, aOR=0.7; 95% CI, 0.26–1.91). The authors speculated that their setting of an LGBT-serving FQHC may have influenced study outcomes by enhancing all participants' feelings of comfort, cohesiveness, and support in both arms of the study. Similarly, Vogel and colleagues (2020), in a pilot study of LGBT young adults, observed no differences in abstinence between a culturally tailored 90-day Facebook smoking cessation intervention (Put It Out Project) and the nontailored 90-day Facebook intervention (Tobacco Status Project) although sample size may have limited the pilot's power to detect differences in cessation outcomes.

Berger and Mooney-Somers (2017) noted that all the studies they reviewed included gay men while two-thirds included lesbian and bisexual people. All three review articles (Lee et al. 2014; Baskerville et al. 2017; Berger and Mooney-Somers 2017) also noted a lack of studies among transgender people and Baskerville and colleagues (2017) noted a large research gap in prevention and cessation interventions for LGBTQ youth and young adults. A recent scoping review of alcohol, tobacco, and other drug treatment interventions for minoritized sexual orientation and gender identity individuals also concluded that a greater focus is needed on interventions for sexual minority women, gay men, and sexual and gender minority people of color (Kidd et al. 2022). Additional research focused on cessation among minoritized sexual orientation and gender identity population groups is warranted and should include assessments of both sexual orientation and gender identity, which will facilitate the examination of differences in cessation outcomes among different population groups and the identification of treatment components that may be particularly effective for increasing cessation (Baskerville et al. 2017; Kidd et al. 2022).

Rural Populations

People who live in rural areas experience tobacco-related health disparities. Compared with people who smoke and live in urban areas, people in rural areas who smoke tend to have worse cessation-related outcomes when attempting to quit and are more likely to die from a tobacco-related disease (Northridge et al. 2008; Garcia et al. 2017). Quit ratios and the prevalence of a past-year quit attempt have also been significantly lower among people who smoked cigarettes and lived in rural counties than among those who lived in large central metropolitan areas (USDHHS 2020).

In one recent meta-analysis, Gupta and colleagues (2020) evaluated the impact of smoking cessation programs among populations living in Appalachia, a socioeconomically disadvantaged rural region in the eastern United States with high smoking rates and poor health outcomes. This meta-analysis of six individual or cluster randomized studies of smoking cessation interventions, including behavioral interventions (in person, web-based, and phone) and brief interventions with pharmacotherapy, found that participation in such interventions increased the probability of smoking abstinence among people in Appalachia who smoke (pooled RR = 2.33; 95% CI, 1.03–5.25). The authors noted that their results should be interpreted with caution given that substantial heterogeneity existed across the six studies, including varying definitions of smoking status and abstinence and large variations in the smoking cessation interventions and their controls.

This section reviews three rigorous trials that examined the efficacy of smoking cessation interventions for adults in rural areas who smoke that were not included in Gupta and colleagues' (2020) meta-analysis (Table 7.15). Quitlines and mHealth-based interventions, reviewed elsewhere in this chapter, are of particular relevance to rural population reach because such interventions have characteristics that can remove or reduce barriers to access to care (such as time, transportation, or childcare), though some rural populations may have access barriers to these interventions due to limited access to Internet and broadband services (Amato and Graham 2018; USDHHS 2020). In addition, an RCT by Choi and colleagues (2016a) pertinent to rural populations is summarized in the section on American Indian and Alaska Native people in this chapter.

Zanis and colleagues (2011) conducted a smoking cessation RCT focused on young adults (18–24 years of age) who smoked who were recruited from six rural counties in Pennsylvania and randomized to receive either quitline counseling or brief in-person counseling. Abstinence rates did not differ statistically significantly across groups

Table 7.15 Individual-level tobacco cessation treatment trials among people who live in rural areas and smoke

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Ellerbeck et al. (2009)	• RCT (KanQuit Study) • Adults who smoked (n = 750) and were recruited from 50 primary care practices in rural areas • Primary quit smoking outcomes measured (longest endpoint): – Self-reported biochemically validated (mailed salivary cotinine <15 ng/ml) 7-day point-prevalence abstinence at 24-month follow-up • Rural Kansas	• Condition 1: Pharmacotherapy only management group: – At baseline, participants received a health education mailing that included information about using NRT and bupropion and copies of You Can Quit Smoking and When Smokers Quit – At 6-, 12-, and 18-months follow-up, participants received a mailing that offered free NRT or bupropion • Condition 2: Pharmacotherapy plus MDM was offered on up to two telephone-based motivational interviewing counseling sessions every 6 months • Condition 3: Pharmacotherapy plus high-intensity disease management (HDM) was offered on up to six motivational interviewing counseling calls every 6 months	• Intent-to-treat analysis (assumes those lost to follow-up continued smoking) • Abstinence rates did not differ significantly between conditions • Validated odds of 7-day point-prevalence abstinence at the 24-month follow-up: – Condition 3 (HDM) (14.8%) versus Condition 2 (MDM) (14.7%): OR = 1.00 (95% CI, 0.60–1.68, p = 0.99) – Condition 2 (MDM) and Condition 3 (HDM) versus Condition 1 (pharmacotherapy only) (13.5%): OR = 1.19 (95% CI, 0.76–1.87, p = 0.44) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Study findings support the feasibility of reaching people who smoke and live in rural areas through primary care visits and engaging them in a 24-month smoking cessation intervention	• Tailoring: – No specific tailoring identified • Limitations: – Smoking cessation rates varied substantially over time and were not explained (i.e., not associated with the use of pharmacotherapy or patient discussions) – Participants were not blinded to the intervention – Biochemically validated self-reports were available for only 58% of patients – Pharmacotherapy was free and limited to nicotine patch and bupropion; other agents might have different results and current practices do not guarantee free medications, thus limiting generalizability – Possible contamination between pharmacotherapy offered in the trial and pharmacotherapy available through other sources

Table 7.15 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Zanis et al. (2011)	• RCT • Young adults, 18–24 years of age, who smoked (n = 192) and were from six rural counties in Pennsylvania • Primary quit smoking outcomes measured (longest endpoint): – Biochemically verified (salivary cotinine <10 ng/ml) 30-day continuous abstinence at 3-month follow-up • Six rural counties in Pennsylvania	• Participants were randomized to two brief intervention conditions: – Condition 1: Received advice from a health educator to quit smoking; written instructions on how to contact the Pennsylvania Tobacco Quitline; and a brief motivational interviewing session about contacting the quitline; those who contacted the quitline received free materials by mail, counseling services, and NRT – Condition 2: Received advice from a health educator to quit smoking, a brief 5-minute intervention to encourage and motivate cessation, and an invitation to recontact the health educator for additional counseling sessions	• No significant differences in abstinence rates were observed by condition (p = 0.09): – Condition 1: 10.2% – Condition 2: 19.8% • Intent-to-treat analysis was not conducted by condition, but it was conducted on the full sample: 11.4% of the sample was abstinent at the 3-month follow-up • Usefulness of findings to understanding or reducing tobacco-related health disparities: – A proactive counseling intervention can engage young adults who smoke and live in rural areas in smoking cessation and can promote smoking cessation among this group of people	• Tailoring: – No specific tailoring identified • Limitations: – Small sample – Findings might not generalize to other rural populations – Same health educator delivered both interventions – Recruiting participants in group settings could have changed the level of services received and behaviors due to perceived social norms – A $5 incentive was given for survey completion, which may have affected rates of participation

Table 7.15 Continued

Study	Design, population, and location	Intervention	Smoking cessation-related finding(s)	Tailoring to the population and study limitations
Byaruhanga et al. (2021)	• Three-arm RCT • Adults who smoked cigarettes (n = 655), lived in rural and remote areas of New South Wales, Australia, and reported using tobacco products daily and having access to video communication, the internet, telephone, and e-mail • Primary outcome: This interim analysis examined 7-day point-prevalence abstinence, prolonged abstinence, and quit attempts at 4-months post-baseline • New South Wales, Australia	• Condition 1: Up to six sessions of video counseling, each lasting approximately 15 minutes and conducted by a trained smoking cessation advisor • Condition 2: Up to six sessions of telephone counseling, each lasting approximately 15 minutes and conducted by a trained smoking cessation advisor • Condition 3: Written materials in a kit from the New South Wales Quitline that was mailed to participants (minimal intervention control)	• Intent-to-treat analysis • 7-day point-prevalence abstinence: Video: 18.9%; Telephone: 12.7%; Written: 8.9% – A significance difference in cessation was observed between video counseling and written materials (OR = 2.39; 95% CI, 1.34–4.26; p = 0.003) but not between video counseling and telephone counseling (OR=1.61; 95% CI, 0.95-2.72; p = 0.08) • Three-month prolonged abstinence: Video: 7.0%; Telephone: 4.4%; Written: 3.1% – No significant differences were found between video counseling and written materials (OR = 2.33; 95% CI, 0.92–5.90; p = 0.7) and between video counseling and telephone counseling (OR=1.64; 95% CI, 0.71-3.78; p = 0.25) • Usefulness of findings to understanding or reducing tobacco-related health disparities: – Video counseling appeared to increase 7-day point-prevalence abstinence rates among rural and remote residents compared with the use of written materials – At 4 months post-baseline, video counseling and telephone counseling produced similar smoking cessation rates	• Tailoring: – No specific tailoring identified • Limitations: – No biochemical validation of self-reported smoking cessation – Did not measure long-term effectiveness or cost-effectiveness – Could not assess impact of COVID-19 pandemic on utilization and effectiveness of video counseling – Did not track whether there were multiple enrollments from the same household – Quitline did not deliver video intervention so potential effect of integration is unknown

Notes: **aOR =** adjusted odds ratio; **CI =** confidence interval; **HDM =** high-intensity disease management; **MDM =** moderate-intensity disease management: **mL =** milliliter; **ng =** nanogram; **NRT =** nicotine replacement therapy; **OR =** odds ratio; **RCT =** randomized controlled trial.

(abstinence at 3-month follow-up: quitline = 10.2%, in person = 19.8%; p = 0.09). However, the observed quit rates suggest that a proactive counseling intervention can engage young adults who smoke in rural areas. The study was limited by its small sample size (n = 192) and the fact that the outcomes might not generalize outside rural areas of Pennsylvania.

Ellerbeck and colleagues (2009) conducted a cessation trial that recruited adults who smoked from rural primary care clinics in Kansas. All intervention materials for the trial were available to participants at baseline and at 6-, 12-, and 18-months follow-up. The longest follow-up was 24 months. Participants were randomized into three conditions: (1) offered free pharmacotherapy plus written self-help materials every 6 months, (2) offered free pharmacotherapy plus moderate-intensity counseling (up to two telephone encounters) every 6 months, and (3) offered free pharmacotherapy plus high-intensity counseling (up to six telephone encounters) every 6 months. Intent-to-treat analysis did not reveal any statistically detectable differences in abstinence rates by treatment condition (24-month abstinence: pharmacotherapy = 13.5%, pharmacotherapy plus moderate intensity = 14.7%, pharmacotherapy plus high intensity = 14.8%; p >0.05). Given the validated 24-month abstinence rates, the study demonstrated the feasibility of reaching rural people who smoke through primary care visits and engaging them in smoking cessation interventions.

Byaruhanga and colleagues (2021) tested real-time video counseling in a three-arm RCT (using video counseling, telephone counseling, and written materials) among 655 rural and remote residents in Australia. Though this study may not be applicable to rural U.S. population groups, it is included here due to the uniqueness of the mode of intervention delivery studied. Video counseling was found to be effective for increasing 7-day point-prevalence abstinence at 4 months post-baseline, with a significant difference in cessation observed between video counseling and written materials (OR = 2.39; 95% CI, 1.34–4.26) but not between video and telephone counseling (OR = 1.61; 95% CI, 0.95–2.72).

Summary

In summary, the results of RCTs show promising results related to the use of evidence-based interventions among adults living in rural areas, including one-on-one counseling delivered in person, by phone, or using video. In rural regions, participants in cessation studies were reached primarily in primary care clinics. In addition, quitlines and mHealth-based interventions promoted through mass media and other community and healthcare system efforts can address many barriers to accessing effective cessation treatment for rural populations (Amato and Graham 2018; USDHHS 2020; Byaruhanga et al. 2021). Nevertheless, more studies are needed to determine the types of cessation interventions that may be most useful in diverse rural geographic regions.

Summary and Recommendations

Multiple population groups remain priorities for tobacco cessation interventions, including those who experience tobacco-related health disparities, those whose prevalence of tobacco use exceeds the overall national prevalence, those who have greater difficulty quitting compared with the overall population, and those that intersect with more than one of these groups. This section reviewed individual-level cessation interventions among lower SES populations, minoritized racial and ethnic groups and sexual orientation and gender identity groups, and rural populations, including interventions tailored to these groups (Fiore et al. 2008; USDHHS 2020).

Tailored interventions developed to date have generally not been associated with increased successful cessation compared with nontailored interventions among adults of lower SES, Black or African American adults, and Hispanic or Latino adults (culturally tailored and nontailored interventions appear largely equivalent in effectiveness at increasing successful quitting). Similar findings exist regarding the limited evidence base on culturally tailored interventions for minoritized sexual orientation and gender identity groups. However, evidence regarding tailored interventions is promising for increasing intermediate cessation outcomes, such as increasing quit readiness and increasing quit attempts, among Black or African American adults. Culturally tailored interventions also appear to show promise for increasing successful cessation among Asian American adults based on the few studies available for both individual and dyadic interventions, but additional research is needed to address methodologic limitations in the available literature.

Despite the importance of individual-level interventions for tobacco cessation, many research gaps remain. Although some strong evidence has been found regarding specific effective strategies for adults of lower SES (e.g., financial incentives), Black or African American adults and the aggregate group of Hispanic or Latino adults (specific behavioral and pharmacologic interventions), and the aggregate group of Asian American adults (culturally tailored interventions, including those with a dyadic component), few studies have been conducted among American Indian and Alaska Native adults and rural population groups, and no RCTs for cessation interventions were found among Native Hawaiian or Pacific Island people. Furthermore, some studies to date have been challenged by heterogeneity in priority population groups as well as methodologic limitations.

Future research on individual-level interventions in population groups that experience tobacco-related health disparities should consider several key elements to increase rigor and reproducibility. First, interventions should be guided by culturally competent models as well as community input and engagement and a recognition of the cultural diversity within many population groups (e.g., Black or African American, Asian, Hispanic, and Pacific Island population groups) (International Collaboration for Participatory Health Research 2013). Culturally specific interventions represent a promising approach for some population groups, irrespective of the type of counseling provided (e.g., motivational interviewing, CBT). However, few studies in this domain articulate a clear theoretical framework for intervention, which limits the understanding of how interventions are developed and adapted. The body of evidence related to intervention tailoring is also limited in its exploration of the "dose" or "level" of cultural tailoring that may be important—that is, tailoring at a "surface structure" level or a "deep structure" level. Future research could benefit from exploring not only the *level* of tailoring but components within each level (i.e., for surface structure, examining who delivers the intervention and where it is delivered, and for deep structure, examining the importance of addressing historical, environmental, and psychological influencers of health behavior) (Resnicow et al. 2002).

Second, the designs of RCTs focused on priority populations should reduce the possibility of confounding by matching the intensity of the interventions being compared across conditions in the trial (e.g., attention-control comparison groups). This design is especially important when comparing culturally specific interventions with standard programs or when channels for delivering interventions differ.

Third, research should account for heterogeneity within priority populations and consider disaggregation of data as well as investigation of interventions for population groups that may have different tobacco use behavior patterns and/or cultural perspectives. Studies should specifically test the effects of evidence-based interventions for different ethnic groups within aggregate minoritized racial and ethnic groups. Specific gaps were noted in the literature and present opportunities for future research. For example, although evidence shows the efficacy of pharmacotherapy specifically among Black or African American and Hispanic or Latino adults, there are relatively few studies. Future research should ensure the enrollment of diverse population groups, including specific attention to groups that have been historically understudied, and should report outcomes by population group. Future research should additionally address barriers to use such as access, lack of knowledge of product use, and social or cultural perceptions such as fear of addiction and perceptions of personal weakness (Webb Hooper et al. 2017b). Research about the efficacy of contingency management, or use of incentives, for various minoritized racial and ethnic groups could also be beneficial.

There is also a substantial gap in the research regarding efficacious tobacco cessation interventions for Native Hawaiian and Pacific Islander populations. Research to fill this gap needs to consider supporting quitting all forms of tobacco use, including products like betel nut with tobacco, which are more likely to be used in Guam than in other parts of the United States. Funding for future research in this area needs to account for the wide geographic distribution of people with heritage in the Pacific Islands.

Another notable gap area is research regarding intervention engagement, particularly with respect to minimizing attrition in interventions. Future research should focus on not only improving reach to priority populations, but also on improving cessation intervention engagement throughout the duration of the intervention. Studies are also needed to understand the social and structural determinants of participation in research studies and how these factors influence successful cessation for each type of intervention. The influence (positive and negative) of social and structural factors is also critical to better understanding intervention engagement, intervention efficacy, and cessation behaviors more generally. Future research on cessation interventions for specific population groups could focus on how addressing and/or incorporating these factors into interventions may impact efficacy and engagement.

Finally, some priority populations have variations in tobacco use behaviors (e.g., light and intermittent smoking) and tobacco products used (e.g., mentholated products, e-cigarettes, cigars, smokeless tobacco) that are not well addressed by the current evidence base for tobacco use and dependence treatment. Future research should focus on filling these gaps, with a particular focus on products and use behaviors with high prevalence in priority populations.

The next phase of intervention research to address tobacco-related health disparities should include research regarding intervention dissemination, implementation, scalability, and sustainability. Such research has the potential to support systems change (e.g., all health insurance plans eventually covering smoking cessation services with no barriers to accessing them) in the provision of tobacco cessation treatment for priority populations. Such research could also increase reach to priority populations and could be used to scale up interventions at the population level. Efficacious interventions should be widely available, easily accessed, and delivered in a person's preferred language. Given the urgent need to reduce tobacco-related health disparities, it is critical that interventions that show positive effects be disseminated into communities and settings with high need. Clinical settings and population-level treatment interventions (e.g., quitlines) remain prime opportunities for reaching and engaging priority populations; research opportunities related to these topics are discussed elsewhere in this chapter.

Strategies could also be identified for the successful integration of tobacco cessation interventions into other contexts that have frequent contact with priority populations but seldom address tobacco, such as United Way 211 centers or centers that provide services as part of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). Finally, as population-level and regulatory measures (e.g., flavor restrictions, nicotine reduction standards, smokefree policies) advance commercial tobacco control at local, state, and national levels, it is critical to identify the ideal combination of cessation-related strategies that best support the public health and health equity potential of such actions.

Summary of the Evidence

Multiple tobacco control policies and practices—implemented at the federal, tribal, territorial, state, community, organizational, interpersonal, and individual levels—can prevent and reduce tobacco use and exposure to secondhand tobacco smoke, increase access to tobacco cessation treatment, and increase successful cessation. This chapter summarizes the evidence on tobacco control policies and practices that can, or have the potential to, reduce tobacco use and exposure to secondhand tobacco smoke and increase cessation among priority populations experiencing disparities in the United States. The extent to which certain types of interventions close the disparities gaps in tobacco use and tobacco-related health *outcomes* is an important area for future research.

Many of the interventions reviewed are evidence-based strategies that prevent or reduce tobacco use in the general population (e.g., smokefree policies, price increases), but these strategies often have not been equitably implemented (e.g., comprehensive in terms of geographic reach and without exemptions). Equitable, nondiscriminatory enforcement of evidence-based tobacco prevention and control policies, as described in Box 8.1 in Chapter 8, is also important to help advance health equity. Despite evidence of the effectiveness of the strategies described in this chapter, generally, more research needs to be specifically focused on the intended and unintended impact of these interventions on population groups experiencing health disparities. In some cases, it may be appropriate to tailor programmatic activities to better address tobacco-related health disparities among certain population groups. Rigorous evaluation of such tailored programs is critical to determine their effectiveness and to identify the most effective implementation strategies.

This chapter has reviewed several instances where new approaches have been shown to be helpful in driving tobacco use prevention and cessation; additional research could help further identify and evaluate the effectiveness of new or tailored interventions for specific population groups. Community-engaged participatory research in affected communities can be particularly helpful in identifying and measuring the impact of policy and programmatic interventions to address the tobacco-related disparities borne by community members, as well as effective policy development, implementation, and enforcement practices.

The effectiveness of some interventions to reduce disparities may vary based on the population demographics of the jurisdiction, characteristics of or type of community (e.g., rural, urban, or suburban), legal and political landscape, and other factors. As with other evidence-based tobacco control interventions that have been adopted, a combination of complementary interventions is expected to accelerate progress in addressing tobacco-related disparities more than a single strategy implemented alone. Additionally, combining complementary strategies, including those with broad reach and impact and those with specific reach to priority population groups, may have the greatest potential to maximize public health impact. This includes assuring that effective whole-population interventions—such as price increases and barrier-free cessation services—equitably reach population groups at greatest need and complementing those where necessary with focused interventions to population groups who still may experience disparities.

Most people initiate tobacco product use as youth, regardless of characteristics such as race or ethnicity, sexual orientation, gender identity, geographic location, or mental health status. Given this fact and the rapidly changing tobacco product market in the United States, continued research is needed to further inform future efforts and to understand how policies and programs aimed at reducing youth initiation impact different population groups.

Tobacco-related disparities can also be addressed by increasing access to comprehensive and barrier-free tobacco cessation services and eliminating social and structural barriers to obtaining cessation treatment services. This includes addressing social determinants of health (including transportation, food security, housing security, financial barriers) as an integrated part of an intervention approach, rather than limiting inclusion of these elements to documentation of their impact on program participation and cessation outcomes. Availability, accessibility, and promotion of cessation services are critical to maximizing the impact and equitable implementation of all tobacco control policies. It is strongly recommended that cessation services be accessible and promoted when implementing tobacco-related policies and that the effects of tobacco control policies on all populations, including priority populations, continue to be evaluated. Appropriate surveillance systems should be used to monitor reductions in tobacco-related disparities and to better understand which complementary interventions may be needed to further reach specific populations.

The evidence demonstrates that the tobacco industry has successfully lobbied in favor of preemption as a policy tool to block or override local, and sometimes state, tobacco control policies aimed at protecting public health. This can pose a significant obstacle to enacting innovative and effective measures to address tobacco-related health disparities. Community engagement—and authority—is necessary to achieve and accelerate progress in health equity. Additional research is recommended to evaluate the impact of preemption on tobacco-related health disparities and determine the best methods for communicating those impacts to affected communities and decision makers.

Conclusions

1. Preemption at the federal and state levels can pose a significant obstacle for pursuing innovative policies to advance tobacco-related health equity and limits the ability of population groups that experience disparities to benefit from proven tobacco control interventions.

2. The evidence is sufficient to infer that comprehensive smokefree laws that apply to all indoor areas of public places and workplaces, including casinos, as well as smokefree policies for multi-unit housing would reduce disparities in smokefree protections and reduce exposure to secondhand tobacco smoke if fully and equitably adopted, implemented, and enforced.

3. Reducing nicotine in cigarettes and other combustible tobacco products to minimally addictive or nonaddictive levels should reduce tobacco use among many population groups experiencing tobacco-related disparities.

4. The evidence is sufficient to infer that policies that prohibit the sale of flavored tobacco products reduce sales of tobacco products and can reduce tobacco use. Eliminating the sale of flavored tobacco products, including flavored cigars, should also reduce tobacco use among groups experiencing disparities in tobacco use, especially if the policies are comprehensive and equitably implemented.

5. The evidence is sufficient to infer that policies that prohibit the sale of menthol cigarettes reduce the sale of cigarettes and increase smoking cessation. Given the disproportionate burden of menthol cigarette use among some population groups, removing menthol cigarettes from the marketplace should also reduce disparities in tobacco initiation, nicotine dependence, cessation success, and tobacco-related health outcomes, especially if policies are comprehensive and equitably implemented.

6. Policies that regulate the location of and reduce the number of tobacco retailers in neighborhoods with a high proportion of lower income, Black, or Hispanic people could help reduce disparities in retailer density, exposure to tobacco product advertisements and displays, and sales and use of tobacco products.

7. The evidence is sufficient to conclude that increases in tobacco product prices will reduce tobacco use to a greater extent among people of lower SES than they do for people of higher SES. Youth are especially price-sensitive, and price increases could help reduce tobacco use among people from all population groups at the age when they are most likely to begin smoking.

8. The evidence is sufficient to infer that quitlines can increase access to cessation treatments among population groups affected by tobacco-related disparities, particularly when quitline promotion and services are developed, delivered, and evaluated with attention to their reach and relevance to these groups.

9. The evidence is sufficient to infer that mass media countermarketing campaigns are effective at increasing quit attempts among many population groups affected by tobacco-related disparities, particularly when designed and delivered with attention to reach and relevance to these groups. However, it remains unclear if campaigns designed specifically for a single focus population are more or less effective at decreasing disparities in initiation or cessation than campaigns designed for multiple focus populations.

10. Cultural tailoring of cessation interventions (versus nontailored interventions) shows promise for increasing quitting readiness and quit attempts among African American adults and for increasing successful quitting among Asian American adults, though tailoring may not increase long-term cessation among African American adults.

11. The evidence is suggestive, but not sufficient, to conclude that incentives paired with cessation treatments increase smoking cessation among populations with lower socioeconomic status.

12. As additional research is undertaken to advance understanding of the impacts of tobacco control interventions—including cessation, media campaign, and policy interventions—on health disparities, extra considerations should be taken to ensure that such research is designed to allow for the examination of the impact of interventions among populations experiencing health disparities (e.g., ensuring enrollment of diverse populations, oversampling of population groups, attention to sample recruitment and retention, and community-engaged participatory research approaches).

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Chapter 8
A Vision for Eliminating Commercial Tobacco-Related Health Disparities

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Introduction

The 50th anniversary Surgeon General's report published in 2014 posed the question, "As future generations look back on our current actions and knowledge of the tobacco epidemic, will current efforts show the commitment to public health and social justice set forth in our national plans and objectives?" (U.S. Department of Health and Human Services [USDHHS] 2014, p. 875). The present chapter establishes a vision and call to action for all to commit to advancing tobacco-related health equity. Supporting communities disproportionately burdened by commercial tobacco use and exposure involves (1) acknowledging the historical context of tobacco-related health disparities; (2) removing the underlying causes of tobacco-related health disparities, including structural racism and discrimination and other social and structural factors that influence this burden; (3) ensuring that populations subject to targeted marketing by commercial tobacco companies and to tobacco-related health disparities are not blamed for these disparities or burdened with the responsibility to ameliorate them; and (4) undertaking a "both/and" approach to addressing tobacco-related disparities by advancing tobacco-specific interventions and social and structural interventions. This chapter begins by reflecting on the past, present, and future of tobacco-related health disparities. It concludes with a vision for advancing tobacco-related health equity and removing structural barriers that perpetuate disparities, while simultaneously advancing population health with the goal of eliminating tobacco-related morbidity and mortality (Robeznieks 2019; Barber 2020).

The 2014 Surgeon General's report concluded that, "Although cigarette smoking has declined significantly since 1964, very large disparities in tobacco use remain across groups defined by race, ethnicity, educational level, and socioeconomic status and across regions of the country" (USDHHS 2014, p. 7). These disparities persist today. The present report expands the scope of tobacco-related health disparities to include self-reported sexual orientation and gender identity, intersectionality, and other factors. Nationally representative data described in this Surgeon General's report show that

- The prevalence of current (past-month) cigarette smoking in 2019 was highest among aggregate groups of American Indian and Alaska Native adults (30.7%) and adults who identified as non-Hispanic, multi-race (30.6%), followed by Black (20.6%), White (19.4%), Native Hawaiian and Pacific Islander (14.1%), Hispanic (13.4%), and Asian (8.0%) adults.

- Among youth, the prevalence of current cigarette smoking in 2019 was highest among aggregate groups of American Indian and Alaska Native youth (20.6%), followed by youth who identified as non-Hispanic, multi-race (8.0%), White (6.7%), Hispanic (6.0%), Native Hawaiian and Other Pacific Islander (4.5%), Black (3.3%), and Asian (2.3%).

- Among adults who smoked during 2017–2019, menthol cigarette use was highest among Black or African American people (88.1%), followed by Native Hawaiian and Pacific Islander (73.5%), Multi-Race (48.7%), Hispanic or Latino (47.3%), Asian (43.6%), American Indian and Alaska Native (32.2%), and White (28.9%) people.

- The prevalence of cigarette smoking is nearly twice as high among lesbian, gay, and bisexual youth as it is among heterosexual youth.

- Disparities in cigarette smoking by level of income have persisted over four decades, with smoking prevalence higher among people living below the federal poverty level.

- Despite substantial overall progress in reducing exposure to secondhand tobacco smoke at the population level, protections have not been equitable across racial and ethnic groups, socioeconomic groups, or by age. From about 1988 to 2018, absolute disparities in exposure to secondhand tobacco smoke increased among children compared to adults, among Black or African American people compared to White and Hispanic people, and among people living below the poverty line compared to people living above the poverty line.

- Disparities in the use of evidence-based cessation treatments exist, including among population groups defined by race and ethnicity, socioeconomic status, and health insurance coverage status.

An Ethical Foundation for Addressing Tobacco-Related Health Disparities

This report frames inequitable policies, practices, and socially determined conditions as contributors to tobacco-related health disparities and uses the theory of social justice emerging from the field of bioethics as an ethical foundation for addressing these contributors. This approach recognizes that such indicators as the prevalence of tobacco product use, smoking-attributable mortality, exposure to secondhand tobacco smoke, and having received advice from a health professional to quit tobacco use also occur within the context of social and economic circumstances, including the marketing, distribution, and sale of commercial tobacco products. Drivers of tobacco-related health disparities include social and structural determinants of health—such as persistent poverty and inequitable economic and social conditions—that lead to inequitable opportunities for health. Discrimination, racism, and targeted marketing by the tobacco industry; geographic disparities in comprehensive smokefree policies; preemptive laws that hinder political empowerment to protect the health and safety of communities; and financial and other structural barriers to accessing cessation treatments also drive health disparities. These drivers have cumulative effects across the lifespan and diminish the general welfare of the nation.

The theory of social justice, as presented by bioethicists Powers and Faden (2006, 2019), is centrally concerned with the achievement of human well-being, which includes but is not limited to physical and mental health. Additional dimensions of well-being include personal security, knowledge and understanding, equal respect, personal attachments (i.e., through interpersonal bonds), and self-determination. Population groups that fare poorly on multiple dimensions, Powers and Faden (2006, p. 15) noted, should be prioritized with “special moral urgency.” The “job” of social justice is to identify patterns of disadvantage that result in the systematic marginalization of groups (Powers and Faden, 2006, p. 3), including tobacco-related health disparities.

Previous chapters examined the interlocking factors that influence tobacco-related health disparities. As represented in Figure 1.1 in Chapter 1 of this report, historical context, differential power structures, and the ideology and values of those with decision-making authority influence (a) commercial drivers of tobacco product use and exposure (including marketing tactics) and (b) economic and political systems, institutions, policies, and research and interventions that establish the context for health and well-being. Industry tactics—including marketing, product design, lobbying, and corporate social responsibility initiatives (Kickbusch et al. 2016)—reflect and reinforce existing structural inequities, racism and discrimination, poverty, historical and present-day trauma, and other stressors that perpetuate health disparities. These converging social and commercial determinants of health predispose, enable, and reinforce differential opportunities to live a life free of premature death and disease caused by commercial tobacco product use and exposure to secondhand tobacco smoke.

The pursuit of social justice in public health does not benefit only those who have been subject to systematic and cumulative disadvantage. Everyone is harmed by inequity, and everyone can benefit from equity. This is observable within and outside the context of tobacco control, for example,

- Equitable smokefree protections promote health, reduce healthcare costs borne by society, and do not harm businesses (Centers for Disease Control and Prevention [CDC] 2021c).
- Models from the Center for Medicare & Medicaid Innovation increasingly address health-related social needs. The Accountable Health Communities model, on which these efforts are built, showed patterns of reduced avoidable and overall emergency room use among Medicare beneficiaries by connecting them to housing, food, and other services. These impacts were more pronounced among Medicare beneficiaries who are Hispanic or a race other than White (Centers for Medicare & Medicaid Services 2023, n.d.).
- Multisector, place-based initiatives, with active participation of community residents, can reinvest in high-need neighborhoods (Dankwa-Mullan and Pérez-Stable 2016). Such initiatives have been shown to increase employment and graduation rates among families with lower incomes, reduce crime, and raise property values in the surrounding area (Bailey et al. 2017; Purpose Built Communities n.d.).

To guide future directions, it is important to acknowledge and learn from the past and present. The following sections discuss the past, present, and future of tobacco-related health disparities in the United States and offer a vision for advancing tobacco-related health equity—with fair and just opportunities and conditions for all people to live a healthy life that is free from tobacco use and exposure and from tobacco-related disease, disability, and death.

Past: A Complex History of Tobacco Commercialization and the Involvement of the Tobacco Industry in Communities

Addressing tobacco-related health disparities requires a reflection on the complex history of the commercialization of tobacco. Chapter 1 summarized how some American Indian communities' ceremonial or traditional tobacco was repurposed during the colonial period into a commercial crop, and it documented how federal policies separated Indigenous communities from their lands and effectively prohibited ceremonial uses of tobacco while allowing the use of commercial tobacco. Chapter 1 further documented the historical ties between cultivation of tobacco for commercial purposes and the enslavement of people of African descent. This historical context is a foundational driver of present-day socioeconomic and health disparities.

The 1998 Surgeon General's report (USDHHS 1998) documented the industry's targeting of racial and ethnic communities through direct employment, support for social services and civil rights organizations, contributions to politicians and political organizations, support for educational and cultural programs, and contracts with small businesses. Tobacco industry documents reveal that the intent of these community engagement efforts is to drive sales of tobacco products among the very groups the companies purport to help (Table 8.1). As determinants of tobacco-related health disparities, these tactics

Table 8.1 Present-day and historic examples of targeted community engagement tactics outlined in industry documents

Tactic	Historic examples from tobacco industry documents	Present-day examples
Indirect/grassroots lobbying and advocacy to encourage the general electorate to oppose tobacco control measures, such as menthol restrictions and cigarette tax ballot initiatives	"Since it is apparent that we are not going to have the endorsement of most Gay and Lesbian leadership, it is important to use these campaign tools to bypass that and go directly to the Gay and Lesbian voter with a message that will resonate . . . [A]reas that would have special interest to this community . . . include lifestyle regulation, government intrusion into private lives, and removing choice as an option for one's life decisions" (Mixner 1998, p. 5).	• **2022:** Direct-to-consumer emails from R.J. Reynolds-affiliated cigarette (Natural American Spirit) and smokeless tobacco (Grizzly) brands called on consumers to take action to oppose menthol bans (PennRutgers TCORS 2022). A Philip Morris (Marlboro) email stated, "These flavor bans can create underground markets that increase crime, reduce tax revenues and hurt small businesses" (Trinkets & Trash 2022). • **2021:** Email from Natural American Spirit in July 2021 urged recipients to say "no" to more cigarette taxes (Trinkets & Trash 2021).
Targeted marketing and segregated marketing	"Reynolds Tobacco has made a special effort to reach Black smokers since the early 1960s [and] special efforts for Hispanics since the early '70s" (Winebrenner 1988, p. 2). "Any attempt to cater to blacks could backfire and hurt Marlboro among the young blue collar whites who constitute the Marlboro franchise" (Johnston 1982, p. 5).	• **2022:** Digital images from Kool non-menthol brand cigarettes featured African- American men and women smoking and included such text as, "By now, you may have heard that California has banned menthol cigarettes. If you're like, 'what now?!' We got you. Discover Kool Non-Menthol. Same Intensity. Same Vibe. Minus the Menthol" (Stanford Research into the Impact of Tobacco Advertising n.d.). • **2019:** Direct-to-consumer email encouraged recipients to "explore the Latinx hip-hop movement and earn points for Marlboro Rewards" (Trinkets & Trash 2019).
Support for social services and civil rights organizations	"Association with a national civil rights organization can be viewed, in its most positive sense, as an endorsement of Brown & Williamson and its products to the minority community. . . . Clearly, the sole reason for B&W's interest in the black and Hispanic communities is the actual and potential sales of B&W products within these communities and the profitability of these sales" (MAB 1984, p. 1).	• **2022:** Altria reported its 2020 charitable contributions to civil rights and social services organizations (Altria n.d.). • **2020:** An Instagram post from Imperial Brands' subsidiary Dutch Masters Cigar and Cigarillo said "Black Lives Matter" (Figure 2 in Heley et al. 2021).

Table 8.1 Continued

Tactic	Historic examples from tobacco industry documents	Present-day examples
Contributions to politicians, political organizations, and lobbying groups	"We cannot view politics as a spectator sport. The most effective way we can work together to help our Company participate is to become a member of the RJR Political Action Committee. . . . By combining our contributions, we speak with a united, powerful voice. We help elect legislators who support business interests. In doing so, we help build a stronger future for ourselves and our co-workers. . . . Contributing to the PAC ensures we have a voice in helping shape the debate before laws and regulations are passed" (Schindler 2000, p. 1).	• **2022:** Altria reported its 2020 charitable contributions to high-profile political organizations, Congressional caucuses that advocate on behalf of people from minoritized racial and ethnic groups, and lobbying groups that oppose taxes or promote tobacco harm reduction (Altria n.d.). • **2022:** "Reynolds American Companies reported political contributions totaling US $6,229,475 for the full year 2020 to US political organisations and to non-federal-level political party and candidate committees" (British American Tobacco 2021, p. 116).
Support for educational and cultural programs	"Tie-in with any company who help black—'we help them, they help us.' Target group age 16+" (Davis 1978, p. 8). "Four leading Black publishers from the National Newspaper Publishers Association will visit with us . . . [Areas for discussion include:] • How the Black Press can support the Tobacco Industry in the smoking-health controversy • General advertising • R.J. Reynolds Industries—NNPA Scholarship Program in Journalism" (Sticht 1979).	• **2022:** Altria reported that charitable contributions in 2020 went to scholarship funds for Black and Hispanic youth, youth-serving organizations, and numerous colleges and universities (Altria n.d.). • **2022:** Santa Fe Natural Tobacco Company Foundation (Reynolds American) "is dedicated to helping preserve, promote, and advance American Indian Culture. Using dedicated funds from the sale of SFNTC tobacco products, the Foundation's three primary objectives are: development of Native American entrepreneurs; facilitation of Native American education; and preservation of Native American languages" (Reynolds American n.d.).
Hire members of minoritized communities for public-facing and advocacy positions; support/partner with small businesses owned by minoritized group members	"Develop concept for in-market research employing . . . Black Sales reps in Core inner city sales territories" (Davis 1978, p. 10). "Tie-in with any company who help black—'we help them, they help us.' Target group age 16+" (Davis 1978, p. 8).	• **2022:** R. J. Reynolds enlisted Black lobbyists and a Black former member of Congress to oppose menthol bans and overestimate the impact of menthol bans on retailers (Baumgaertner et al. 2022). • **2020:** Altria subsidiary John Middleton Co. (Black & Mild cigars) announced *Closing the Gap,* a business initiative designed to donate to "nonprofits that support Black-owned businesses in our community, strengthen relationships and continue spending toward Black-owned vendors and suppliers, [and] utilize our marketing efforts to amplify Black-owned businesses" (Trinkets & Trash 2020b). • 2020: Swisher Sweets announced an inclusion, diversity, and transformation strategy to "partner with multicultural groups . . . , create opportunities for Black-owned businesses, develop a talent pipeline with Historically Black Colleges and Universities, [and] create sustainable corporate and field career opportunities for minorities within Swisher International" (Trinkets & Trash 2020a).

persist and affect additional and intersectional population groups, including people who are lesbian, gay, bisexual, transgender, queer, intersex, or other sexual orientation and gender identities (LGBTQI+).

Present: Building Momentum for Health and Racial Equity

In 2020, racial and ethnic disparities in the burden of COVID-19 and the killing of George Floyd and other unarmed Black or African American people by police elevated awareness of the impact of racial inequity in the media and public dialogue (Heley et al. 2023). In January 2021, a presidential executive order on advancing racial equity and support for underserved communities through the federal government was released (The White House 2021). In April 2021, the director of CDC declared racism to be a serious public health threat and announced efforts to advance science, invest in communities, foster diversity and inclusion, catalyze public and scientific discourse around racism and health, and be accountable for progress (CDC 2021b). The present report identifies tobacco-related health disparities as a social injustice and acknowledges poverty and discrimination as key drivers of disparities.

Even as these important developments unfolded, the tobacco industry co-opted racial justice and civil rights as themes in its marketing and community engagement efforts. Heley and colleagues (2023) examined how manufacturers of cigars, cigarillos, and hookah integrated the #BlackLivesMatter hashtag into social media advertising and cigar merchandise. No such marketing was found for tobacco products, such as smokeless tobacco, that are more commonly used by White people (Heley et al. 2023). Appropriating the #BlackLivesMatter hashtag in marketing demonstrates how the tobacco industry undermines tobacco control efforts through continued engagement with communities harmed by tobacco-related health disparities. Efforts by Reynolds American Inc., which markets Newport and Camel cigarettes, to oppose bans on menthol cigarettes have included (a) hiring a team of Black influencers and lobbyists who have claimed that banning menthol cigarettes would increase policing in Black communities (Baumgaertner et al. 2022) and (b) offering a pastor in Detroit hundreds of thousands of dollars to campaign against a menthol cigarette ban, which he rejected (The Bureau of Investigative Journalism 2022). Importantly, however, other Black advocacy groups, including the National Association for the Advancement of Colored People (NAACP), contend that “the industry and its allies stoked fears that banning menthol would lead to more overpolicing in Black communities,” but “[b]anning menthol will save Black lives” (Johnson 2023).

Although momentum to combat systemic inequity has accelerated, progress in tobacco prevention and control has stalled in many places across the United States, exacerbating geographic disparities in access to effective interventions. As of 2022,

- Twenty-two states, mostly concentrated in the South and Midwest, as well as Guam and the Northern Mariana Islands “do not yet have in place comprehensive smokefree indoor air laws covering all bars, restaurants, and worksites,” (CDC 2022e) and no new comprehensive smokefree laws have been enacted at the state level since 2012 (Holmes et al. 2016).

- Thirteen states tax cigarettes at a rate of less than $1.00 per pack, and four states tax cigarettes at less than $0.50 per pack (CDC 2022b). Only 16 states tax little cigars at the same rate as cigarettes (CDC 2022b). Meanwhile, federal tobacco taxes have not increased in more than a decade (Holmes et al. 2016; CDC 2022b).

- Thirty-one states lack comprehensive Medicaid coverage for tobacco cessation treatments, defined as coverage of individual counseling, group counseling, and all seven FDA-approved cessation medications (CDC 2022c).

- Many local efforts are hampered by preemption at the state level. For example, as of June 30, 2022, 12 states have laws or court decisions in effect that explicitly preempt local ordinances from restricting smoking in government worksites, private worksites, restaurants, or bars (CDC 2022d).

Meanwhile, the tobacco industry continues its marketing, research and development, litigation against public health policies, lobbying, and public relations efforts (World Health Organization 2008). The tobacco product landscape has diversified to include (a) combustible tobacco products, which are responsible for the overwhelming burden of tobacco-related death and disease in the United States (USDHHS 2014); (b) a rapidly expanding array of noncombustible tobacco products, including smokeless tobacco products, e-cigarettes, heated tobacco products, and oral nicotine products marketed for nontherapeutic purposes; and (c) an expanding portfolio of flavors that mask the harsh taste of tobacco, make tobacco products appealing and harder to quit, and contribute to disparities in initiation and successful cessation.

Through such public relations efforts as the "Foundation for a Smoke-Free World," which was established by Philip Morris International in 2017,[1] the industry has promoted itself as a leader in the fight to eliminate *smoking* (but not the use of other tobacco products)—even as it heavily relies on revenues from the sale of cigarettes (including menthol cigarettes) and other combustible tobacco products. Specifically,

- Altria, which makes Marlboro cigarettes and Black & Mild cigars and had a significant minority stake in e-cigarette brand JUUL until March 2023, revealed in its 2021 earnings report that it made 87% of its total revenues from combustible tobacco products (Altria Group 2021).
- British American Tobacco (2022), which owns the Newport and Camel menthol cigarette brands through its Reynolds American Inc. and R.J. Reynolds Tobacco subsidiaries, reported that 86% of its 2021 revenue was from combustible tobacco products.

Efforts to rapidly eliminate the use of combustible tobacco products by addressing their availability, appeal, and addictiveness will reduce the burden of tobacco-related death and disease (USDHHS 2014).

Although progress in commercial tobacco control has stalled in many places, some states and localities have moved forward with efforts to address tobacco-related health disparities. For example,

- As of December 2023, two states (California and Massachusetts) and nearly 200 communities have prohibited the sale of flavored tobacco products, including menthol cigarettes, protecting about one-sixth of the population (Campaign for Tobacco-Free Kids 2023; Truth Initiative 2023).
- In October 2021, the Navajo Nation Council passed the *Niłch'éí Bee Íínáá (Air is Life) Act* of 2021, a 100% commercial tobacco smokefree policy for the Nation with no exceptions, including casinos. The act is the first comprehensive ban on the use of all commercial tobacco products on American Indian tribal lands (Nez Henderson and Leischow 2022).
- Between 2008 and 2022, the number of states with comprehensive coverage for tobacco cessation treatments for all traditional Medicaid enrollees increased from 6 to 19 (DiGiulio et al. 2020; CDC 2022c).

Success in advancing tobacco-related health equity relies on building momentum to secure optimal outcomes for all people. Achieving tobacco-related health equity also hinges on future implementation efforts that (a) address social and structural determinants of health disparities; (b) leverage strong multisector partnerships and strategic and sustainable investments; and (c) engage meaningfully with communities that are most affected by health disparities in all phases and stages of strategic implementation.

Comprehensive Tobacco Treatment Remains Inaccessible to Many People with Lower Incomes Who Use Tobacco

As described in Chapter 4, provisions in the *Patient Protection and Affordable Care Act* (ACA) require comprehensive coverage of tobacco cessation treatments for pregnant adults enrolled in Medicaid. In addition, comprehensive coverage is required for (a) all enrollees in expanded Medicaid in states that choose to expand Medicaid coverage pursuant to the ACA and (b) enrollees in most private health plans, including all plans sold in federal or state exchanges (CDC 2021a). However, analyses conducted in 2018 (McMenamin et al. 2018) and 2020 (DiGiulio et al. 2020; McMenamin et al. 2020) revealed that efforts to expand Medicaid coverage of cessation treatments have been mixed. For example, although coverage of all nine evidence-based tobacco cessation treatments (individual and group counseling and seven FDA-approved medications) for traditional Medicaid enrollees has improved over time, the number of state Medicaid programs with such comprehensive coverage remains low. Further, there are common barriers to accessing services—such as copays, prior authorizations, and limits on services based on the number of quit attempts (DiGiulio et al. 2020; CDC 2022c). Adequately promoted, comprehensive, barrier-free, and evidence-based cessation insurance coverage increases the availability and utilization of cessation treatment services (USDHHS 2020). The full implementation of the ACA and wide availability of comprehensive, barrier-free coverage of tobacco cessation treatments for all Medicaid enrollees has the potential to contribute to substantial reductions in tobacco use among Medicaid enrollees. Additional studies are needed to determine the extent to which such implementation may close the tobacco-related disparities gaps between people who are enrolled in Medicaid and those who are not.

[1]In 2023, the Foundation for a Smoke-Free World announced that its agreement with Philip Morris International was terminated after accepting a final grant of $122.5 million from Philip Morris International (Tobacco Tactics 2023). Additionally, in December 2023, the foundation changed its name to Global Action to End Smoking, Inc. (New York State, Department of State, Division of Corporations n.d.).

Future: Ending the Tobacco Use Epidemic for All

Progress and Challenges

In April 2022, FDA issued proposed product standards to prohibit menthol as a characterizing flavor in cigarettes and prohibit all characterizing flavors (except tobacco) in cigars (*Federal Register* 2022a,b). In addition to explaining that these measures are appropriate for the protection of public health, FDA noted that the proposed rules are also expected to reduce tobacco-related health disparities and advance health equity (*Federal Register* 2022a,b; Zeller 2022). FDA projects that, if finalized, the proposed product standards would have major impacts on public health. A federal regulation on menthol cigarettes and flavors in cigars is expected to reduce tobacco use initiation among youth and young adults and reduce disparities in tobacco use and quitting among people who predominantly use flavored commercial tobacco products (FDA 2022b).

In addition, FDA signaled, by including it in the spring 2022 Unified Agenda of Regulatory and Deregulatory Actions, its intention to reduce addictiveness by advancing a product standard to reduce nicotine in cigarettes and certain other combustible tobacco products (FDA 2022a). Such an action has been projected to prevent more than 33 million people from starting to smoke, result in an adult smoking prevalence of 1.4%, and prevent more than 8 million people from dying from tobacco-related illnesses by the year 2100 (Apelberg et al. 2018). Additional research can provide information about the impact of reduced nicotine on reducing tobacco use, promoting quitting, and eliminating health consequences among minoritized racial and ethnic groups, people with lower socioeconomic status, and other groups who experience disparities.

Historical and present-day tactics of the tobacco industry (Table 8.1) suggest that public health efforts to reduce tobacco use and eliminate disparities—including menthol and cigar flavor restrictions—will be met with tobacco industry opposition at local, state, and federal levels through litigation, ballot initiatives, and direct and indirect (grassroots) lobbying. For example, as of April 2024,

- Tobacco companies effectively delayed implementation of California's statewide restriction on the sale of flavored tobacco products, which was enacted in 2020. Specifically, Philip Morris USA, R.J. Reynolds, ITG Brands, Swedish Match, and the National Association of Tobacco Outlets funded a referendum to overturn the law. On November 9, 2022—the day after California voters overwhelmingly approved the law—R.J. Reynolds filed a lawsuit to challenge the law and seek an injunction against its implementation, which the U.S. Supreme Court rejected (Public Health Law Center at Mitchell Hamline School of Law 2020). In January 2024, the U.S. Supreme Court again rejected an appeal from R.J. Reynolds contending that California's law was preempted by federal law (Raymond 2024).

- Tobacco product manufacturers, tobacco retailers, tobacco retailer associations, and/or cigar trade associations have pending lawsuits against the state of California and cities in Oregon to challenge restrictions on flavored tobacco products.

- Litigation initiated by R.J. Reynolds and Philip Morris USA to block the U.S. government from implementing pictorial warnings on cigarette packages is ongoing.

The tobacco industry is also expected to continue to seek ways to circumvent restrictions through product design and marketing tactics. As documented in Chapter 3, after California's menthol cigarette and other flavored tobacco product restriction became effective, R.J. Reynolds began marketing cigarettes containing the odorless and tasteless synthetic cooling agent WS-3 using the descriptor "non-menthol." In addition, in 2021, manufacturers of some e-cigarettes and nicotine pouches began marketing products in the United States with synthetic nicotine not derived from tobacco. These products, which are offered in flavors known to appeal to youth and are marketed for discreet use (Marynak et al. 2021), fell outside the federal statutory definition of tobacco products. On March 15, 2022, Congress granted FDA authority to regulate tobacco products containing nicotine from any source (FDA 2022c); however, gaps remain in some local and state statutes (Berman 2021; Public Health Law Center 2022). As documented in the 2014 and 2016 Surgeon General's reports (USDHHS 2014, 2016), sufficient scientific evidence about nicotine exists to (a) warn young people and pregnant adults against using nicotine from any source and (b) justify incorporating nontobacco nicotine products into existing tobacco product regulation, surveillance, and health communication and marketing efforts.

Nevertheless, future tactics from the tobacco industry to circumvent regulations, such as reductions in nicotine in cigarettes to reduce addictiveness, may include the use of nicotine analogs (i.e., compounds with similar pharmacologic properties to nicotine but with different chemical structures). Previously internal industry documents released during litigation reveal that tobacco companies have extensively investigated nicotine analogs, including for the purposes of circumventing future regulations (Vagg and Chapman 2005). Beginning in October 2023, at least one brand of e-cigarette products entered the U.S. market asserting that it contains a "synthetically derived molecule that is structurally similar to, but chemically different from, other vaping alkaloids [and] . . . produces the same sensation as nicotine" (Jordt et al. 2023, citing SPREE BAR 2023). With claims that the products are exempt from regulation, the products are offered in appealing flavors, such as Rainbow Fruit, and packages feature images of young models with stylish sunglasses and blue lipstick. To foreclose these tactics, local, state, territorial, tribal, and federal policymakers could broaden definitions in their tobacco control laws to apply to products that contain nicotine or nicotine analogs from any source and authorize their regulation. Policymakers also could broaden definitions in flavored sales prohibitions to include products with somatosensory properties such as cooling.

Other countries' efforts to address flavored tobacco products also provide important insights into potential future strategies by the tobacco industry to circumvent restrictions. For example, in May 2020, the European Union banned cigarettes with characterizing flavors, including menthol-characterizing flavor (European Network for Smoking and Tobacco Prevention 2020). Before and immediately after the effective date of the European Union ban, Japan Tobacco International introduced multiple brands of Winston cigarettes that (a) were found in laboratory analyses to contain substantially more menthol than regular (i.e., tobacco flavored) cigarettes and (b) used blue or green packaging to suggest menthol's presence, but without using the descriptor *menthol* (Ciurcanu and Cerantola 2021). These tactics underscore the importance of monitoring tobacco products marketed as tobacco flavored and the levels of menthol, synthetic coolants, and other additives that invoke multisensory flavor experiences.

Given the tobacco industry's past and present efforts to delay, block, or avoid the implementation of federal regulations (World Health Organization 2008; Marynak et al. 2021), localities, states, tribes, and territories should not wait for the implementation of federal strategies to address tobacco-related health disparities. Importantly, the *Family Smoking Prevention and Tobacco Control Act of 2009* preserves state, local, tribal, and territorial governments' authority to enact any policies "in addition to, or more stringent than, requirements established under this chapter [of the *Tobacco Control Act*], including a law, rule, regulation, or other measure relating to or prohibiting the sale, distribution, possession, exposure to, access to, advertising and promotion of, or use of tobacco products by individuals of any age" (FDA 2018). This preservation of state and local authority ensures the continuation of community-driven health equity initiatives.

Common Threats Between Commercial Tobacco and Cannabis

Cannabis use represents an important public health concern, especially given the high prevalence of tobacco and cannabis co-use in youth and young adults; social, economic, and health disparities associated with chronic cannabis use; and disparities in exposure to secondhand cannabis smoke by age and race and ethnicity (University of California–Davis Health System 2016; Terry-McElrath et al. 2017; Substance Abuse and Mental Health Services Administration 2021). Although efforts to decriminalize cannabis possession and reschedule cannabis under federal law are important to redress racial and ethnic disparities in the criminal justice system (The White House 2022), the issue of decriminalization is distinct from health-related concerns about exposure to cannabis smoke. The increased legalization of recreational cannabis at state and local levels represents a threat to smokefree norms and protections and has implications for health disparities (Jacobus and Tapert 2014; D'Souza et al. 2016; Substance Abuse and Mental Health Services Administration 2020, 2021). As of July 2022, two states (Colorado and Nevada) with statewide smokefree laws contain an exemption for cannabis smoking in 100% smokefree restaurants and one state (Michigan) contains an exemption for cannabis smoking in 100% smokefree restaurants and bars (American Nonsmokers' Rights Foundation 2022). Although the short- and long-term health effects of exposure to cannabis smoke are unknown (National Academies of Sciences, Engineering, and Medicine 2017), a World Health Organization (2016) review concluded that evidence suggests that cannabis smoke is carcinogenic, and California added cannabis smoke to its list of carcinogens, as required under California Proposition 65 (California Office of Environmental Health Hazard Assessment n.d.). Studies suggest that many of the same constituents of tobacco smoke are present in cannabis smoke; some constituents (e.g., ammonia and hydrogen cyanide) are higher in concentration in cannabis smoke than in tobacco smoke (Moir et al. 2008; Tomar et al. 2009). Furthermore, the commercial tobacco industry is investing heavily in commercial cannabis and seeking to shape regulations for and policies about cannabis (Dewhirst 2021), which may undermine efforts to address health disparities and specifically jeopardize efforts to promote equitable smokefree protections.

Misinformation and Tobacco Industry Interference in Science

Although not a recent phenomenon, health misinformation spread at unprecedented speed and scale during the COVID-19 pandemic and with significant negative consequences (USDHHS 2021) This has important implications for the present and future of tobacco prevention and control. *Confronting Health Misinformation: The U.S. Surgeon General's Advisory on Building a Healthy Information Environment* documents how misinformation led to public confusion and mistrust about COVID-19 health information (USDHHS 2021). The advisory notes that experiences of racism in the healthcare system and increasing political polarization may also facilitate the spread of misinformation in some communities. Mistrust in science and medicine and of scientists, healthcare professionals, and public health officials could hamper efforts to eliminate tobacco-related health disparities and educate the public about both the health consequences of tobacco use and the health benefits of tobacco cessation. Furthermore, the tobacco industry could use mistrust opportunistically to further undermine evidence-based tobacco control strategies (Albarracin et al. 2018; Tan and Bigman 2020), including by attempting to frame restrictions on flavored tobacco products as contrary to social justice, as described previously.

Briggs and Vallone (2022, p. 388) noted that the tobacco industry is "once again infiltrating scientific spaces and presenting a direct threat to the vital work of unbiased tobacco control scientists." Tobacco industry sponsorship of published scientific research is strongly associated with research results that are favorable to the tobacco industry (Shaw et al. 2016; Hendlin et al. 2019; Pisinger et al. 2019; Tan et al. 2019). Additional tactics by the tobacco industry to distort knowledge ecosystems and alter public perceptions include publishing sponsored research; sponsoring special journal supplements; rebranding efforts that project concern for consumer health and wellness despite continued marketing of combustible tobacco products; participating in academic conferences; and "appropriating the language of harm reduction" while muddying debate within the broader research and public health community (Briggs and Vallone 2022, p. 389). Industry funding of and participation in research may also be used to cast doubt about promising strategies to reduce tobacco-related health disparities, such as restrictions on flavored tobacco products (World Health Organization 2008). Because the activities of the tobacco industry are "incompatible" with public health objectives (World Health Organization 2008), it is critical to anticipate, recognize, and reject conflicts of interest in scientific, policy, and regulatory arenas.

Finally, state laws passed to restrict local authority in the wake of COVID-19 could also present challenges for tobacco control efforts, particularly in states in the South and Midwest that are already characterized by a higher prevalence of tobacco use, poorer health outcomes, and lower socioeconomic status (Truth Initiative 2019). For example, in June 2021, West Virginia enacted a law that requires any new rules from a local board of health to be approved, disapproved, or amended by the county or city that authorized the creation of that board of health (The Network for Public Health Law 2022). Before this, more than half of West Virginia's population gained protection from exposure to secondhand smoke because of the adoption of smokefree rules by local boards of health, which required no approval by a legislative body (West Virginia Department of Health and Human Resources 1995; Marino 2021). However, as of May 2023, no new smokefree rules have been adopted by a local board of health in West Virginia since the June 2021 law was enacted (American Nonsmokers' Rights Foundation 2023). The placement of limits on public health authority driven by concerns about nontobacco health issues could also affect the ability to prevent and control tobacco use and exposure to secondhand tobacco smoke at the local level, such as through tobacco price increases and smokefree laws, and exacerbate geographic disparities in states with a high prevalence of tobacco use.

A Health Equity Lens on Population-Level and Endgame Strategies

This report reinforces the evidence that longstanding, core population-level strategies—such as implementing price increases, smokefree air policies, and hard-hitting media campaigns and providing cessation resources—are effective components of a comprehensive tobacco prevention and control strategy. Further, this report acknowledges inequitable progress in implementing these strategies, while also revealing the dearth of evaluations to assess the impact of population-level strategies on reducing tobacco-related health disparities. But even if core tobacco prevention and control strategies such as smokefree protections were implemented equitably and comprehensively, they would not be sufficient to end the epidemic of tobacco-related death and disease (USDHHS 2014, 2020). Social, structural, and commercial determinants of health must be addressed to produce an endgame in which zero lives are harmed by or lost to tobacco. What is clear, however, is that current gaps in the equitable implementation of effective strategies exacerbate disparities and must be closed.

To move the field forward in the context of uneven progress and evolving science, tobacco control strategies may be analogized as tools in a shed, with ample shelf space for both (a) proven population-level strategies and (b) promising strategies to advance tobacco-related equity. This toolshed of tobacco control strategies can be continually expanded to accommodate new approaches that advance tobacco-related health equity, particularly if well-designed studies free of influence from the tobacco industry demonstrate their effectiveness. For example, in addition to proven population-level strategies such as smokefree policies, evidence presented in this report supports restricting nicotine levels and flavors in tobacco products, requiring minimum prices (such as through an established price floor and prohibiting price discounts), and reducing the density of tobacco retailers (see Chapter 7). Robust science that takes into consideration the social and structural determinants of health is pivotal to building the evidence for what works, in what circumstances, and for whom—and understanding what does not work—to maximize benefits for public health and minimize the opportunity costs of efforts.

Recent Advancements in Equity-Informed Approaches

The experiences of tobacco control practitioners who have achieved recent successes in advancing evidence-based and promising interventions to advance tobacco-related health equity show that progress is achieved through a commitment to core principles under a theory of social justice, including equal respect, knowledge and understanding, self-determination, and power sharing. For example,

- The African American Tobacco Control Leadership Council's successful efforts to advocate for a comprehensive ban on the sale of flavored tobacco products in San Francisco (Mills et al. 2021) demonstrate the importance of (a) building relationships of trust with communities that are affected by inequities before asking for their support (Malone 2021) and (b) listening to and clearly and consistently addressing community concerns (Mills et al. 2021).

- In addition, the 13-year journey to enact the Navajo Nation's *Air is Life Act* offers important insights that can inform future efforts (Nez Henderson and Leischow 2022). A series of failures to pass the legislation led those involved in research and advocacy to refocus efforts to better understand how Navajo healers, tribal elders, and other community leaders view traditional or ceremonial tobacco versus commercial tobacco, and how they share related knowledge and information and community concerns about policies. Findings informed public education efforts, and a series of meetings between researchers, advocates, and community leaders used relevant data on the economic impacts and health benefits of smokefree policies to allay concerns.

- Successes in San Francisco and the Navajo Nation have helped to build momentum for a statewide ban on flavored tobacco products in California and for a smokefree policy in the Eastern Band of Cherokee Indians in North Carolina (Nez Henderson and Leischow 2022).

These collaborative efforts exemplify commitment to sharing power, which involves transforming community concerns into actionable initiatives and active, transparent, and frequent communication that eliminates silos between public health, academic institutions, and other community organizations to advance tobacco-related health equity (Wallerstein et al. 2019).

At a basic level, commitment to fostering equal respect and knowledge and understanding hinges on the measurement of self-identified characteristics and self-reported drivers of inequities (e.g., social determinants or conditions), including through nationally representative surveys of youth and adults (Powers and Faden 2019). As Malone (2021, p. e76) notes, "for some disadvantaged populations, it has been a real fight to simply become recognized and visible enough to have data systematically collected for research." Researchers must protect recent advancements in measurement; further advance measurement of structural and social determinants of health across the lifespan (e.g., discrimination, built environment); advocate for disaggregation in measurement and oversampling of disparate populations; and assess markers of disparity, such as constructs related to sexual orientation and gender identity. Such data will inform interventions to address social and structural determinants among intersectional groups.

Achievement of optimal individual health requires that health systems and other institutions facilitate knowledge and understanding that drives (a) decisions to quit or never use tobacco products, (b) access to and utilization of cessation resources, and (c) measurement thereof. Taking action to curtail exposure to marketing of and the use of commercial tobacco products—whether through clinical, community, or policy interventions—demonstrates respect and regard for communities with a long history of disparities. Curtailing tobacco use through such interventions provides communities with opportunities to determine their own fate and to inform the delivery of health-promoting interventions that are free from the influences of the tobacco industry and the social and structural drivers of health disparities.

Importantly, policies that preempt local authority to protect the public's health are incompatible with self-determination, which focuses on cultivating the capacity for self-direction (Powers and Faden 2019). Preemption of local authority represents a persistent threat to health equity goals across multiple dimensions, including but not limited to protecting infants, children, and adults from the harms of commercial tobacco use and/or exposure, as documented in previous Surgeon General's reports (USDHHS 2014, 2016).

A "Both/And" Approach to Tobacco-Specific and Social and Structural Interventions

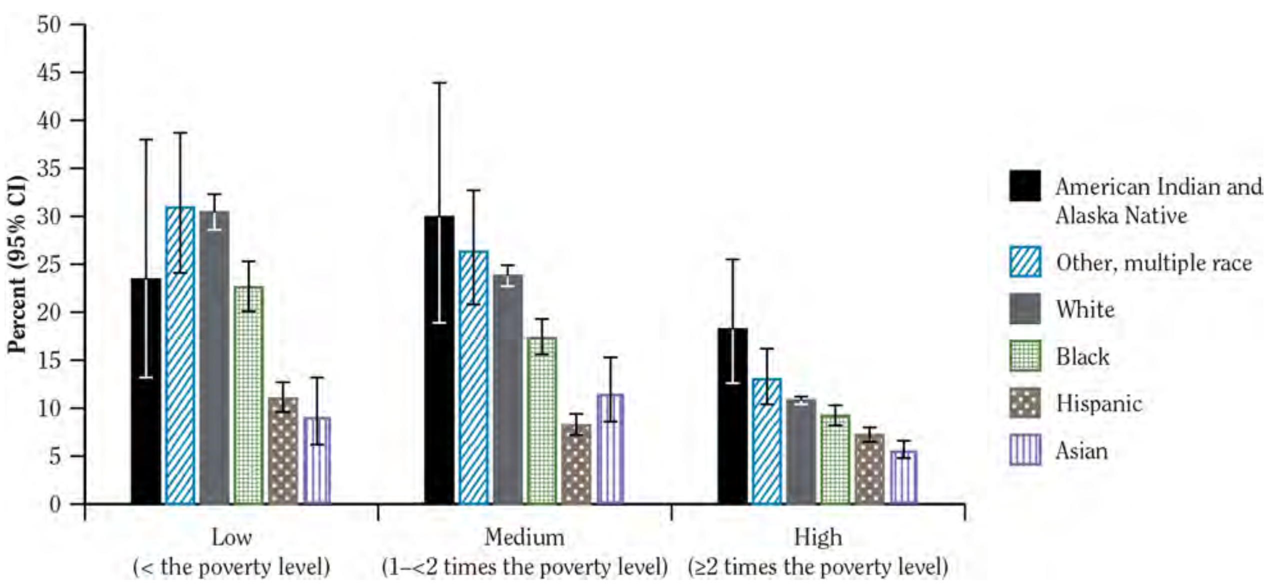
Interventions that are solely focused on tobacco product use and exposure, rather than social and structural drivers of multidimensional disparities, are unlikely to sustainably promote health equity across its multiple dimensions (including but not limited to other risk factors for chronic disease as poor diet, physical inactivity, social isolation, and excessive alcohol use). Social and structural interventions—or efforts to "change the social, physical, economic, or political environments that shape or constrain health" including by addressing social determinants of health such as limited educational and employment opportunities, safe and quality housing, and discrimination—are worthy of attention and engagement by groups that have historically focused on more narrowly defined behaviors and outcomes (National Institutes of Health 2022). For example, data presented in Chapter 2 and in Figures 8.1 and 8.2 demonstrate that disparities in smoking by race and ethnicity or by sexual orientation narrow or disappear altogether among those with incomes greater than twice the poverty level. A both/and approach—combining tobacco-specific interventions with social and structural determinant interventions—is warranted to maximize the impact of efforts on tobacco-related health equity, particularly given the explicit tactics of the tobacco industry to target communities and undermine public health efforts.

Recognizing that cross-cutting efforts are needed that shift from siloed approaches "tackling inequities one disease, organ system, or life stage at a time," the National Institutes of Health announced the Community Partnerships to Advance Science for Society (ComPASS) strategy to address structural factors that impact multiple dimensions of health (National Institutes of Health 2022). It will be critical to measure the potential impact of these efforts on tobacco-related health equity, and for organizations typically involved in more narrowly defined efforts (i.e., tobacco control) to participate in and learn from these efforts.

Considerations for Advancing Equity in Endgame Approaches

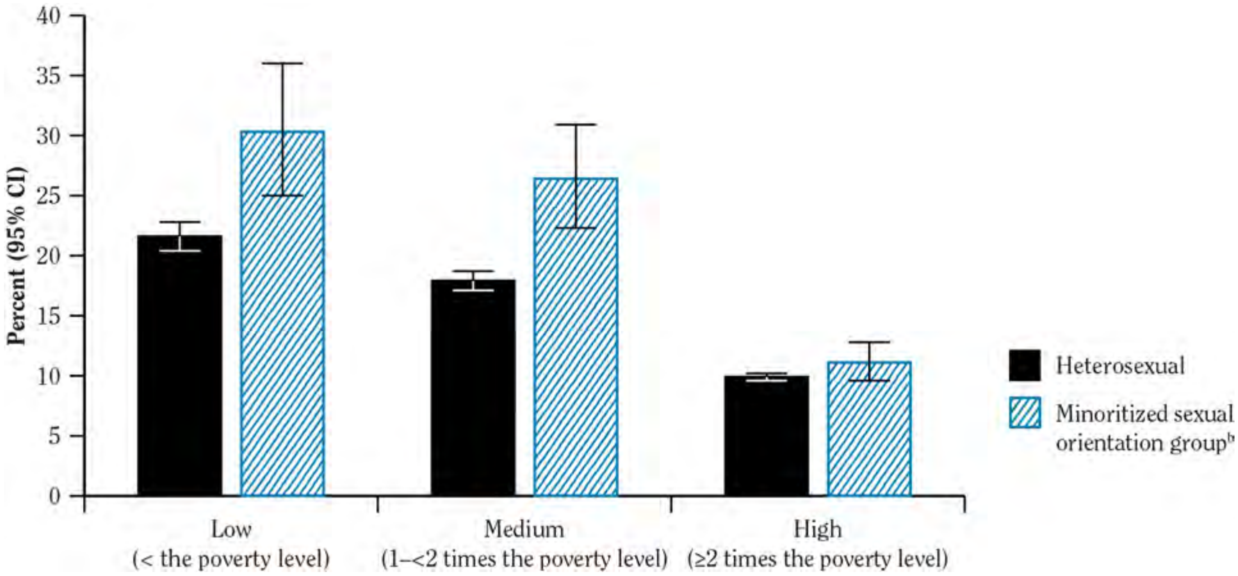
The 2014 and 2020 Surgeon General's reports on tobacco (USDHHS 2014, 2020) offered recommendations to advance the tobacco endgame to eliminate the burden of death and disease caused by commercial tobacco use. The 2014 report concluded that "the burden of death and disease from tobacco use in the United States is overwhelmingly caused by cigarettes and other combustible tobacco products; rapid elimination of their use will dramatically reduce this burden" (USDHHS 2014, p. 7). Both

Figure 8.1 Prevalence of current use of cigarettes among adults, 18 years of age and older, by race and ethnicity and socioeconomic status;[a] National Health Interview Survey (NHIS) 2019–2021 combined data, United States



Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.
[a]Socioeconomic status was assessed by calculating the ratio of family income to the corresponding poverty threshold.

Figure 8.2 Prevalence of current use of cigarettes among adults, 18 years of age and older, by sexual orientation and socioeconomic status;[a] National Health Interview Survey (NHIS) 2019–2021 combined data, United States



Source: NHIS, National Center for Health Statistics, public use data, 2019–2021.
[a]Socioeconomic status was assessed by calculating the ratio of family income to the corresponding poverty threshold.
[b]The minoritized sexual orientation group includes adults who identified as gay, lesbian, or bisexual or who reported "something else."

reports acknowledged that without endgame solutions, population-based tobacco prevention and control strategies are necessary but insufficient to end the tobacco epidemic. Two strategies to advance the tobacco endgame were prominently discussed in the 2014 and 2020 reports:

- Implementing a tobacco product standard to lower the level of nicotine in cigarettes to minimally addictive or nonaddictive levels; and

- Restricting the sale of tobacco products, such as prohibitions on entire categories of tobacco products.

Progress has occurred in these domains in recent years, particularly in terms of local policies that prohibit the sale of menthol and other flavored products or of tobacco products altogether, but the end is not yet in sight. As noted earlier, FDA has advanced proposed rules to prohibit menthol as a characterizing flavor in cigarettes and to prohibit characterizing flavors in cigars (*Federal Register* 2022a,b) and also announced its intention to advance a product standard to reduce nicotine in cigarettes and certain other combustible tobacco products to minimally addictive or nonaddictive levels (*Federal Register* 2018).

There remains, however, a lack of consensus about whether endgame strategies should seek to eliminate *combustible* tobacco product use or to eliminate *all* tobacco product use. Because the tobacco industry has an obvious financial stake in preferred endgame objectives, it is important to consider conflicts of interest in the industry's efforts to influence endgame planning (Briggs and Vallone 2022).

Importantly, dialogue around the endgame has evolved to focus not only on tobacco use by individuals but also on the tobacco industry's influence on society. For example, the UNDO project from the California Department of Public Health frames endgame initiatives as an effort to "undo the tobacco industry's influence" on individuals, communities, and society (UNDO n.d.). Similarly, Malone and colleagues (2014, p. 10) frame endgame strategies as "[I]nitiatives designed to change/eliminate permanently the structural, political and social dynamics that sustain the tobacco epidemic, in order to achieve within a specific time an endpoint for the tobacco epidemic." Structural dynamics include the inequitable distribution of burdens that perpetuate use, including retailer density; political dynamics include industry lobbying, community engagement (including allyship) and front groups; and social dynamics include the public's acceptance of the sale of addictive, deadly products. "For any endgame plan," Smith and Malone (2020, p. 705) later wrote, "the narrative about cigarette sales must shift to end the perception that cigarettes are an ordinary consumer product. Rather, selling cigarettes should be characterised as selling an inherently defective/unsafe product that falls into the same category as contaminated food, asbestos and lead paint." Similarly, Malone and Proctor (2022, p. 376) advocate for framing the end of tobacco sales as a strategy to "enhance human health and freedom" rather than *prohibition*—a polarizing term implying a loss of freedom that they believe has served as an obstacle to meaningful dialogue on endgame solutions.

To advance human well-being, tobacco endgame strategies must also ensure that groups disproportionately burdened by tobacco-related morbidity and mortality (within and across population groups), which are often the same groups facing other forms of structural and social disadvantage, are given primary consideration, are not an afterthought, and are meaningfully seated at the proverbial and strategic discussion table. Unless equity is a central focus of efforts, the possibility exists for endgame approaches to

- Exacerbate existing disparities, for example, if they are concentrated in high-resource communities or supplant efforts to address social and structural determinants of health; or

- Be used by the tobacco industry to justify targeted marketing of (a) e-cigarettes and other products that are promoted as "reduced-harm" and (b) commercial cannabis to population groups that are already burdened by health-related disparities and that would otherwise completely quit using tobacco products.

Given these considerations, the overriding objective of endgame efforts is to advance health equity by creating and promoting fair and just opportunities and social, structural, and political conditions for all people to live a healthy life that is free from commercial tobacco-related disease, disability, and death. Table 8.2 outlines examples of potential health equity safeguards in endgame approaches to simultaneously address the *appeal* (including flavors), *addictiveness* (including nicotine levels), and *availability* of commercial tobacco products (including sales, marketing, and retailer density). These efforts to reduce appeal, addictiveness, and accessibility would be expected to result in true harm reduction at the population level. Tobacco-specific endgame interventions should complement, not replace, practices to remove the underlying social, structural, and political barriers to health equity (Table 8.3).

Endgame approaches should incorporate health equity safeguards. For example, an approach to comprehensively address appeal and addictiveness is important to optimally promote health equity. Specifically, given the disproportionate use of menthol cigarettes and cigars by

Table 8.2 Health equity safeguards in endgame approaches

Potential strategy	Potential health equity safeguards
Reduce nicotine in cigarettes and other tobacco products to minimally addictive or nonaddictive levels	• Ensure parity of nicotine levels across tobacco products, including little cigars and cigarillos • Ensure removal of menthol, mint, and other cooling chemical additives at any level across all tobacco products, including products advertised as low nicotine • Prohibit substitution of nicotine with nicotine analogs or other additives, constituents, or components that increase the addictive nature of tobacco; authorize regulation of nicotine analogs • Develop immediate strategic solutions to address geographic, technologic, and systemic barriers to population access to evidence-based cessation support, such as advice to quit, quitlines, reach of mass media campaigns, and no- to low-cost pharmacotherapy and behavioral cessation counseling • Monitor and counter potential unintended consequences of tobacco policy interventions, such as switching from tobacco to cannabis, inequitable enforcement or increased profiling of communities, and illicit sales • Equitably enforce existing and future regulations against retailers and manufacturers that continue to sell tobacco products and/or components illegally
Restrict the manufacture and/or sale of flavored tobacco products, including menthol cigarettes and flavored cigars	• Ensure removal of menthol at any level across all tobacco products, including very low nicotine cigarettes and cigars • Eliminate chemicals, additives, constituents, and components, including sweeteners and coolants, that impart taste, smell, or sensations that reduce harshness or increase the appeal of tobacco products • Reduce the nicotine in cigarettes and other tobacco products to nonaddictive levels • Develop plans to enforce flavor restrictions and to penalize manufacturers, distributors, and retailers for noncompliance • (As above) Develop immediate strategic solutions to address geographic, technologic, and systemic barriers to population access to evidence-based cessation support, such as advice to quit, quitlines, reach of mass media campaigns, and no- to low-cost pharmacotherapy and behavioral cessation counseling

Table 8.2 Continued

Potential strategy	Potential health equity safeguards
Restrict consumer marketing of tobacco products	• Prioritize the enforcement of marketing restrictions on retailers (e.g., in-store and exterior ads for tobacco products at retail stores) and restrictions on marketing by tobacco company sales representatives to retailers (e.g., urging retail store owners to sign up for tobacco company “participating retailer programs,” or to increase amount of high-visibility, behind-the-counter shelf space dedicated to tobacco products) in communities with low resources and/or high densities of tobacco retailers • Create a new public health workforce of faith leaders, community leaders, and youth and young adults who are advocates for and engage in commercial tobacco countermarketing, including countermarketing related to menthol • Work with urban and rural development partners to transform low-resource communities into healthy communities that support the marketing, sales, and promotion of healthy products and that reject harmful products
Restrict the manufacture and/or sale of entire categories of tobacco products, such as combustible tobacco products	• Build trusting relationships across communities, conduct research to understand and address community concerns, and use messages emerging from communities to inform endgame efforts • (As above) Create a new public health workforce of faith leaders, community leaders, and youth and young adults who are advocates for and engage in commercial tobacco countermarketing, including countermarketing related to menthol • Work with and invest in minority-owned retailers and retailers in low-resource communities to support the marketing of healthy products and reject harmful products • Prioritize efforts in racially, ethnically, and socioeconomically diverse communities that are disproportionately affected by tobacco marketing • Reduce product addictiveness and appeal by eliminating flavors and lowering nicotine levels to increase the acceptability of sales bans and to reduce incentives for consumers to cross community, state, or tribal lines to purchase tobacco products • Work with leaders of Indigenous population groups to identify replacement products for commercial tobacco products that are sold on tribal reservations and in casinos, while respecting tribal sovereignty • Identify incentives for workplaces, including casinos, that employ wage workers to create and support smokefree air environments • (As above) Develop immediate strategic solutions to address geographic, technologic, and systemic barriers to population access to evidence-based cessation support, such as advice to quit, quitlines, reach of mass media campaigns, and no- to low-cost pharmacotherapy and behavioral cessation counseling
Prevent sales of tobacco products to future generations	• Eliminate penalties for purchase, use, or possession of tobacco products while allowing youth to participate in appropriately supervised evaluations of retailer customer-age compliance • Prevent substitution of cannabis, synthetic nicotine, and nicotine analogs for tobacco products. • Prohibit internet sales of all tobacco products • Enforce restrictions on internet sales of commercial tobacco products • Support cessation interventions across the lifespan, including among older adults

some groups, if nicotine in cigarettes is lowered to minimally or nonaddictive levels without removing menthol, or if nicotine limits in cigarettes are not applied to other combustible tobacco products, such as cigars, then existing tobacco-related health disparities have the potential to widen, even if there is a benefit to the overall population.

Tobacco-related health disparities may also intensify if endgame policies only advance in high-resource communities. For example, although public support exists for restrictions on the sale of all tobacco products, with 57.3% of 6,455 adults surveyed supporting such a policy (Al-Shawaf et al. 2023), only two communities have done so: Beverly Hills and Manhattan Beach, California. The populations of these communities are more than 70% non-Hispanic White (compared with 57.8% nationwide), and the median household income exceeds $100,000 (compared with $67,521 nationwide) (U.S. Census Bureau n.d.). The solution is not to stifle endgame policy efforts; many of the most effective tobacco prevention and control interventions, such as smokefree laws, originated at the local level, including in high-resource communities, before becoming normalized and widespread (USDHHS 2014). Nevertheless, decades after the smokefree movement began, persistent inequities in protections from exposure

Table 8.3 Potential social, structural, and political strategies to remove barriers to tobacco-related health equity

Domain	Example strategy
Social	• Work with communities to develop and provide resources for solutions that support all dimensions of well-being and address social determinants—such as poverty, racism, and inequity—in education, healthcare, housing, and other domains • Invest in resources to denormalize commercial tobacco products and expose tactics of the tobacco industry • To the extent legally permissible, restrict commercial tobacco advertising, sponsorship, and product placement, particularly in communities that are disproportionately harmed by commercial tobacco products • Invest in resources in communities to (re)construct a culture of health and deconstruct a culture of tobacco use promoted through targeted marketing
Structural	• Invest in resources to advance equity in access to high-quality and affordable education, transportation, housing, jobs, and mental and physical healthcare • Divest from the commercial tobacco industry • Commit funding to support community-based and/or academic institutions that monitor (a) the implementation of commercial tobacco control policies and (b) emerging tobacco industry tactics to expand product markets to disparate communities • Reduce the disproportionate concentration of tobacco retailers in neighborhoods that are economically disadvantaged; have greater concentrations of residents from minoritized racial and ethnic groups; and have greater concentrations of people who identify as LGBTQI+ • Launch new partnerships to collaborate on ways that the U.S. Department of Health and Human Services, including the U.S. Food and Drug Administration, can work together with law enforcement agencies to address systemic racism and ensure equitable enforcement of commercial tobacco control policy protections, holding industry, businesses, and law enforcement agencies accountable rather than individuals and communities • Invest in resources to convene and support urban and rural development partners to redesign low-resource communities into healthy communities that support the marketing, sales, and promotion of healthy products and that reject harmful products
Political	• Identify and eliminate potential conflicts of interest in policy development and implementation processes and hold actors accountable for avoiding conflicts of interest • Counter protobacco influences, including through litigation and industry, legislative, and regulatory mechanisms • Eliminate preemption and preserve authority to enact more protective measures at lower levels of government

to secondhand smoke suggest that endgame strategies will not end the tobacco epidemic unless racially, ethnically, and socioeconomically diverse communities that are disproportionately subjected to tobacco marketing and exposure are viewed as equally deserving of such efforts and are allotted equitable resources, conditions, and opportunities to lead and implement such efforts. Tobacco control practitioners can work with communities to advance approaches that emanate from and resonate with residents. Simultaneously, comprehensive federal restrictions on the appeal and addictiveness of tobacco products, including flavors and levels of nicotine, could complement a gradual phaseout of cigarette sales and reduce incentives to cross state, local, or tribal borders to purchase tobacco products (Smith and Malone 2020).

Efforts to curtail the social, structural, and political dynamics that perpetuate the tobacco industry's influence on society are essential complements to endgame policy approaches. Table 8.3 provides examples of these potential strategies, which align with Figure 1.1 in Chapter 1 of this report by seeking to (a) change the social context that manifests as systems, institutions, policies, and funding and investment; and (b) closely regulate channels used by the tobacco industry that result in tobacco-related health disparities, including marketing, supply, and corporate citizenship. Emerging funding efforts, such as the aforementioned ComPASS program from the National Institutes of Health, aim to fund community-led organizations to develop and implement health equity structural interventions and intervene on structural factors that produce and perpetuate health disparities. To ground and bolster these complementary equity-oriented solutions in tobacco endgame strategies, meaningful community participatory and collaborative approaches with decision makers and other multisectoral partners (e.g., tobacco control, public health, public policy, research, healthcare, and civil rights organizations) are needed in all phases and stages of work (Organizing Committee for Assessing Meaningful Community Engagement in Health & Health Care Programs & Policies 2022).

Finally, as previous Surgeon General's reports on tobacco have emphasized (USDHHS 2014, 2020), endgame approaches, including structural interventions, should complement tobacco prevention and control strategies proven to reduce tobacco use at the population level, such as tobacco price increases, comprehensive smokefree policies, hard-hitting media campaigns, and barrier-free cessation support.

The Call to Action

The 1998 Surgeon General's report was the first to focus exclusively on tobacco-related health disparities in racial and ethnic groups (USDHHS 1998). Surgeon General David Satcher, who commissioned the 1998 Surgeon General's report, stated that, "to eliminate disparities in health, we need leaders who care enough, know enough, will do enough, and are persistent enough" (Satcher and Higginbotham 2008, p. S10). A whole-of-society approach is needed that holds institutions, leaders, and individuals accountable for progress (Mills et al. 2022). This call to action includes strategies to address root causes of tobacco-related health disparities and their social, structural, economic, and political dimensions.

What Governments (Including Those at the Local, State, Territorial, Tribal, and Federal Levels) Can Do

- Prioritize and invest in initiatives that directly support changing the structural and social determinants of health that drive tobacco-related health disparities. This includes investments in communities and multisectoral collaborations to address the built environment, social and community contexts, quality of and access to education and healthcare, and structural racism and discrimination.

- Incorporate social determinant interventions as part of a comprehensive tobacco prevention and control approach. This includes providing resources to support social determinant interventions that address the conditions in which people are born, grow, work, live, and age within CDC's *Best Practices for Comprehensive Tobacco Control Programs—2014* (CDC 2014) (Table 8.3).

- Prioritize geographic areas and populations that are not yet protected by evidence-based tobacco control interventions, including comprehensive smokefree protections and price increases for tobacco products. Dedicate revenue from tobacco excise taxes to advancing tobacco-related health equity. Work with communities, academic partners, and other interested partners to develop novel and strategic initiatives that support the implementation of such interventions while addressing social determinants.

- Invest in robust surveillance systems that measure self-identified characteristics among youth and adults who are at increased risk for tobacco use and targeted marketing by the tobacco industry, disaggregated sociodemographic constructs and other markers of disparity, and social determinants of health and other drivers of commercial tobacco-related disparities. Invest in oversampling of population groups that are subject to tobacco-related health disparities, for example in alignment with CDC's *Identifying and Eliminating Tobacco-Related Disparities: Key Outcome Indicators for Evaluating Comprehensive Tobacco Control Programs—2014* (CDC 2022a).

- Advance endgame approaches that fundamentally alter the appeal, addictiveness, and availability of commercial tobacco products. Ensure that endgame approaches advance health equity, are accompanied by meaningful expansion of access to and utilization of evidence-based cessation treatments, and employ safeguards against unintended consequences (Table 8.2).

- Ensure equitable policy protections for individuals, including nonselective implementation and enforcement (Box 8.1).

- Work with healthcare organizations to support innovative healthcare delivery models (e.g., telehealth, population management strategies) that increase access to cessation services. This includes supporting reimbursement of such services and robust evaluation of effectiveness, particularly in populations impacted by tobacco-related disparities. Additionally, support and expand the use of clinical quality measures related to tobacco use screening and treatment to assess performance and incentivize care delivery.

Box 8.1 What can be done at the local, state, and federal levels to advance equitable enforcement of evidence-based tobacco prevention and control strategies?

- Reform or eliminate enforcement practices for violations of local or state sales or smoke-free laws that target individual consumers, including youth, and prioritize policy enforcement efforts that focus on industry actors;
- Ensure that enforcement practices and penalties for violations of tobacco-free schools and similar policies are proportional to the alleged violations and leverage restorative justice and positive disciplinary alternatives for individuals instead of traditional enforcement mechanisms;
- Monitor unintended consequences of tobacco policy interventions, particularly for communities and population groups that are disproportionately affected by health inequities;
- Ensure that city planning prioritizes health equity by reducing the density of tobacco retailers and by affording spaces and places with equitable and comprehensive smokefree air protections (e.g., included as a condition of rezoning);
- Work with and respect community members as the experts on their own local conditions;
- Protect all people, regardless of location, by limiting exposure to marketing from the tobacco industry to the extent legally permissible;
- Respect tribal sovereignty and distinguish between ceremonial tobacco and commercial tobacco in policies and programmatic initiatives;
- Allow for self-determination and limit the use of preemption by higher levels of government, which can thwart local policies that have the potential to improve health equity and reduce tobacco-related health disparities; and
- Ensure that policy implementation and enforcement is accompanied by meaningful expansion, promotion, and access to cessation services.

- Expand Medicaid eligibility and enrollment and ensure comprehensive, barrier-free cessation coverage for all Medicaid enrollees. Support health plans, including Medicaid, in identifying enrollees who use tobacco products to facilitate promotion of and connection to cessation supports without stigma, penalty, or barriers to coverage access.
- Advance comprehensive regulatory policies at multiple levels rather than industry self-regulatory approaches. Limit policy exemptions that may lead to loopholes in or inequitable implementation of comprehensive policies.
- Identify and eliminate potential conflicts of interest when conducting, disseminating, and translating science that informs government-sponsored programs, initiatives, and regulatory actions. This can include relying on independent, rather than industry-sponsored, study findings when assessing the health impacts of novel tobacco products.

What Public and Private Sector Funders and Foundations Can Do

- Fund and incentivize cross-cutting, multisectoral initiatives to address upstream structural and social determinants of health, including tobacco-related health equity as an intended outcome.
- Ensure equity in funding practices, including conceptualization, selection, and implementation. Ensure community voices and diverse partners are represented in decision making and that solutions address community-articulated problems, questions, and needs. Expand the investment of structural interventions and provide significant resources for capacity building to support structural changes.
- Supplant tobacco industry funding with funding to civil rights, religious, and community-serving organizations.
- Disincentivize acceptance of tobacco industry funds among applicants and awardees, including through conditions of disclosure and funding, to the extent permissible. Require funded initiatives to measure the impact on equity. This includes the impact related to commercial tobacco initiation, tobacco cessation, and exposure to secondhand tobacco smoke.
- Fund sustainable, community-based participatory research initiatives. Dedicate funds for meaningful dissemination of findings to community members.
- Divest endowments from tobacco companies.

What Public Health Practitioners and Health Communicators and Educators Can Do

- Equitably implement CDC's *Best Practices for Comprehensive Tobacco Control Programs—2014* (CDC 2014), prioritizing populations that are not yet protected by evidence-based tobacco prevention and control strategies. This includes efforts to increase the price of tobacco products (including through excise taxes, minimum price policies, and elimination of discounts) and dedicate revenues to tobacco control; advance smokefree protections, including in multi-unit housing; implement evidence-based tobacco countermarketing campaigns; and promote barrier-free access to and utilization of tobacco cessation treatment.

- Distinguish between commercial and traditional tobacco and acknowledge and respect the positive meanings of traditional tobacco for American Indian people.

- Advance social, structural, and political strategies to remove barriers to tobacco-related health equity by working in partnership with communities most impacted by the harms of commercial tobacco (Table 8.3). Bolster accessibility and appropriateness of health communications and countermarketing efforts. This includes developing and disseminating culturally appropriate communication efforts to raise awareness and counter disinformation about commercial tobacco products, including the goals of interventions to advance tobacco-related health equity.

- Scale up culturally relevant, free, and accessible resources that support tobacco cessation and that feature diverse and intersectional population groups and their experiences. Develop community-informed cessation resources and interventions.

- Work with healthcare systems and organizations to support the integration of tobacco use screening and treatment into routine clinical care for all patients. This includes ensuring that all healthcare facilities, including behavioral healthcare settings, are tobacco-free.

- Enhance the timely identification and measurement of commercial tobacco-related health disparities and drivers of health inequities. This can include:

  – Routinely measuring and reporting disaggregated sociodemographic characteristics and drivers of social and structural inequity;

  – Collaborating with researchers to gather data to support further development of interventions; and

  – Conducting health equity impact assessments and equity-framed monitoring and evaluation to inform communications, research, surveillance, program, and policy efforts.

What Healthcare Professionals and Healthcare Organizations Can Do

- Advance the accessibility and availability of cessation services to improve equity in treatment access and utilization. By acknowledging that healthcare is not accessed, experienced, and/or received equitably by all people and population groups, healthcare professionals and healthcare organizations can:

  – Integrate clinical screening and treatment for all commercial tobacco use (not just cigarettes) in all healthcare settings and with all patients;

  – Ensure that clinical protocols for tobacco use screening and treatment are patient-centered and facilitate the receipt of evidence-based cessation treatment;

  – Increase access to innovative, accessible, and culturally and linguistically appropriate cessation services, including in geographic areas where policy protections are uneven or do not exist;

  – Create and sustain linkages to community cessation services (e.g., state quitlines) to enhance referrals, data sharing, and patient follow-up in an effort to increase patient access to and engagement with cessation supports;

  – Evaluate care delivery and quality of care for specific population groups that are impacted by tobacco-related disparities;

  – Ensure that all healthcare settings, including behavioral healthcare settings, are tobacco-free, with no exceptions; and

  – Provide barrier-free, widely promoted coverage of all evidence-based cessation treatments by all types of health insurers.

- Enhance and extend meaningful collaboration and partnerships between healthcare institutions, community healthcare clinics, community-based cessation services, community health workers, and community members. This includes conducting clinical screening of all patients to assess the use of tobacco products, delivering clinical cessation services to those who screen positive, and referring patients to adjunct services that can support and extend clinical care.

- End bias in screening for tobacco use and delivering cessation treatment through systems change and training at all levels. Work with medical and healthcare professional associations, educational institutions, and continuing education vendors to eliminate bias that may impede clinical screening for tobacco product use and the timely and appropriate delivery of and referral to cessation treatment.

- Address social determinants of health by incorporating into healthcare interventions ways to attend to the social and structural drivers of tobacco-related health inequities. By acknowledging that social determinants of health impact health-related outcomes, healthcare professionals and healthcare organizations can:

  – Integrate the assessment of social determinants of health, such as housing and food insecurity, into routine clinical care;

  – Develop and implement systems to connect patients with unmet social needs to appropriate community resources and support; and

  – Evaluate the delivery of interventions to address social determinants of health, including interventions among specific population groups experiencing tobacco-related disparities.

What Researchers and Research Institutions Can Do

- Lead with scientific integrity, using quality standards and practices that are grounded in equity. Researchers and research institutions that conduct and devise standard protocols for performing research, surveillance, and evaluation activities can:

  – Ensure the use of health equity principles and approaches in all phases of tobacco-related surveillance, research, and evaluation, including, but not limited to, design, implementation, data interpretation, and dissemination in oral and published reports and manuscripts;

  – Measure and report self-identified categories among youth and adults, sociodemographic constructs and other markers of disparity (e.g., disability, behavioral health conditions, and sexual orientation and gender identity), and social determinants of health and other drivers of commercial tobacco-related disparities; and

  – Use intersectional approaches to analyze and disseminate data that identify tobacco-related health inequities within and across population groups while acknowledging numerous facets of identity that exist and interact among individuals and groups.

- Advance community-based participatory research approaches that respect and acknowledge community strengths and inherent resources. For example, include communities as meaningful partners in all phases and stages of conducted research; ensure research engagements and partnerships are mutually beneficial, strengthen capacity, and create co-learning opportunities; implement sustainable plans for long-term commitment; and disseminate knowledge gained to and through all involved partners.

- Disaggregate data reporting and oversample disparate populations to foster greater understanding of tobacco-related health disparities.

- Go beyond estimating population-level results to include examinations of the effects of strategies for reducing disparities and advancing tobacco-related health equity.

- Measure the use of the full spectrum of commercial tobacco products and flavors, including menthol, along with the social determinants of their use. This includes measuring use and drivers of use pertaining to the varied landscape of tobacco products and flavors among diverse and intersectional population groups.

- Commit to strict implementation of conflict-of-interest policies, including those that prohibit participation in research involving or sponsored by the tobacco industry.

What Businesses and Employers Can Do

- Implement equitable policies and practices that support and protect all members of the workforce. This can include implementing tobacco-free worksite policies that protect all workers across the workforce from exposure to secondhand tobacco smoke; offering living wages and healthcare insurance that includes comprehensive, barrier-free coverage of evidence-based smoking cessation resources; and divesting employer-sponsored retirement funds from the tobacco industry (CEO Cancer Gold Standard n.d.).

- Work independently and with other businesses to denormalize and disincentivize the sale of tobacco products. This can include not displaying tobacco product advertising, not selling tobacco products, and investing in companies that do not sell or advertise tobacco products.

What Schools and Academic Institutions Can Do

- Reinforce campuses as places for learning by establishing tobacco-free campus policies and providing education about the harms of using tobacco products. Leverage restorative justice principles and include alternatives that are less punitive than traditional enforcement mechanisms (e.g., enrollment in or referral to tobacco education and/or cessation services rather than expulsion for using tobacco products).

- Offer, or provide connection to, evidence-based cessation services for faculty, staff, and students who need support quitting tobacco use.

- Reject funding by and engagement with the tobacco industry. Eliminate conflicts of interest in research, curricula, scholarship, employment, and infrastructure initiatives.

- Divest academic institution endowments from tobacco companies.

- Provide supportive infrastructure for community-based participatory research.

What Communities Can Do

- Advance social, structural, and political strategies to remove barriers to tobacco-related health equity (Table 8.3).

- Identify and reject efforts by the tobacco industry to influence policymaking.

- Foster relationships and shared decision making among decision makers, funders, and community members who are most impacted by commercial tobacco. Respect community members as the experts in their own communities.

- Ensure that communities impacted most by tobacco-related health disparities participate in decisions about how resources are used and evaluated.

What Individuals and Families Can Do

- Do not use commercial tobacco products. People who use tobacco products can plan a quit attempt that might include talking to a doctor or other healthcare professional, calling their state tobacco quitline at 1-800-QUIT-NOW, or visiting smokefree.gov for help quitting.

- Encourage friends, family members, and coworkers—including youth—to quit the use of tobacco products. Support them in getting help to quit through such resources as 1-800-QUIT-NOW and smokefree.gov.

- Be an ally and exemplify allyship in principle and practice.

- Acknowledge and remedy social injustices that result in tobacco-related health disparities.

- Hold leaders accountable for protecting the health of all people, including groups that are disproportionately burdened by tobacco-related health disparities, and for ensuring that policy enforcement focuses on the tobacco industry and tobacco retailers instead of focusing on individual consumers and frontline salesclerks.

- Identify and debunk misinformation about commercial tobacco products and tobacco prevention and control strategies.

- Support, reward, and recognize community-serving and civil rights organizations that reject the support of or donations from the tobacco industry.

- Support businesses—especially those serving low-resource communities—that do not sell tobacco products but instead offer consumer products that promote health and wellness.

- Share personal stories about the negative impacts of commercial tobacco use on families.

What Everyone Can Do

- Collaborate to advance a commercial tobacco endgame with the goal of enabling all people to live a healthy life that is free from tobacco use and exposure and from tobacco-related disease, disability, and death.

- Work together and be accountable. Accountability includes aligning resources, stated commitments, and actions to advance health equity.

- Measure progress, reward successes, acknowledge and learn from mistakes, and deploy resources when shortcomings need to be addressed.

Now is the time to move beyond envisioning to realizing a society with equitable opportunities and conditions for all people to live a life free from tobacco use, exposure to tobacco and secondhand tobacco smoke, and death and disease caused by commercial tobacco use. Through our plans, objectives, and actions, together we can achieve tobacco-related health equity.

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List of Abbreviations

μg/m^3	micrograms per cubic meter of air
μM	micromolar
AAC	Ask, Advise, Connect
AAPC	average annual percent change
AAR	Ask, Advise, Refer
ACA	Patient Protection and Affordable Care Act
ACHA	American College Health Association
ACO	accountable care organization
Add Health	National Longitudinal Study of Adolescent to Adult Health
ADI	acceptable daily intake
AIMS	Abnormal Involuntary Movements Scale
ANBL	All Nations Breath of Life
ANPRM	Advanced Notice of Proposed Rulemaking
AoA	Administration on Aging
aOR	adjusted odds ratio
APC	annual percent change
aRR	adjusted relative risk
aRR	adjusted risk ratio
ASQ	Asian Smokers' Quitline
ATP	adenosine triphosphate
AUDADIS-5	Alcohol Use Disorder and Associated Disabilities Interview Schedule-5
BAM	Behavioral Activation Model
BARS	Barnes Akathisia Rating Scale
BASF	Badische Anilin und Soda Fabrik
BOP	Bureau of Prisons
BPRS	Brief Psychiatric Rating Scale
BRFSS	Behavioral Risk Factor Surveillance System
C3I	Cancer Center Cessation Initiative
cAMP	cyclic adenosine monophosphate
CAS	Chemical Abstract Service
CBPR	community-based participatory research
CBT	cognitive behavioral therapy
CCQ	Clinical COPD Questionnaire
CD	compact disc
CDC	Centers for Disease Control and Prevention
CEMA	N-Acetyl-S-(2-cyanoethyl)-L-cysteine
CES	Cigarette Evaluation Scale
CES-D	Center for Epidemiological Studies-Depression Scale
CI	confidence interval
CISNET	Cancer Intervention and Surveillance Modeling Network
CLD	causal loop diagram
CMS	Centers for Medicare and Medicaid Services
CNA	certified nursing assistant
cNRT	combination nicotine patches and nicotine lozenges
CO	carbon monoxide
ComPASS	Community Partnerships to Advance Science for Society
COPD	chronic obstructive pulmonary disease
CORE	Congress of Racial Equality
CPD	cigarettes smoked per day
CPT	cigarette purchase task
CST	cultural smokeless tobacco
DSM IV	Diagnostic and Statistical Manual of Mental Disorders, 4th edition
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, 5th edition
DTBP	ditert butylphenol
DVD	digital video disk
EAGLES	Evaluating Adverse Events in Global Smoke Cessation Study
e-cigarette	electronic cigarette
ED	emergency department
EHR	electronic health record
ENDS	electronic nicotine delivery systems
FD&C Act	Federal Food, Drug, and Cosmetic Act
FDA	U.S. Food and Drug Administration
FEMA	Flavor and Extract Manufacturers Association
FEV1	forced expiratory volume in 1 second
FQHC	Federally Qualified Health Center
FSFW	Foundation for a Smoke-Free World
FTC	Federal Trade Commission
FTCD	Fagerstrom Test of Cigarette Dependence
FTND	Fagerstrom Test of Nicotine Dependence
g	gram
GED	General Educational Development (certificate or diploma)

GHE	general health education
GPCR	G-protein-coupled receptor
GRAS	generally recognized as safe
GRP	Gross Rating Point
GSSP:GSH	ratio of glutathione to oxidized glutathione
HAVE	Host-Agent-Vector-Environment
HBCUs	Historically Black Colleges and Universities
HDM	high-intensity disease management
HONC	Hooked on Nicotine Checklist
HPHC	harmful and potentially harmful constituent
HRBS	Health-Related Behaviors Survey
HRSA	Health Resources and Services Administration
HUD	U.S. Department of Housing and Urban Development
IARC	International Agency for Research on Cancer
ICD	International Classification of Diseases
IFF	International Flavors & Fragrances
IFRA	International Fragrance Association
IOM	Institute of Medicine
IPFQR	Inpatient Psychiatric Facility Quality Reporting
ITC	International Tobacco Control
IVR	interactive voice response
kg	kilogram
LDC	Libre del Cigarrillo
LGBTQ+	lesbian, gay, bisexual, transgender, queer, or intersex
LMF	linked mortality file
LNC	low-nicotine-content
MAO	monoamine oxidase
MBAT	mindfulness-based addiction treatment
MDM	moderate-intensity disease management
MEC	Mobile Examination Center
mg	milligram
mHealth	mobile health
MI	motivational interviewing
mL	milliliter
MNWS	Minnesota Nicotine Withdrawal Scale
MRGPCR	Mas-related G-protein-coupled receptor
MTF	Monitoring the Future
NAACP	National Association for the Advancement of Colored People
nAChR	nicotinic acetylcholine receptor
NASCAR	National Association for Stock Car Auto Racing
NATS	National Adult Tobacco Survey
NCHS	National Center for Health Statistics
NCI	National Cancer Institute
NDI	National Death Index
NDSS	Nicotine Dependence Syndrome Scale
NESARC-III	National Epidemiologic Survey on Alcohol and Related Conditions III
ng	nanogram
ng/mL	nanograms per milliliter
NHANES	National Health and Nutrition Examination Survey
NHIS	National Health Interview Survey
NICU	neonatal intensive care unit
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
nmol	nanomole
NNAL/Cr	4-(methylnitrosamino)-1-(3-pyridyl)-1-butanol/creatinine
NNC	normal-nicotine-content
NNPA	National Negro Publishers Association
NRT	nicotine replacement therapy
NSDUH	National Survey on Drug Use and Health
NTS	nucleus tractus solitarius
NYTS	National Youth Tobacco Survey
OASIS	Overall Anxiety Severity and Impairment Scale
OELs	occupational exposure limits
OR	odds ratio
PAF	population attributable fraction
PAM	Precaution Adoption Model
PANAS	Positive and Negative Affective Schedule
PANSS	Positive and Negative Syndrome Scale
PATH	Population Assessment of Tobacco and Health
PCHQR	PPS-Exempt Cancer Hospital Quality Reporting
PheT	phenanthrene tetraol
PM	particulate matter
PMTA	Premarket Tobacco Product Application
ppm	parts per million
PPS	prospective payment system
PROP	propylthiouracil

PSCDI	Penn State Cigarette Dependence Index
PSS	Perceived Stress Scale
PTC	phenylthiocarbamide
PTSD	posttraumatic stress disorder
QIDS	Quick Inventory of Depressive Symptomatology
QSU	Questionnaire on Smoking Urges-short form
RCT	randomized clinical trial
RELS	recommended exposure limits
RIFM	Research Institute for Fragrance Materials
RNC	reduced-nicotine-content
RR	relative risk
RR	risk ratio
SAF	smoking-attributable fraction
SAMHSA	Substance Abuse and Mental Health Services Administration
SAMMEC	Smoking-Attributable Mortality, Morbidity, and Economic Costs
SANS	Scale for Assessment of Negative Symptoms
SAVM	Smoking and Vaping Model
SBIRT	Screening, Brief Intervention, and Referral to Treatment
SD	standard deviation
SE	standard error
SEM	standard error of the mean
SES	socioeconomic status
SFNTC	Santa Fe Natural Tobacco Company
SGM	sexual and gender minority
SM	sexual minority
SNAP	Supplemental Nutrition Acceptance Program
SNP	single nucleotide polymorphism
SSN	Social Security number
TCPT	Tobacco Control Policy Tool
TLVs	threshold limit values
TNE	total nicotine equivalents
TPSAC	Tobacco Products Scientific Advisory Committee
TRP	transient receptor potential
TRPA1	transient receptor potential ankyrin 1
TRPM8	transient receptor potential melastatin 8
TUS-CPS	Tobacco Use Supplement to the Current Population Survey
UNC	usual-nicotine-content
USDHEW	U.S. Department of Health, Education, and Welfare
USDHHS	U.S. Department of Health and Human Services
USSTC	U.S. Smokeless Tobacco Company
VA	U.S. Department of Veterans Affairs
VLNC	very-low-nicotine-content
WHO	World Health Organization
WIC	Women, Infants, and Children
WISDM	Wisconsin Inventory of Smoking Dependence Motives
WS	Wilkinson Sword
YLD	years of life lived with disability or injury
YLL	years of life lost
YRBS	Youth Risk Behavior Survey
YRBSS	Youth Risk Behavior Surveillance System

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