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Sexual Orientation and Health Disparities: Understanding Group Differences in Mental Health, Resilience, and Substance Use

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Sexual Orientation and Health Disparities:

Understanding Group Differences in Mental Health, Resilience, and Substance Use

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Community Health Sciences

by

Evan Austin Krueger

2019

ABSTRACT OF THE DISSERTATION

Sexual Orientation and Health Disparities:

Understanding Group Differences in Mental Health, Resilience, and Substance Use

by

Evan Austin Krueger

Doctor of Philosophy in Community Health Sciences

University of California, Los Angeles, 2019

Professor Donald E. Morisky, Co-Chair

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Sexual orientation health disparities are well-documented. However, sampling and measurement limitations frequently require researchers to collapse distinct sexual minority subgroups into a single "lesbian, gay, or bisexual" (LGB) analytic group, obscuring subgroup differences in health (e.g., between lesbians/gay men, bisexuals, and heterosexuals reporting same-sex attractions or behaviors ["heterosexual-identified sexual minorities, HSM"]). While a growing, but limited body of research has shown that different subgroups of sexual minorities vary on the basis of mental health status and substance use behaviors, little is known about the factors contributing to subgroup differences in health. This dissertation attempts to fill this gap in the literature using nationally-representative quantitative data. Heterosexuals reporting only

opposite-sex attractions and behaviors ("heterosexuals") are compared to three sexual minority subgroups (lesbians/gay men, bisexuals, and HSM) in each of three studies.

In a first study, group differences in mental health (SF-12) were assessed, and across a range of sociodemographic, lifestyle, and psychosocial characteristics. Next, the degrees to which sociodemographic, lifestyle, and psychosocial characteristics attenuated mental health disparities between heterosexuals and each sexual minority subgroup were assessed. A second study assessed sexual orientation group differences in mental health resilience, among those reporting two or more stressful life events in the past year. Path analysis assessed the degree to which social support mediated (i.e., accounted for) subgroup differences in "thriving" and "languishing" resilience status. In a third study, group differences in DSM-V alcohol, tobacco, and cannabis use disorders were assessed between sexual orientation subgroups. Path analyses assessed the degree to which stressful life events mediated substance use disparities between heterosexuals and sexual minority subgroups, as well as the degrees to which stressful life events and LGB discrimination events mediated differences in substance use among sexual minority subgroups.

Together, findings from all three papers underscore the broad diversity that exists across subgroups of sexual minorities. Further, these papers highlight that while sexual minorities share common experiences of poor mental health and increased substance use, relative to heterosexual people, that important health and social differences also exist *within* the sexual minority population. These papers contribute new knowledge to our understanding of sexual minority health disparities, and to the social determinants of mental health, resilience, and substance use.

The dissertation of Evan Austin Krueger is approved.

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2019

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LIST OF ACRONYMS

DSM Diagnostic and Statistical Manual
HSM Heterosexual-identified sexual minority
LGB Lesbian, gay, bisexual
LGBT Lesbian, gay, bisexual, transgender
SLE Stressful Life Events
SUD Substance Use Disorder

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Portions of this dissertation have been published previously or are currently under consideration for publication. Specifically, portions of Chapter 2 and results from Chapter 4 have been published previously. The author's rights were retained for use of this article for the dissertation, and no additional permissions are required. E.A.K. conceived the research questions, directed the analysis, and drafted all parts of the manuscript. D.M.U. advised on the analysis and contributed to writing of the manuscript. The final publication is available at https://link.springer.com/article/10.1007/s00127-018-1649-0. The full bibliographic citation is:

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CHAPTER 1. Introduction

Sexual Orientation, Health Disparities, and Minority Stress

Sexual orientation health disparities are well-documented, with a large body of work devoted to exposing disparities in mental health (Bostwick, Boyd, Hughes, & McCabe, 2010; Cochran, Sullivan, & Mays, 2003; Graham et al., 2011; Ward, Dahlhamer, Galinsky, & Joestl, 2014). For instance, compared to heterosexuals, sexual minority people (e.g., people who identify as lesbian, gay, or bisexual [LGB]) report more depression symptoms and diagnoses, especially among youths (Almeida, Johnson, Corliss, Molnar, & Azrael, 2009; Cochran, 2001; Cochran & Mays, 2000; Marshal et al., 2011; Russell & Joyner, 2001). Sexual minorities are also more likely than heterosexuals to experience mental distress and mood and anxiety disorders (Bostwick et al., 2010; Cochran et al., 2003), and are more likely to attempt suicide (King et al., 2008).

A rapidly growing body of research is also devoted to uncovering sexual orientation disparities in substance use. Sexual minority people are disproportionately more likely than heterosexuals to report use and dependence on a wide range of both legal and illicit substances, including alcohol (Fish, Hughes, & Russell, 2018; Hatzenbuehler, Corbin, & Fromme, 2008), tobacco (Blosnich, Farmer, Lee, Silenzio, & Bowen, 2014; Lee, Griffin, & Melvin, 2009; McCabe et al., 2018), marijuana, and other substances (McCabe, Hughes, Bostwick, West, & Boyd, 2009; NIDA, 2017; Watson, Goodenow, Porta, Adjei, & Saewyc, 2018).

Stress theories attribute many health disparities to chronic exposure to socially-derived stress (Aneshensel, 1992; Pearlin, Menaghan, Lieberman, & Mullan, 1981; Turner, 2010). In addition, Minority Stress Theory describes how sexual minority people experience stress

resulting from one's (real or presumed) minority status (e.g., discrimination or harassment based on sexual orientation) (Meyer, 1995, 2003a). Indeed, Minority Stress Theory was initially developed to explain sexual minority disparities in mental health (Fingerhut, Peplau, & Gable, 2010; Hatzenbuehler, 2009; Hatzenbuehler, Nolen-Hoeksema, & Erickson, 2008; Juster, Smith, Ouellet, Sindi, & Lupien, 2013; Lewis, Derlega, Griffin, & Krowinski, 2003; Meyer, 1995, 2003a; Wight, LeBlanc, de Vries, & Detels, 2012). However, it has since been applied to describe a range of disparities in physical and physiological health (Cochran & Mays, 2007; Everett, Rosario, McLaughlin, & Austin, 2014; Hatzenbuehler & McLaughlin, 2014; Hatzenbuehler, McLaughlin, & Slopen, 2013; Juster et al., 2013; Lick, Durso, & Johnson, 2013), as well as health behavior (Hatzenbuehler, Nolen-Hoeksema, et al., 2008; Marshal et al., 2008), including substance use.

Alternative mechanisms.

Despite the rapid proliferation of sexual minority health research, much still remains to be studied. For instance, while sexual minority disparities exist across a wide range of health and social conditions, mechanisms beyond minority stress are not commonly proposed, and are seldom tested formally. Minority stress is an invaluable explanatory model for understanding the processes affecting the health of sexual minority populations, but in addition to stressors such as discrimination, the theory suggests sexual minority people are also exposed to more "general" stressors, not necessarily related to their minority statuses (e.g., job strain, financial burden) at higher rates than heterosexual people (Hatzenbuehler, Nolen-Hoeksema, et al., 2008; Hatzenbuehler, Phelan, & Link, 2013; Meyer, 2003a, 2003b; Phelan, Link, & Tehranifar, 2010). However, relatively little work has explored whether, or how, these stressors are associated with sexual minority disparities in health.

Other explanatory models, outside of stress frameworks, are also useful for understanding sexual minority health. For instance, Fundamental Causes Theory describes the "social patterning of disease," defining how social conditions serve as important "upstream" determinants of health and disease. The theory seeks to explain that distal social factors serve as root causes of health outcomes, which are mediated by health behaviors and other factors more proximal to the individual. Indeed, distal to the individual, social factors influence, and provide a context within which more proximal factors, such as health behaviors, operate and influence health (Link & Phelan, 1995; Phelan et al., 2010). In addition to health outcomes, prior research has shown that sexual minorities experience disparities across a wide range of factors that are "upstream" to health, including education, income, and even sleep quality (Badgett, 1995, 1996; Chen & Shiu, 2017; Leppel, 2009).

Sexual orientation subgroups.

Importantly, relatively little work has considered the complex, multidimensional nature of sexual orientation when studying sexual orientation differences in health, stress, and other social patterning mechanisms. While, on average, sexual minorities have poorer mental health and increased substance use relative to heterosexuals (Graham et al., 2011), limited, but growing evidence suggests that mental health differences exist *within* the larger sexual minority population on the basis of sexual identity, with bisexual people experiencing differential, and often greater health disparities than gay and lesbian-identified people (Balsam, Beauchaine, Mickey, & Rothblum, 2005; Koh & Ross, 2006; Marshal et al., 2011; Saewyc et al., 2008). However, given the relatively small sizes of each subgroup, it is commonly necessary to collapse all sexual minorities into a single analytic category (e.g., LGBs) in sexual orientation population

research. Unfortunately, this approach masks any variations that might exist between those utilizing different identity labels.

Additionally, sexual orientation is multidimensional, consisting not just of sexual identity, but also sexual attractions and sexual behaviors. Important operational and measurement differences exist between these measures – distinctions which can alter prevalence estimates of the sexual minority population (Mustanski et al., 2014). For instance, while recent population-based studies estimate between 3-6% of the U.S. population identifies with a sexual minority identity label (e.g., LGB) (Copen, Chandra, & Febo-Vazquez, 2016; Gates & Newport, 2012; Newport, 2018; Ward et al., 2014), upwards of 8% of adults report same-sex sexual behavior, and 11% report same-sex attraction (Gates, 2011). Sexual identity, attraction, and behavior do not always align as expected. Indeed, population studies have shown that similar, or larger, proportions of men and women who report same-sex attractions and behaviors self-identify as heterosexual, rather than as LGB (Gattis, Sacco, & Cunningham-Williams, 2012; Krueger, Meyer, & Upchurch, 2018). Thus, a more complex assessment of sexual orientation is warranted, as single-indicator measures do not comprehensively capture who is included in the population of sexual minorities (Lindley, Walsemann, & Carter, 2012; Munoz-Laboy, 2004; Young & Meyer, 2005).

Population-based samples.

Probability-based samples are generally lauded as the "gold standard" for population research, yet community-derived samples remain the bedrock for research with sexual minority populations. Sampling limitations have long-hindered population research with sexual minority (e.g., lesbian, gay, and bisexual [LGB]) populations; homosexuality has long been stigmatized, with serious social consequences for LGB people (Hatzenbuehler, Phelan, et al., 2013; Meyer,

2003a), and LGBs have historically been a "hard-to-reach" population (Ellard-Gray, Jeffrey, Choubak, & Crann, 2015). Additionally, challenges related to defining and measuring the LGB population have limited the degree to which measures of sexual orientation – identity, attraction, and behavior – are included in population-based research and surveillance studies (Dilley, Simmons, Boysun, Pizacani, & Stark, 2010; Sell, 2007). In recent years, however, probability samples became a viable option for sexual minority health research when large-scale studies began to add questions about sexual minority status, including the National Epidemiologic Survey on Alcohol and Related Conditions, the National Health Interview Surveys, and the Behavioral Risk Factor Surveillance System. Such surveys offer valuable opportunities to understand the health profiles and social experiences of diverse sexual orientation subgroups.

Dissertation Studies

This dissertation contributes to the extant literature in several ways, using a nationally representative sample of U.S. adults. Three studies were undertaken which sought to understand distinctions in mental health status, resilience, substance use, and across a wide range of upstream social determinants across four diverse sexual orientation groups. In each study, heterosexuals reporting only opposite-sex attractions and behaviors were compared to three sexual minority subgroups (lesbians/gay men, bisexuals, and heterosexuals reporting same-sex attractions or behaviors [HSM]). Additionally, all analyses were stratified by gender, in order to focus on differences in health between sexual orientation groups, and the mechanisms driving them, while controlling for potential interactive effects by gender. Each study, and associated aims, are outlined briefly below. Specific research questions, hypotheses, and conceptual models

for each study are described in detail in Chapter 2 (Background, Theoretical Considerations, and Dissertation Studies).

Study 1: Understanding how sexual orientation groups vary across sociodemographic, lifestyle, and psychosocial characteristics, and assessing implications for mental health status.

Sexual orientation disparities (e.g., heterosexual vs LGB) in mental health are well-established (Bostwick et al., 2010; Cochran et al., 2003; Graham et al., 2011; Ward et al., 2014), and to a lesser extent, research has also shown subgroups (e.g., lesbian/gay vs. bisexual) vary with regard to mental health (Cochran & Mays, 2009; Krueger et al., 2018). However, these data present an opportunity to understand the factors that distinguish sexual minority populations from one another, and further, to assess broadly how underlying differences between groups help to explain subgroup differences in mental health, using nationally representative data. Described in detail in Chapter 3, Study 1 relied on a global measure of mental health status (mental health component score, derived from the 12-item short form health survey [SF-12]), rather than on specific measures of mental health symptomatology or diagnoses (e.g., depression, anxiety). Study 1 had two aims.

1. **Aim 1:** To understand how sexual orientation groups vary across a wide range of sociodemographic characteristics, lifestyle behaviors, and psychosocial factors. Among other characteristics, the sociodemographic characteristics that were assessed included age, race/ethnicity, educational attainment, and religiosity. Lifestyle behaviors included, but were not limited to, alcohol and tobacco utilization, physical activity, and presence of

sleep problems. Two psychosocial factors, stressful life events and social support, were assessed.

2. **Aim 2:** To assess whether group differences in sociodemographic characteristics, lifestyle behaviors, and psychosocial characteristics are associated with mental health disparities between heterosexuals and sexual minority subgroups. Specifically, I assessed whether different categories of characteristics (i.e., sociodemographic, lifestyle, and/or psychosocial) attenuated disparities in mental health status between heterosexuals and each sexual minority subgroup.

Study 2: Assessing sexual orientation group differences in social stress, support, and mental health resilience.

Chronic exposure to social stress is associated with poor mental health (Aneshensel, 1992) and sexual minority disparities in mental health can be attributed, in large part, to increased exposure to stress (Meyer, 2003a). However, while population-level health disparities signify that sizeable proportions of sexual minority people indeed have poorer health than heterosexuals, many sexual minorities do not suffer from chronically poor mental health, despite higher exposure to stressful experiences (Saewyc, 2011). Resilience refers to the ability to maintain mental health, despite experiencing stress (Herrman et al., 2011), and social support enhances resilience to stress (Ozbay et al., 2007). Described in detail in Chapter 3, resilience status was operationalized as current mental health status (SF-12 mental health component score), among respondents reporting multiple (two or more) past-year stressful life events (mean number of stressors = 1.71). This study builds on findings from Study 1 and has two aims.

3. **Aim 3:** To assess whether, and how, sexual orientation groups vary with regard to resilience status. Specifically, this aim assessed, among respondents reporting an above-

average number of stressful life events, whether sexual minority subgroups were less likely than heterosexuals to have above-average mental health scores (i.e., be "thriving") and/or were more likely to have below-average mental health scores (i.e., be "languishing"). Additionally, differences in "thriving" and "languishing" resilience status were compared across sexual minority subgroups.

4. **Aim 4:** To assess whether group differences in social support mediate group differences in resilience status. Specifically, this aim assessed whether there were indirect effects through social support underlying sexual orientation group differences in thriving and languishing resilience statuses.

Study 3: Understanding sexual orientation group differences in social stress and substance use disorders.

Ample research has shown considerable disparities in substance use on the basis of sexual orientation (e.g., between LGB and heterosexual people) (Graham et al., 2011; Hatzenbuehler, Corbin, et al., 2008; Marshal et al., 2008; Marshal, Friedman, Stall, & Thompson, 2009; Talley, Hughes, Aranda, Birkett, & Marshal, 2014). A limited body of research has shown different sexual minority subgroups differ with respect to substance use behaviors on the basis of sexual identity (Boyd, Veliz, Stephenson, Hughes, & Mccabe, 2019; Fish et al., 2018; Gattis et al., 2012; Hughes, Wilsnack, & Kristjanson, 2015; McCabe et al., 2018; Talley, Aranda, Hughes, Everett, & Johnson, 2015). Increasingly, research has indicated minority stress as a primary mechanism contributing to sexual minority disparities in substance use (Coulter, Bersamin, Russell, & Mair, 2018; Goldbach, Tanner-Smith, Bagwell, & Dunlap, 2014; Hughes, McCabe, Wilsnack, West, & Boyd, 2010; McCabe, Bostwick, Hughes, West, & Boyd, 2010). However, the degrees to which stressful life events (e.g., being a victim of theft or getting

divorced) serve as primary mechanisms driving sexual minority disparities in substance use have been examined to a lesser extent, and to my knowledge, no studies have directly compared the effects of stressful life events and LGB discrimination on sexual minority disparities in substance use. This study has three aims.

5. **Aim 5:** To assess the prevalence of three past-year substance use disorders across sexual orientation groups. Specifically, this aim assessed whether, compared to heterosexual respondents, respondents from sexual minority subgroups were more likely to have past-year alcohol, cannabis, and tobacco use disorders. Further, to assess the role of identity in shaping sexual minority substance use disparities, lesbian/gay and bisexual respondents were then compared to HSM respondents, across each substance use disorder.
6. **Aim 6:** To assess whether stressful life events mediate substance use disparities between heterosexuals and sexual minority subgroups. Specifically, this aim assessed whether there were indirect effects through stressful life events underlying differences in alcohol, cannabis, and tobacco use disorders between heterosexuals and each sexual minority subgroup.
7. **Aim 7:** To simultaneously assess stressful life events and perceived LGB discrimination events as mediators of substance use differences between sexual minority subgroups. Specifically, this aim assessed whether there were indirect effects through stressful life events and/or LGB discrimination events underlying differences in alcohol, cannabis, and tobacco use disorders between HSM respondents and lesbian/gay and bisexual respondents.

CHAPTER 2. Background, Theoretical Considerations, and Dissertation Studies

Background

Sexual orientation and health.

As an umbrella term, "sexual orientation" refers broadly to an individual's romantic or sexual interest in members of the opposite, same, both, or neither sex (Marshal et al., 2008; Saewyc et al., 2004), and "sexual minorities" are those oriented towards members of the same or both sexes. Compared to heterosexual people, sexual minorities (e.g., lesbians, gay men, and bisexual people [LGB]) experience disparities across a wide range of health indicators. (Graham et al., 2011; Ward et al., 2014). For instance LGB people are more likely to abuse alcohol (Hatzenbuehler, Corbin, et al., 2008), smoke (Blosnich et al., 2014; Lee et al., 2009), and are less likely to receive a range of health screenings (Fredriksen-Goldsen, Kim, Barkan, Muraco, & Hoy-Ellis, 2013) than are heterosexuals. Disparities with respect to mental health are also well-documented. For instance, compared to heterosexuals, LGB people report more depression symptoms and diagnoses, especially among youth (Almeida et al., 2009; Cochran, 2001; Cochran & Mays, 2000; Marshal et al., 2011; Russell & Joyner, 2001). LGB people are also more likely than heterosexuals to experience mental distress and mood and anxiety disorders (Bostwick et al., 2010; Cochran et al., 2003), and are more likely to attempt suicide (King et al., 2008).

Health disparities research relies on clear definitions and careful measurement of the population of interest. However, until recently, sexual orientation research was largely limited to surveys derived from community-based samples (Sell & Holliday, 2014), and while nationally representative surveys have increasingly provided researchers with valuable population estimates

and prevalence rates for health conditions among sexual minority populations, sexual orientation is still often measured using categories (e.g., LGB versus heterosexual) that do not capture the complexity of the construct. For instance, the only measure of sexual minority status on the recently-concluded Gallup Daily Tracking Survey was a combined sexual orientation and gender identity question that asked respondents whether they "personally identify as lesbian, gay, bisexual, or transgender" (Newport, 2018). In addition, when measured separately, it is commonly necessary to collapse all sexual minority people into a single (LGB) category for analysis due to insufficient sample sizes within specific subgroups. Regardless of the reason, this approach masks any variation that exists between those utilizing different identity labels (e.g., lesbian/gay vs. bisexual).

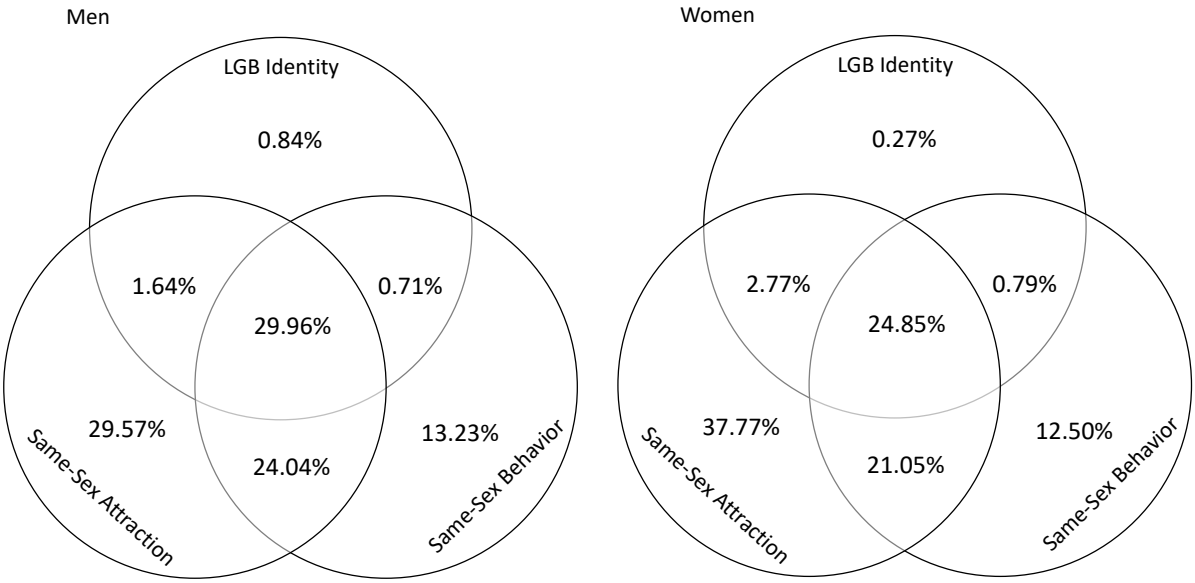
Further, sexual orientation is multidimensional, referring not just of one's sexual identity, but also their sexual attractions and sexual behaviors. Important operational and measurement differences exist between these measures – distinctions which can alter prevalence estimates of the sexual minority population (Mustanski et al., 2014). For instance, while recent studies estimate between 3-6% of the U.S. population identifies with a sexual minority identity label (e.g., identifies as LGB) (Copen et al., 2016; Gates & Newport, 2012; Newport, 2018; Ward et al., 2014), upwards of 8% of adults report same-sex sexual behavior, and 11% report same-sex attraction (Gates, 2011). Sexual identity, attraction, and behavior do not always align as expected. Indeed, population studies have shown that similar, or larger, proportions of men and women who report same-sex attractions and behaviors self-identify as heterosexual, rather than as LGB (Gattis et al., 2012; Krueger et al., 2018). Refer to Figure 2.1 to see how sexual identity, attraction, and behavior align among sexual minority respondents in the National Epidemiologic Survey on Alcohol and Related Conditions-III, the nationally-representative dataset used for this

dissertation (described in detail in Chapter 3)[1]. Thus, a more complex assessment of sexual orientation is warranted, as single-indicator measures do not comprehensively capture who is included in the population of sexual minorities (Lindley et al., 2012; Munoz-Laboy, 2004; Young & Meyer, 2005).

Fortunately, large-scale health surveys (e.g., National Epidemiologic Survey on Alcohol and Related Conditions, National Longitudinal Study of Adolescent to Adult Health, National Health Interview Survey) are increasingly including multiple measures of sexual orientation (i.e., identity, attraction, and behavior), and with multiple response options, allowing respondents to select from a list of sexual minority identities, rather than a single "LGB" response option. Doing so allows researchers to disaggregate distinct subpopulations (e.g., monosexuals [lesbian/gay] from bisexuals) in epidemiologic analyses and contributes to further refinement of sexual minority population health research.

[1] Among sexual minority respondents in the National Epidemiologic Survey on Alcohol and Related Conditions-III (i.e., those reporting a non-heterosexual identity, same- or both-sex attractions, and/or same- or both-sex behaviors, only 29.96% of men and 24.85% of women reported an LGB identity, same/both-sex attractions, *and* same-sex behaviors. Among sexual minority men, 66.84% reported same/both-sex attractions and/or same/both-sex behaviors, but did not identify as heterosexual (29.57% reported same/both-sex attractions only, 13.23% reported same/both-sex behaviors only, and 24.04% reported both same/both-sex attractions and behaviors). Among sexual minority women, 71.32% reported same/both-sex attractions and/or same/both-sex behaviors, but did not identify as heterosexual (37.77% reported same/both-sex attractions only, 12.50% reported same/both-sex behaviors only, and 21.05% reported both same/both-sex attractions and behaviors).

Figure 2.1. Venn diagram of LGB identity, same-sex attraction, and same-sex behavior among sexual minorities in NESARC-III (Fish & Krueger, unpublished)



Defining sexual minority subpopulations for this dissertation.

As noted, operational distinctions can contribute to error in measuring the sexual minority population and, potentially inconsistent findings across studies. This dissertation seeks to understand sexual orientation and health from a holistic perspective that accounts for variability across sexual minority subgroups, on the basis of identity (e.g., between lesbian/gay and bisexual people), as well as across multiple dimensions of sexual orientation (e.g., between sexual minorities who identify as such – as lesbian, gay, or bisexual – and those who do not – as heterosexual, but who also endorse same-sex attractions or behaviors).

Of note, there is growing interest among researchers in the experiences of this latter group – heterosexual-identified people who also report same-sex attractions and behaviors, and how meaning is made of their chosen sexual identities. A variety of terms, each with subtly different meanings, have been used to describe members of this understudied population (for a recent review, see Hoy and London, 2018). A few such terms include "discordant heterosexuals" (Gattis et al., 2012; Krueger et al., 2018; McCabe et al., 2018; Talley et al., 2015), "heteroflexible" people (Carrillo & Hoffman, 2017; Silva & Whaley, 2017; Ward, 2012), and people with "branched" sexual orientations (van Anders, 2015; Wolff, Wells, Ventura-DiPersia, Renson, & Grov, 2017). Each of these terms, however, poses challenges, and may refer to somewhat distinct populations. For instance, while "discordant heterosexual" clearly defines the population, some may find the term pejorative. However, the term "branched" may be overly inclusive, referring both to heterosexuals with same-sex attractions/behaviors, as well as LGB people with no same-sex attractions/behaviors, while "heteroflexible" might be interpreted to refer to a separate population who consider themselves to be *mostly*, but not entirely heterosexual. Given these challenges with terminology, I use the term "heterosexual-identified

sexual minorities" (HSM) to clearly describe who is included in the population of interest to this dissertation – sexual minorities, by virtue of their sexual attractions/behaviors, but who identify as heterosexual – while avoiding potentially stigmatizing terminology.

Variability across sexual orientation groups.

While relatively little research has compared characteristics of sexual minority subgroups, important sociodemographic, behavioral, and health differences may exist across these subpopulations, which contribute to subgroup differences in health. Among existing studies, considerably more is known about differences that exist by identity (e.g., between lesbian/gay and bisexual populations). For instance, roughly half of lesbian, gay, and bisexual people in the U.S. identify as bisexual (52%), rather than as lesbian (17%) or gay (31%) (Gates, 2011; Movement Advancement Project, 2016). Compared to lesbian/gay people, bisexuals are younger, on average, and report less education and lower incomes (Pew, 2013). In their survey of LGBT Americans (2013), Pew researchers found bisexuals (28%) were less likely than lesbians (71%) or gay men (77%) to be "out" to the important people in their lives, and smaller proportions of bisexual people (22%) thought being LGBT was a "positive factor in their life," compared to lesbians (38%) and gay men (46%).

However, despite a growing appreciation for the theoretical and operational distinctions between identity, attraction, and behavior amongst scientists, relatively little work exists with respect to differences between LGB- and heterosexual-identified sexual minority (HSM) populations, or the implications for the field in using different measures of sexual orientation in research, though several papers over the past 25 years have acknowledged, and even measured the degree of overlap between identity, attraction, and behavior (Chandra, Mosher, Copen, & Catlainn, 2011; Igartua, Thombs, Burgos, & Montoro, 2009; Narring, Stronski Huwiler, &

Michaud, 2003; Remafedi, Resnick, Blum, & Harris, 1992; Smith, Rissel, Richters, Grulich, & de Visser, 2003; Worthington & Reynolds, 2009).

Limited research has shown important gender differences in the expression of identity, attraction, and behavior. For instance, existing work suggests that women are more likely than men to report discrepancies between sexual identity, attraction, and behavior (e.g., they may report a heterosexual identity, as well as same-sex attraction [i.e., HSM], or an LGB identity, but only opposite-sex behavior) (Igartua et al., 2009; Narring et al., 2003; Smith et al., 2003). For instance, in a national school-based sample of Swiss youths, boys experiencing same-sex attraction or behavior were more likely to identify themselves as homosexual, and same-sex attracted/behaving girls were more likely to identify as bisexual or uncertain about their sexual identities (Narring et al., 2003). Using pooled data from the 2005 and 2007 Youth Risk Behavior Surveys (YRBS), Mustanski et al. (2014) also reported that girls were more likely to report discrepancies between behavior and identity.

Discrepancies between identity, attraction, and behavior have also been reported with respect to race/ethnicity. For instance using YRBS data, Mustanski et al. (2014) reported Black and Hispanic youths were more likely than their White counterparts to report discrepancies between identity and behavior. Using a convenience sample of 1494 African American, Hispanic, White, and Asian men and women, Ross et al. (2003) reported that Asian males were least likely (21.6%), and Black females (66.6%) and White males were most likely (65.3%) to report discrepancies between identity and behavior. Finally, in a representative population survey of New York City men, Pathela et al. (2006) found that among men reporting same-sex behavior, LGB-identified men were more likely than heterosexual men (i.e., HSM) to belong to minority

racial and ethnic groups, and be foreign-born. They were also more likely to report lower education and income levels.

Considerably less research exists with regard to other sociodemographic and psychosocial characteristics at the intersections of identity, attraction, and behavior. However, in their study of New York City men, Pathela et al. (2006) reported that men with discrepant identities and behaviors had lower education and income levels than those with concordant identities and behaviors. It is also possible that age and cohort-based differences exist with respect to discrepancies between identity, attraction, and behavior. Using a representative sample of Australian men and women aged 16-59, Smith et al. (2003) reported that younger people endorse more same-sex attraction and behavior than older people, possibly signifying generational differences in acceptance of homosexuality. Finally, Remafedi et al. (1992) reported that same-sex attraction was positively associated with socioeconomic status, and that that religiosity was negatively associated with non-heterosexual identity, and with same-sex attractions and behaviors among boys, but not among girls in a representative sample of Minnesota high schoolers.

Sexual orientation and mental health.

Sexual orientation has long been linked to mental health. Indeed, early LGB population studies, which relied almost exclusively on samples derived from clinic- and prison-based populations, showed sexual minority people experienced vast disparities in mental health, and were used to portray LGB people as sick and morally flawed, compared to heterosexual people (Meyer & Wilson, 2009; Morin, 1977). Clearly, these studies suffered severe selection effects given that they drew upon a particular subset of the LGB population, and in doing so, advanced biased conclusions about the total LGB population. Perhaps not surprisingly, homosexuality was

listed as a mental disorder (a "sociopathic personality disturbance") in the Diagnostic and Statistical Manual (DSM) until 1973 (Bayer, 1987; Russell & Fish, 2016). However, as views on homosexuality and the sophistication of sampling strategies evolved, researchers have come to understand sexual minority status not as intrinsically linked to poor mental health, but instead, through a social determinants of health framework (Hatzenbuehler, 2010). Regardless, in both the earlier and more current epidemiologic and psychological literature on sexual minority populations, it is clear that sexual minority people do experience ample disparities in mental health, compared to heterosexual people, broadly (Graham et al., 2011; Ward et al., 2014).

Relatively few studies have explored differences in mental health status between subgroups of the sexual minority population. However, extant research has increasingly suggested bisexual people experience differential, and often greater disparities in mental health than lesbian/gay people, relative to heterosexuals (Balsam et al., 2005; Koh & Ross, 2006; Marshal et al., 2011; Saewyc et al., 2008), with bisexual people reporting more symptoms of anxiety, depression, and suicide ideation than both heterosexual and lesbian/gay people (Dodge & Sandfort, 2007). For instance, using pooled data from the Behavioral Risk Factor Surveillance System, Conron and colleagues (2010) found bisexual respondents were more likely like than both heterosexual and lesbian/gay respondents to endorse feeling "worried" and "sad/blue" more than 15 days in the past month, and to have seriously considered suicide in the past year. Among women in the Washington Behavioral Risk Factor Surveillance System, bisexuals also reported more frequent mental distress and poor general health than lesbian women (Fredriksen-Goldsen, Kim, Barkan, Balsam, & Mincer, 2010). The authors of these studies suggested further research was needed to assess differential exposure to stress, stigma, and lack of connectedness to the larger "LGB" community as mechanisms driving these disparities.

Few studies have explored differences in mental health between sexual minority people who identify as such (i.e., as LGB) and those who do not (i.e., identify as heterosexual). Using data from the California Health Interview Survey, Cochran and Mays (2009) showed that compared to heterosexual people, LGB-identified men and women, as well as heterosexual-identified men (but not women) reporting same-sex behaviors carried elevated risk for distress, depression, and anxiety. In addition, formative research recently suggested that LGB-identified, "mostly heterosexual," and completely heterosexual-identified sexual minority (HSM) young adults all reported increases in depressive symptomatology, relative to heterosexuals. However, while perceived stress mediated disparities in depressive symptomatology for all subgroups among women, it did not mediate the disparities for gay/bisexual or HSM men (Krueger et al., 2018).

Described in detail below, Study 1 contributes new knowledge to the field of LGB health disparities research by first identifying how diverse sexual orientation groups differ across a range of characteristics – sociodemographic, lifestyle/behavioral, and psychosocial. Further, differences in mental health status are enumerated across sexual orientation groups, and this dissertation assesses how group differences across sociodemographic, lifestyle, and psychosocial characteristics are differentially associated with disparities in mental health status between heterosexual and sexual minority subgroups.

A note about measuring "mental health."

"Mental health" broadly describes an individual's psychological and emotional wellbeing, as well as the presence or absence of mental disorder ("Mental Health and Mental Disorders," 2016). As an umbrella category, mental health research deals with a variety of measures, which in some cases assess symptomatology (e.g., CES-D, which assess depressive

symptomatology) (Radloff, 1977) and prevalence of specific mental disorders (e.g., depression, anxiety, schizoaffective disorder). Other measures, often included as scales on surveys, are not designed to assess specific symptomatology, but instead more globally assess overall mental health functioning and wellbeing (e.g. the Kessler 6 scale measures "non-specific psychological distress," rather than depression or anxiety, specifically (Kessler et al., 2002)). Another such measure, the Short Form 12-item patient health questionnaire (SF-12) comprehensively assesses health – across both physical and mental dimensions. When the mental health component score is used, it provides a global assessment of overall mental health functioning, not targeted to a specific disease or age group (Ware, Kosinski, & Keller, 1996). In order to more comprehensively understand the stress, health, and wellbeing processes of diverse sexual orientation groups in this dissertation, I assessed mental health using the SF-12 mental health component score, described in detail in Chapter 3.

Mental health and resilience.

While it is clear that sizeable proportions of sexual minority people indeed have poorer health than heterosexuals, many sexual minorities do not suffer from chronically poor mental health, despite higher exposure to stressful experiences (Saewyc, 2011). Coping and resilience research studies how exposure to stressful experiences can also lead to adaptive responses, which buffer the harmful effects of stress on health over time (Kwon, 2013). While there is no universally agreed-upon definition of resilience (Colpitts & Gahagan, 2016; Fletcher & Sarkar, 2013), the term refers generally to the ability to positively cope with, adapt to, and overcome stress (Fletcher & Sarkar, 2013), or to ability to maintain or regain mental health, despite experiencing stress (Herrman et al., 2011). Thus, resiliency likely plays a critical role in helping

sexual minority people to persevere, and in many instances, thrive in spite of stress exposure (Kwon, 2013).

Several sociodemographic factors and coping behaviors are thought to contribute to resilience among sexual minority populations (Beasley & Jenkins, 2015; Livingston et al., 2015; Russell, 2005). For instance, the rapid improvement in social acceptance and anti-discrimination efforts has been hypothesized to increase sexual minorities' abilities to cope with stress, and to reduce their exposure to social stressors in the first place (Meyer, 2016). However, the degree to which social conditions are in fact "improving,' in what ways, and how they relate to health is still not clear (Russell & Fish, 2019). Relatedly, increasingly positive representation in the media has also been hypothesize to increase resilience among sexual minority people, by fostering community connectedness and increasing perceived ability to "fight back" (Craig, Mcinroy, Mccready, & Alaggia, 2015). Sexual identity disclosure to others ("coming out") has also been studied extensively as a factor contributing to sexual minority resilience, though results have been mixed; the degree to which coming out is a resilience – versus risk – factor depends largely on the timing, location, and to whom one comes out (Russell, 2005). One consistently-identified factor contributing to resilience, across both sexual minority and general resilience research, is social support, which refers to the network of close relations (e.g., family, friends, community members) that are available to one during times of distress or need (Ozbay et al., 2007). More specifically, identifying and mobilizing social supports is an especially important determinant of one's ability to cope with stress (Bariola et al., 2015; Bos, Sandfort, Bruyn, & Hakvoort, 2008; Kwon, 2013; Mereish & Poteat, 2015; Ozbay et al., 2007).

Considerably less has studied how these factors may differ among sexual minority subgroups, and how they relate to resilience. Study 2 of this dissertation contributes to our

understanding of mental health resilience among diverse sexual orientation populations and provides avenues for future research and interventions. Since resilience can be understood, generally, as one's ability to maintain mental health in the face of stress, the mental health statuses of heterosexuals are compared to each of three sexual minority subgroups who were exposed to multiple past-year stressors (see Chapter 3 for full details of how resilience was operationalized). Study 2 also assessed whether group differences in social support help to explain (i.e., mediate) sexual orientation group differences in resilience.

Sexual orientation and substance use.

Finally, in addition to mental health challenges, considerable sexual orientation-based disparities also exist with respect to substance use morbidity (Hatzenbuehler, Corbin, et al., 2008; Marshal et al., 2008, 2009; Talley et al., 2014). For instance, sexual minorities are disproportionately more likely that heterosexual men to report use and dependence on a wide range of both legal and illicit substances, including alcohol (Fish et al., 2018; Hatzenbuehler, Corbin, et al., 2008), tobacco (Blosnich et al., 2014; Lee et al., 2009; McCabe et al., 2018), marijuana, and other illicit substances (McCabe et al., 2009; NIDA, 2017; Watson et al., 2018).

Similar to mental health, important substance use differences are evident between sexual orientation subgroups, when studied separately (Boyd et al., 2019; Fish et al., 2018; Gattis et al., 2012; Hughes et al., 2015; McCabe et al., 2018; Talley et al., 2015). For instance, in an Australian national sample, "mainly heterosexual," (but not lesbian)-identified women were more likely to report at-risk drinking, and bisexual (but not lesbian)-identified women were more likely to report marijuana use, compared to heterosexual women (Hughes, Szalacha, & Mcnair, 2010). In addition, compared to their heterosexual peers, young gay (but not bisexual)-identified men reported greater odds of past-month cigarette smoking in a recent U.S. national sample

(Schuler, Rice, Evans-polce, & Collins, 2018). Further, using data from the Chicago Health and Life Experiences of Women study, Talley et al. (2015) reported that among young adults reporting same-sex attraction and/or same-sex behavior, those reporting heterosexual identities were more likely than those reporting LGB identities to report engaging in hazardous drinking. Interestingly, this association was stronger among older participants (Talley et al., 2015).

Finally, in their seminal paper on the topic, Gattis et al. (2012) used Wave 2 of the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC) to study substance use disorders (SUDs) across several sexual orientation groups[2]. Notably, they made direct comparisons between heterosexual men and women who reported same-sex attractions and behaviors, and heterosexual men and women who reported opposite-sex attractions and behaviors. Identity-behavior comparisons were reported separately from identity-attraction comparisons. With respect to identity and behavior comparisons, HSM men had significantly *lower* odds of lifetime alcohol use disorder, while HSM women had significantly *higher* odds of the same disorder, compared to heterosexual men and women with opposite-sex behaviors. Further, HSM men had *higher* odds of inhalant use, while HSM women had *higher* odds of stimulant, hallucinogen, and inhalant- use disorders, compared to heterosexuals with opposite-sex behaviors. With respect to identity and attraction, HSM men had *lower* odds of alcohol use disorder, but no substance use differences were found between HSM and heterosexual women (Gattis et al., 2012).

[2] Rather than recreational or even "risky" substance use, presence of an SUD indicates that a higher threshold of risk has been met, with significant effects on health and everyday functioning. Specifically, SUDs occur when use of a substance is recurrent, and when it causes clinically-significant impairment to the user, in one or several domains, including, but not limited to their physical health, or their ability to meet major responsibilities at work or home (SAMHSA, 2019).

Study 3 of this dissertation contributes new knowledge to the field of LGB substance use, described in detail below. First, the study adds to existing research by exploring sexual orientation group differences in disordered alcohol, cannabis, and tobacco use, using NESARC, Wave 3. In addition, the study contributes new knowledge by testing multiple social stress mechanisms of disordered substance use across sexual orientation groups, offering avenues for future research and intervention.

Theoretical Considerations

Social Stress and Sexual Minority Health Disparities.

A large body of psychological research has demonstrated the strong association between stress, particularly chronic forms of stress, and mental health hardship, such as depression (Aneshensel, 1992; Hammen, 2005; Lewis et al., 2003; McLaughlin, Conron, Koenen, & Gilman, 2010; Pechtel & Pizzagalli, 2011). Social stress has also been linked to increased utilization of, and addiction to alcohol, tobacco, and other drugs (Frone, 1990; Rhodes & Jason, 1990). Sexual minority health disparities are hypothesized to be driven largely by social environmental factors which place sexual minorities under greater stress and at increased risk for developing mental and behavioral health challenges, such as substance use and depression (Diamond et al., 2011; Hatzenbuehler, 2010, 2011; Meyer, 1995, 2003a). Broadly, sexual minority stress can be understood through two explanatory theoretical frameworks: The Stress Process and Minority Stress Theory.

The Stress Process.

The Stress Process model was proposed by Pearlin et al. (1981) to describe how psychosocial stressors in the environment proliferate to create psychological stress within the

individual, manifesting to create ill effects on health. Stressors refer to "circumstances and experiences to which it is difficult to adjust and, therefore, that can impose deleterious effects on emotions, cognitions, behavior, physiological functioning, and well-being" (Pearlin & Bierman, 2013). Broadly, the model proposes two types of stress: *eventful experiences,* which represent immediate and temporary sources of stress, might include, for example, job loss (Pearlin et al., 1981) or hate crime victimization (Herek, Gillis, & Cogan, 1999). In addition to eventful experiences are *life strains,* which represent chronic, more persistent sources of stress, such as neighborhood crime (Aneshensel, 2010) or prejudice (Meyer, 2003b). Though the natures of eventful experiences and life strains differ, both serve as *sources of stress*, and may contribute to psychological distress.

Further, proliferation occurs when new stressors compound and add to existing stress. The process of stress proliferation is hypothesized to affect individual health, including the occurrence of depression (Pearlin et al., 1981), and differences in lifetime exposure to social stress have been used to describe health disparities (Turner, 2010). It is also possible that the proliferation results in a "diminishment of self" (Pearlin et al., 1981), through the diminishment of mastery and self-esteem. Mastery refers to the extent to which people feel they have control over circumstances in their lives, while self-esteem refers to notions of self-worth (Pearlin et al., 1981). Diminishment of either is harmful to health (Turner, 2009).

Social supports and coping strategies serve as mediators of the stress process, both of which are affected by the nature of the stressor, can be employed to mitigate, and potentially avoid distress (Aneshensel & Stone, 1982; Pearlin & Schooler, 1978). Embeddedness and meaningful engagement in a social network can ameliorate social stressors, while coping strategies may increase, modify, or reduce the symptoms of stress (Pearlin et al., 1981).

The stress process is relevant to sexual minority populations in multiple ways. For example, sexual minority people report more *eventful experiences* (e.g., harassment), as well as more *life strain* (e.g., family problems due to coming out), compared to heterosexual people on average (Meyer, 2003a). Proliferation of both eventful experiences and life strains has also been shown to underlie sexual minority disparities in health (Meyer, 2003a), and differences in social support and positive coping have also been shown to underlie sexual minority differences in ability to be resilient to stress (Frost, Meyer, & Schwartz, 2016; Meyer, 2015; Meyer, Schwartz, & Frost, 2008).

Minority Stress.

Minority Stress Theory builds upon the Stress Process model and is a leading theoretical lens to study health disparities among sexual minority people. Broadly, minority stress refers to the increase in social stress that results from one's membership in a stigmatized social group (e.g., racial/ethnic minorities, women, sexual minorities) (Meyer, 2003a). Building on the Stress Process model, Minority Stress Theory proposes that sexual minorities experience social stressors that are specific to their minority status, which might include sexual orientation-related stigma, discrimination, or threats of violence. Increased exposure to these types of stressors, as well as general stressors (potentially experienced by all members of the population; e.g., financial distress, job strain), is hypothesized to drive the increased rates of mental and behavioral health challenges experienced by the population (Fingerhut et al., 2010; Lick et al., 2013; Meyer, 1995, 2003a; Wight et al., 2012).

The theory describes how an inherently heterosexist social environment creates *unique* stressors, which, in addition to general stressors, contribute to health disparities (Fingerhut et al., 2010; Lick et al., 2013; Meyer, 2003a; Wight et al., 2012). Due to increased exposure to stress

(both unique and general), members of minority groups experience disparities in mental health. Focusing specifically on sexual minorities (gays, lesbians, and bisexuals), Minority Stress Theory proposes that sexual minorities experience social stressors that are specific to their minority status. Increased exposure to these types of stressors, in addition to general stressors, is hypothesized to drive the increased rates of mental health disorder experienced by the population (Meyer, 1995, 2003a).

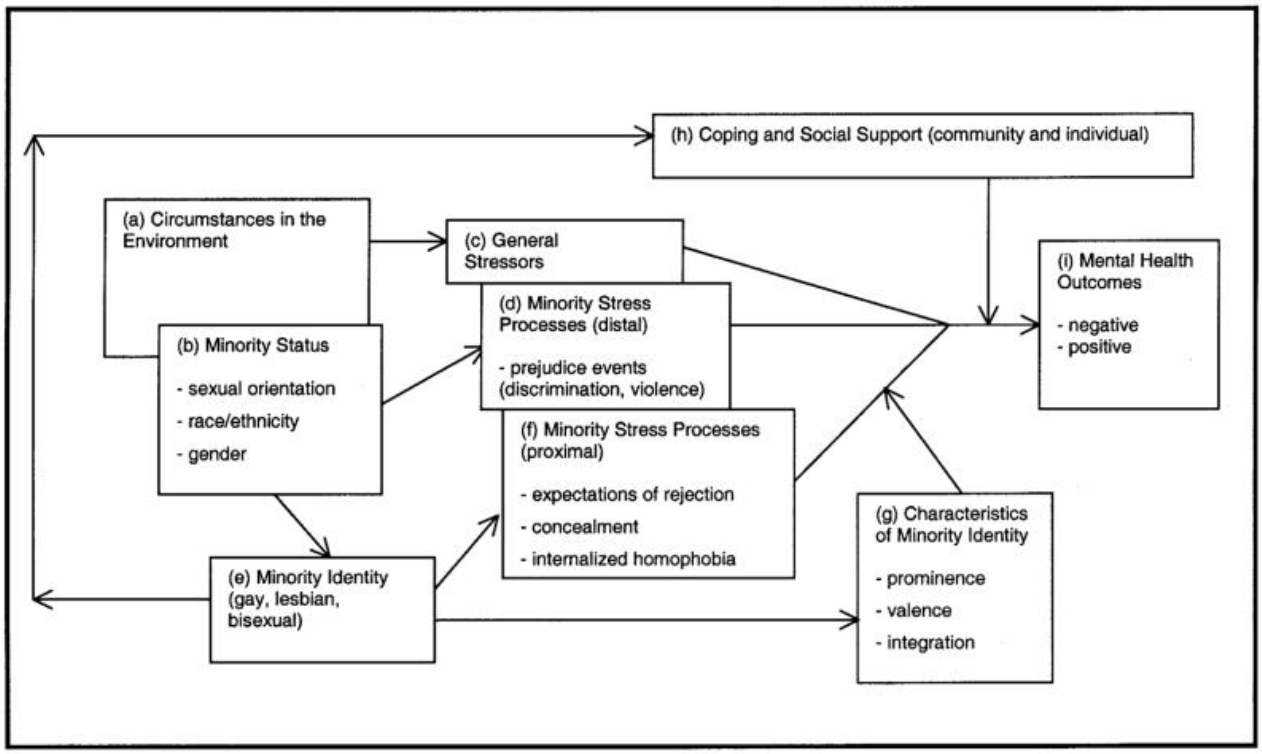
See Figure 2.2 for a visual depiction of the Minority Stress model (Meyer, 2003a). Environmental circumstances (e.g., the 2008 financial crisis) create "*general stressors*," or stresses that can impact all members of the population (e.g. job loss as a result of budget cuts). *Distal minority stressors,* such as experiences of discrimination, interact with general stressors, such that LGBs may be more likely to lose their jobs than heterosexuals during an economic downturn, for example, due to the existence of legal employment discrimination. Experience with distal minority stressors influence the development of *proximal minority stressors*. These represent the internalizing of stress, and can lead to internalized homophobia and expectations of further discrimination. Together, general stressors, and both distal and proximal minority stressors impact the *mental health* of an individual (Meyer, 1995, 2003a).

Sexual identity (identity as straight, lesbian, gay, bisexual, queer, etc.) moderates this process at several points. For example, a lesbian-identified woman may experience less proximal minority stress than a sexual minority woman who does not identify as such, a question I seek to test in this study. She (by virtue of identifying publicly as a lesbian) will not experience stress associated with concealing her identity from others, or from having to remain vigilant to keep it concealed. She may also experience less internalized homophobia than a sexual minority woman who does not assume a lesbian identity. *Characteristics of sexual identity*, such as the

prominence of the identity or how well integrated it is into an individual's global self-view are thought to moderate the relationship between the stressors and mental health outcomes. For example, a lesbian woman who must conceal her identity from coworkers, but for whom the identity is not a prominent aspect of herself might not develop depressive symptoms, while a lesbian woman whose identity *is* central to her self-view might. Finally, and relatedly, identity influences the *coping strategies and social support* systems that one has available to them. For instance, one who does not identify as a sexual minority may not have access to a "gay community" or may not wish to receive LGBT-specific health services. The presence of coping and support systems also moderates the impact of stressors (both general and minority-specific) on mental health (Meyer, 1995, 2003a).

Minority Stress Theory was initially developed to describe LGBT disparities in mental health (Fingerhut et al., 2010; Hatzenbuehler, 2009; Hatzenbuehler, Nolen-Hoeksema, et al., 2008; Juster et al., 2013; Lewis et al., 2003; Meyer, 1995, 2003a; Wight et al., 2012). However, it has since been applied to describe a range of disparities in physical and physiological health (Cochran & Mays, 2007; Everett et al., 2014; Hatzenbuehler & McLaughlin, 2014; Hatzenbuehler, McLaughlin, et al., 2013; Juster et al., 2013; Lick et al., 2013), as well as health behavior (Hatzenbuehler, Nolen-Hoeksema, et al., 2008; Marshal et al., 2008). This dissertation adds to the existing stress literature by examining differences in exposure to stress, separately by sexual orientation group, as well as its effects on mental health and substance use. As described above, existing work suggests sexual orientation groups experience differential health outcomes, and varying rates of exposure to stress (Gattis et al., 2012; Krueger et al., 2018).

Figure 2.2 The Minority Stress Model



Source: Meyer, I. H. (2003). Prejudice, social stress, and mental health in lesbian, gay, and bisexual populations: conceptual issues and research evidence. Psychological Bulletin, 129(5), 674–697. https://doi.org/10.1037/0033-2909.129.5.674

Evidence supporting stress as a mechanism of sexual minority health disparities.

Several studies have provided data to support the causal association between stress and sexual minority mental health disparities. For instance, Juster et al. (2013) demonstrated that chronic stress is a significant predictor of depressive symptoms among sexual minorities. However, in a sample of LGB-identified participants, Lewis et al. (2003) showed that while both gay-related and chronic life stress were predictive of depressive symptomatology, gay-related stress accounted for an even larger proportion of variance in symptoms than did chronic life stress. Finally, results from a mediation analysis confirmed that perceived discrimination accounted for increased depressive symptomatology among sexual minority youth, as well as elevated risk for suicide ideation and attempt among LGBs (Almeida et al., 2009).

Increasingly, research has also indicated minority stress as a primary mechanism contributing to sexual minority disparities in substance use (Coulter et al., 2018; Goldbach et al., 2014; Hughes, McCabe, et al., 2010; McCabe et al., 2010), with for instance, homophobic bullying mediating sexual minority alcohol use disparities (Pollitt, Mallory, & Fish, 2018). Bullying and other victimization events that are not necessarily related to sexual orientation are also associated with sexual minority disparities in alcohol and marijuana use (Hatzenbuehler, Corbin, & Fromme, 2011; Lowry, Johns, Robin, & Kann, 2017; Phillips et al., 2017; Woodford, Krentzman, & Gattis, 2012).

However, as noted, Minority Stress Theory suggests that in addition to minority-specific stressors, sexual minority people are also exposed to more general stressors (e.g., job strain or financial stress, which both sexual minority and heterosexual people can experience) at higher rates than heterosexuals. Considerably less research has assessed how such general stressors are associated with sexual minority health disparities, and in particular, subgroup differences in

health. Relatively little is known about subgroup differences in health overall, and less is known about the mechanisms driving subgroup differences in health. The Fundamental Causes perspective is informative for considering how subgroup differences in health may be shaped by a variety of social conditions, described below.

Social Conditions as Fundamental Causes of Disease.

A large body of work has demonstrated that health disparities exist with respect to a number of social positions, such as gender (Read & Gorman, 2010), race/ethnicity (Braveman, Egerter, & Williams, 2011), socioeconomic status (Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010; Braveman et al., 2005), and sexual orientation (Blosnich et al., 2014). Indeed, a wide variety of social conditions serve to differentiate health outcomes among individuals. For instance, Marmot (2005) points to stark global mortality gradients by socioeconomic status and educational attainment, with residents from poorer countries, and with lower levels of education experiencing higher mortality rates than those in richer countries, and with more education.

Developed by Link and Phelan (1995), Fundamental Causes Theory builds upon this research to explain how social conditions serve as important "upstream" determinants of health and disease. Further, the theory seeks to explain that distal social factors serve as root causes of health outcomes, which are mediated by health behaviors and other factors more proximal to the individual. Indeed, distal to the individual, social factors influence, and provide a context within which more proximal factors, such as health behaviors, operate and influence health (Link & Phelan, 1995; Phelan et al., 2010).

Link and Phelan (1995) provide examples of the "social patterning of disease," emphasizing the link between health and socioeconomic status, specifically. However, the social patterning of disease is also evident by race/ethnicity and gender, among other minority statuses

(Connell, 2012; George & Lynch, 2003; Krieger, 2003; Twenge & Nolen-Hoeksema, 2002; Williams, Lavizzo-Mourey, & Warren, 1994). Belonging to a social category that is undervalued in society places a greater burden on individuals, whereby social placement allows disparities to manifest and persist within the population (Dressler, Oths, & Gravlee, 2005; Read & Gorman, 2010; Rieker & Bird, 2005; Turner & Avison, 2003).

From a Social Conditions as Fundamental Causes perspective, it is important to understand the full mechanisms by which health and disease are achieved. While individual differences in health behaviors (e.g., adherence to vaccination recommendations) certainly influence health outcomes (e.g., contagion of preventable disease), social placement and social conditions place these health behaviors into context. Individuals and groups with advantageous placement (e.g. higher salary, job prestige) are afforded access to *flexible resources*, frequently coming together as a package, which may be used to benefit health. For example, compared to a blue-collar employee without paid sick leave, a white-collar employee may have greater access physician recommendations from their colleagues and discretionary income with which to seek health care, in addition to paid sick leave during which to see a physician. Alternately, the blue-collar employee may have constrained choices, or resources at their disposal. With a lower income, for example, they may not have the ability to choose a physician, or the time available to see them (Link & Phelan, 1995; Phelan et al., 2010).

Sexual orientation as a social determinant of health.

Sexual orientation serves as a mechanism of social placement, whereby sexual minority individuals are exposed to unique circumstances that contribute to health. Recent theoretical work has discussed stigma as a fundamental social cause of health, and as a mechanism by which social disparities are propagated (Hatzenbuehler, Phelan, et al., 2013; Link & Phelan, 2014;

Phelan, Lucas, Ridgeway, & Taylor, 2014). Unlike other minority traits (e.g., race and gender), sexual orientation may not be visually apparent; it is considered a concealable trait (Pachankis, 2007), contributing to sexual stigma and gay oppression as especially relevant contributors to sexual orientation health disparities (Aguinaldo, 2008; Hatzenbuehler & Pachankis, 2016). Further, the persistence of legal discrimination is still a concern for many sexual minority Americans (Hodel, Levi, & De Biasi, 2014; Sears & Mallory, 2011). Employment discrimination increases job insecurity and economic concerns among sexual minority individuals (Hodel et al., 2014; Sears & Mallory, 2011). Exposure to sexual orientation stressors has implications for psychological functioning, including rumination, vigilance, and physiological stress responses (Everett et al., 2014; Hatzenbuehler, McLaughlin, et al., 2013; Hatzenbuehler & Pachankis, 2016).

Poverty and educational differences, as well as aspects of the physical environment (e.g., isolation associated with rural residency, urban blight) place sexual minorities, particularly sexual minority women, in lower social standing than heterosexual people (Hodel et al., 2014). Finally, lower access to quality health care increases the likelihood that sexual minority Americans will experiences disparities in health (Graham et al., 2011; Hodel et al., 2014; Ward et al., 2014).

This dissertation utilizes aspects of stress and fundamental causes theories to assess sexual orientation subgroup differences across a range of social conditions and behaviors (Study 1). The dissertation also assesses various forms of social stress (general and minority) and social support as mediators of sexual orientation subgroup differences in mental health, resilience, and substance use status (Studies 2 and 3).

Gender as a social determinant of health.

Another important social determinant to consider is gender. Gender is a social construct that extends from (and is frequently conflated with) biological sex; females are expected to identify as women, and males as men (Phillips, 2008; West & Zimmerman, 1987). Social meaning is derived from sex, by which individuals are assigned particular roles and expectations, from mannerisms, to the division of labor in the home, to jobs in the workforce (Lorber, 1994; Schilt & Westbrook, 2009; West & Zimmerman, 1987). These gendered roles serve as mechanisms of social placement, shaping the way people interact with others, and with society (West & Zimmerman, 1987), impacting health (Read & Gorman, 2010; Rieker & Bird, 2005). While gender roles and expectations evolve over time, women have traditionally assumed roles that are subservient to men. On average, women earn less in the workforce than men, and they assume positions of lower position and influence than men (Read & Gorman, 2010).

Gender norms and expectations intersect with homophobia to produce differences by gender and sexual orientation with respect to exposure to and responses to stress. Differential policing of gender norms (Remafedi et al., 1992; Smith et al., 2003) contributes to the finding that gay men experience greater sexual orientation-related hostility than do lesbians (Herek, 2000; Purdie-Vaughns & Eibach, 2008; Smith et al., 2003). Further, compared to heterosexuals, LGB women experience beneficial decreases in several markers of physiological stress, including Epstein-Barr Virus and C-Reactive Protein, while LGB men show elevated levels of the same markers (Everett et al., 2014). The authors theorized that gender nonconforming responses to stress (e.g. greater employment of problem-focused coping strategies) among sexual minority women may produce beneficial decreases in inflammation, while it may underlie the disparity witnessed among men (Everett et al., 2014).

The differences in sexual identity presentation by gender presented earlier (Pathela, Blank, Sell, & Schillinger, 2006; Remafedi et al., 1992; Ross et al., 2003) are likely a function of the social stressors associated with gender and sexual orientation, separately and in combination with one another. Sexual minority men and women experience health in different ways, and often in ways that differ from the observed patterns between heterosexual men and women (Conron et al., 2010; Newcomb, Birkett, Corliss, & Mustanski, 2014; Veenstra, 2011). For example, unlike general population studies, which find higher rates of substance use and dependence among men, compared to women, some sexual minority research using population data has shown that rates of substance use for sexual minority women not only exceed those of heterosexual women, but also of sexual minority men (McCabe et al., 2009). Because of the potentially important interactions between sexual orientation and gender, I stratified all analyses performed as part of this dissertation by gender, in order to focus on differences in health and the mechanisms driving those differences between sexual orientation subgroups, while controlling for potential interactive effects by gender. Specific analyses are described in Chapter 3.

Dissertation Studies

Through a series of three studies, this dissertation aims to address key gaps in the extant literature. In each study, heterosexuals reporting only opposite-sex attractions and behaviors were compared to three sexual minority subgroups (lesbians/gay men, bisexuals, and heterosexuals reporting same-sex attractions or behaviors [HSM]). In the first study, since relatively little is known about the demographic and behavioral diversity that exists within the sexual minority population, sexual orientation group differences were assessed across a wide range of sociodemographic, lifestyle, and psychosocial characteristics. Associated implications

for mental health status were also examined. In the second study, group differences in mental health "resilience" were examined among those reporting an above-average number of stressful life events, and the mediating role of social support was assessed in contributing to resilience. Finally, in the third study, group differences in substance use were assessed, and two stress mechanisms – stressful life events and LGB discrimination – contributing to group differences were assessed.

Study 1: Understanding how sexual orientation groups vary across sociodemographic, lifestyle, and psychosocial characteristics, and assessing implications for mental health status.

Rationale.

Since much existing research compares self-identified sexual minorities (i.e., LGB-identified) to heterosexuals, relatively little is known about the mental health statuses, or the life experiences of sexual minorities who do not identify as such (i.e., HSM individuals), or about differences that exist between lesbian/gay and bisexual people. Further, while sexual minority health disparities are frequently attributed to increased exposure to minority stress, or stress resulting from one's presumed minority status (e.g., discrimination or harassment) (Hatzenbuehler & Pachankis, 2016; Meyer, 2003a), lifestyle characteristics are also strongly associated with health. For instance, those who engage in exercise and who adhere to a healthy diet experience, on average, longer, healthier lives (Mander, 2012; Warburton, Nicol, & Bredin, 2006), and experience lower rates of depression (Penedo & Dahn, 2005). Conversely, smoking is negatively associated with both physical (Glantz & Johnson, 2014; Saha, Bhalla, Whayne, & Gairola, 2007) and mental health status (Chaiton, Cohen, Loughlin, & Rehm, 2009).

Further, ample research has documented the "social patterning of disease" (Link & Phelan, 1995; Phelan et al., 2010), whereby sociodemographic characteristics, such as race, gender, and socioeconomic status (SES) serve as powerful predictors of population health disparities (Dressler et al., 2005; Read & Gorman, 2010; Rieker & Bird, 2005; Turner & Avison, 2003). For example, individuals who are heterosexual, white, educated, more affluent, and male commonly enjoy many physical and mental health benefits, relative to those occupying marginalized social statuses (Connell, 2012; George & Lynch, 2003; Krieger, 2003; Link & Phelan, 1995; Phelan et al., 2010). Religiosity, another sociodemographic characteristic, has also been shown to be associated with mental health, though the directionality and causal nature of this relationship is less clear (George, Ellison, & Larson, 2002; Koenig & Larson, 2001; Levin, 1994).

Finally, health is determined through complex causal pathways. No single determinant is expected to affect mental health in the absence of other factors; sociodemographic, lifestyle, and psychosocial characteristics affect health interactively (Denton, Prus, & Walters, 2004; Jackson, Knight, & Rafferty, 2010). For instance, LGB women are more likely than heterosexual women or men to report workplace harassment (Badgett, Lau, Sears, & Ho, 2007). Prolonged exposure to such stressors may have a direct impact on an LGB woman's mental health, but employment discrimination may also limit her income, and hence her ability to leverage monetary resources for maintaining her health (Link & Phelan, 1995; Phelan et al., 2010). Therefore, given established associations between sociodemographic, lifestyle, *and* psychosocial factors and health, it is plausible that factors from each of these categories contribute to mental health disparities between heterosexual and sexual minority populations.

Study 1 addresses these gaps in the literature, and highlights avenues for future research, by first assessing how sexual orientation groups vary across a wide range of sociodemographic, lifestyle, and psychosocial characteristics. Next, this study assesses how underlying differences across these characteristics are associated with subgroup variations in mental health status. The study has the following two specific aims. Associated research questions and hypotheses are also presented.

Aim 1: To understand how sexual orientation groups vary across a wide range of sociodemographic characteristics, lifestyle behaviors, and psychosocial factors.

- *Research Question 1.1:* Do sexual orientation groups differ significantly from one another across sociodemographic characteristics (e.g., age, race/ethnicity, education), lifestyle behaviors (e.g., alcohol use, smoking status, exercise status), and sociodemographic factors (e.g., stressful life events, social support)?
  - ⇒ *Hypothesis 1.1.1:* While this study aim was largely exploratory, I hypothesize that sexual minority subgroups (i.e., lesbian/gay, bisexual, HSM) differ significantly from heterosexual respondents across several characteristics. For instance, I expect that on average, sexual minority subgroups will report lower incomes, increased use of alcohol and tobacco, and more stressful life events and less social support than heterosexuals. I further hypothesize that key differences will vary by respondents' sex. For example, sexual minority women are expected to report lower, while sexual minority men are expected to report higher educational attainment than heterosexual women and men, respectively.

⇒ *Hypothesis 1.1.2:* I also hypothesize sexual minority subgroups will differ from one another across a range of characteristics. For example, I expect bisexual respondents to report less educational attainment and lower incomes, compared to lesbian/gay respondents. Few *a-priori* hypotheses are made about heterosexual-identified, relative to LGB-identified sexual minorities, given little prior research on the topic.

Aim 2: To assess whether group differences in sociodemographic characteristics, lifestyle behaviors, and psychosocial characteristics are associated with mental health disparities between heterosexuals and sexual minority subgroups.

- *Research Question 2.1:* Do sexual orientation groups differ significantly from one another by mental health status?
  - ⇒ *Hypothesis 2.1.1:* I hypothesize all sexual minority subgroups will have lower (worse) mental health scores, relative to heterosexual respondents, consistent with prior theory and research.
  - ⇒ *Hypothesis 2.1.2:* Compared to lesbian/gay respondents, bisexual respondents are expected to have lower mental health scores. Further, while HSM respondents are expected to have lower mental health scores than heterosexuals, they are also hypothesized to have higher mental health scores than both lesbian/gay and bisexual respondents, due to their heterosexual identities.
- *Research Question 2.2:* Are group differences across sociodemographic, lifestyle, and psychosocial characteristics associated with group differences in mental health status?
  - ⇒ *Hypothesis 2.2.1:* I hypothesize that sexual orientation group differences across sociodemographic, lifestyle, and psychosocial characteristics will be accordingly

associated with sexual orientation group differences in mental health status. (e.g., should bisexual respondents report less educational attainment and lower incomes than lesbian/gay respondents, they would be expected to have lower mental health scores than lesbian/gay respondents).

Conceptual Model, Study 1.

The conceptual model for Study 1 is depicted in Figure 2.3. While the conceptual model highlights the expected causal mechanisms contributing to subgroup differences in mental health status, this study is not intended to formally assess the myriad mechanistic pathways through which subgroups differ in health (one such causal pathway is formally assessed in Study 2). Instead, to address dissertation Aims 1 and 2, this study is first meant to identify how subgroups vary with respect to a wide array of sociodemographic characteristics, lifestyle behaviors, and psychosocial characteristics, using a large, nationally representative sample (Aim 1), informing future research related to the mechanisms driving subgroup differences in health.

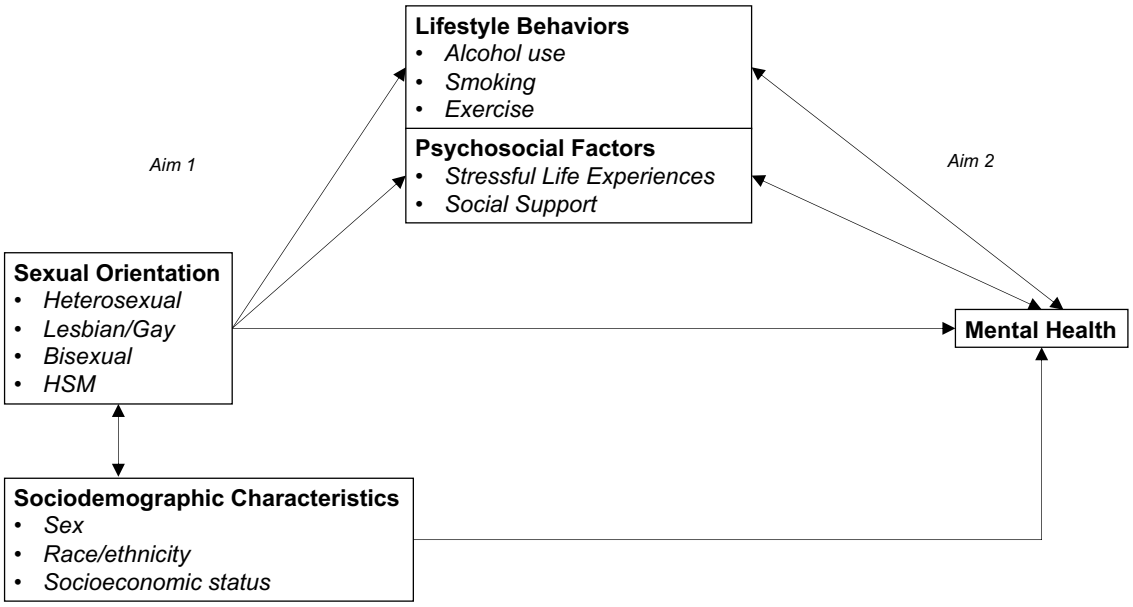
Sexual minority subgroups may be expected to vary with regard to sociodemographic characteristics. A double-headed arrow is drawn between sexual orientation and sociodemographic characteristics to depict that sexual orientation (a sociodemographic characteristic) is expected to covary with several other sociodemographic characteristics (e.g., sex, race/ethnicity, socioeconomic status). In some (e.g., socioeconomic status), but not all (e.g., sex, race/ethnicity) cases, sexual orientation is expected to be causally associated with other sociodemographic characteristics.

Subgroups are also expected to vary with regard to lifestyle behaviors (e.g., alcohol use, smoking, exercise) and psychosocial characteristics (e.g., stressful life events, social support), and while causality will not be formally assessed, the associations are expected to be

unidirectional (e.g., sexual minority status is expected to be causally associated with increased rates of alcohol consumption and increased exposure to social stress, but alcohol use and stress exposure are not expected to influence one's sexual orientation). As such, unidirectional arrows are drawn from sexual orientation to lifestyle behaviors and psychosocial factors.

Second, this study assesses how underlying subgroup differences across broad categories of characteristics (i.e., sociodemographic characteristics, lifestyle behaviors, psychosocial factors) are associated with differences in health (Aim 2), in order to guide future research and interventions in this area. Specifically, consistent with prior research, sociodemographic characteristics (e.g., sex, race/ethnicity, religiosity, socioeconomic status, etc.), lifestyle behaviors (e.g., alcohol use, smoking status, exercise status), and psychosocial factors (i.e., stressful life events, social support) are all expected to be associated with mental health. As such, any underlying subgroup differences across these characteristics may be expected to account for subgroup variation in mental health status. Bidirectional arrows are used to signify that, while not formally tested in Study 1, sociodemographic, lifestyle, and psychosocial factors are expected to covary with mental health status in a bidirectional nature. For example, social stress is expected to be causally associated with poorer mental health, but poor mental health is also expected to be causally associated with increased exposure to some social stressors (e.g., job and family strain).

Figure 2.3 Conceptual Model for Study 1



Study 2: Assessing sexual orientation group differences in social stress, support, and mental health resilience.

Rationale.

While at the population level, sexual minority people experience ample disparities in social stress experiences (Fingerhut et al., 2010; Lick et al., 2013; Meyer, 1995, 2003a; Wight et al., 2012) and mental health outcomes (Aneshensel, 1992; Hammen, 2005; Lewis et al., 2003; McLaughlin et al., 2010; Pechtel & Pizzagalli, 2011), many sexual minorities do not suffer from chronically poor mental health, despite higher exposure to stressful experiences (Saewyc, 2011). Coping and resilience research studies how exposure to stressful experiences can also lead to adaptive responses, which buffer, or protect against the harmful effects of stress on health over time (Cohen & Wills, 1985; Kwon, 2013). While there is no universally agreed-upon definition of resilience (Colpitts & Gahagan, 2016; Fletcher & Sarkar, 2013), the term refers generally to the ability to cope with, adapt to, and overcome stress (Fletcher & Sarkar, 2013), or to ability to maintain or regain mental health, despite experiencing stress (Herrman et al., 2011). Prior research suggests that exposure to adversity increases one's resilience, or ability to "handle" similar adversities in the future. Thus, resiliency likely plays a critical role in helping sexual minority people to persevere, and in many instances, thrive in spite of stress exposure (Kwon, 2013).

One consistently-identified external factor contributing to resilience, across both sexual minority and general resilience research, is access to, and utilization of positive social supports (Bariola et al., 2015; Bos et al., 2008; Kwon, 2013; Mereish & Poteat, 2015; Ozbay et al., 2007). However, a growing body of research has shown that sexual minority people have fewer supportive resources (lower ability to rely on friends, coworkers, or family members when

needed) available to them than heterosexual people (Bos et al., 2008; Saewyc, 2011). As such, lower social support may be an important social determinant of sexual orientation-based disparities in mental health, but higher social support may also help to explain why many sexual minority people do not experience poor mental health, despite exposure to stress.

Finally, the sexual minority population is diverse, and increasingly, research has pointed to differences in mental health between sexual minority subgroups who differ on the basis of identity (e.g., lesbian/gay, bisexual, and heterosexual-identified people reporting same-sex attractions or behaviors). However, the mechanisms contributing to these differences are poorly understood, though is possible that psychosocial and behavioral differences between subgroups contribute to subgroup differences in social support and mental health resilience. Indeed, compared to lesbian/gay people, bisexual people report feeling less connected to the larger LGB community (Friedman et al., 2014), to family and peers (Saewyc et al., 2009), and report experiencing bisexual stigma from both heterosexual and lesbian/gay people (Dodge et al., 2012; Lambe, Cerezo, & O'Shaughnessy, 2017; Rust, 2012). It is possible heterosexual-identified minorities also feel stigmatized, and less-supported from both heterosexual people and LGB-identified people, though to my knowledge, this has not been studied directly.

Study 2 will address some of these gaps in the literature. First, this study will examine sexual orientation group differences with respect to social stress, support, mental health status, and resilience. Discussed in detail in Chapter 3, "resilience" is operationalized in this study as having high ("thriving), average, or low ("languishing") mental health status, among those reporting multiple (two or more) past-year stressful life events. These cutoffs were empirically-derived from the data. The study will also assess how/whether social support mediates any

subgroup differences in resilience status that emerge. The study has the following two specific aims. Associated research questions and hypotheses are also presented.

Aim 3: To assess whether, and how, sexual orientation groups vary with regard to resilience status.

- Research Question 3.1: Do sexual orientation groups vary with regard to mental health resilience status, among those reporting two or more past-year stressful life events?
  - ⇒ Hypothesis 3.1.1: Among respondents reporting two or more past-year stressful life events, I hypothesize smaller proportions of respondents from each sexual minority group will have "thriving" resilience scores, and larger proportions will have "languishing" resilience scores, compared to heterosexual respondents.

Aim 4: To assess whether group differences in social support mediate group differences in resilience status.

- Research Question 4.1: Is social support associated with "thriving" and "languishing" resilience status, among respondents reporting two or more past-year stressful life events?
  - ⇒ *Hypothesis 4.1.1:* I hypothesize higher social support will be associated with "thriving," while lower social support will be associated with "languishing."
- Research Question 4.2: Do sexual orientation groups vary with regard to perceived levels of social support, and does social support mediate group differences in resilience status?
  - ⇒ *Hypothesis 4.2.1:* I hypothesize lesbian/gay, bisexual, and HSM respondents will report less social support than heterosexual respondents. Less social support will, in turn

mediate lower rates of "thriving" and higher rates of "languishing" resilience status for sexual minority respondents, compared to heterosexual respondents.

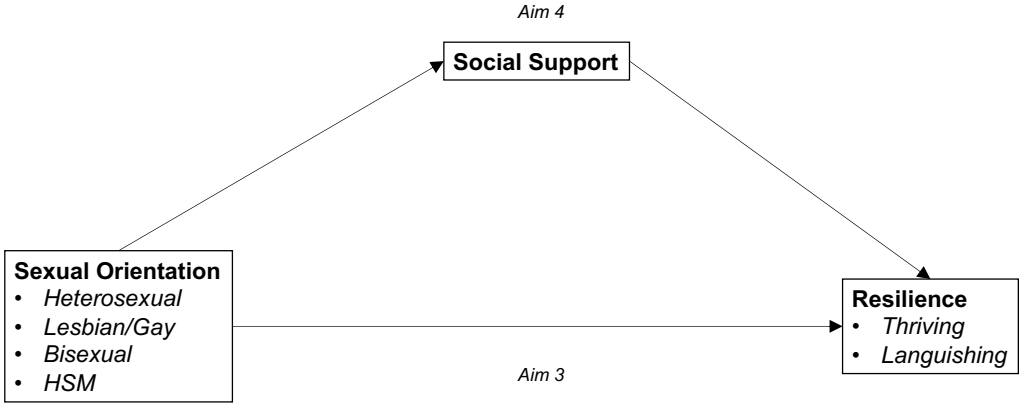
Conceptual Model, Study 2.

The conceptual model for Study 2 is depicted in Figure 2.4. The study has two aims. First, Aim 3 will assess whether sexual orientation groups differ with respect to resilience status, among respondents who report above-average (two or more) past-year stressful life events. All such respondents will be categorized as having a resilience status of "thriving" (above average mental health), "average" (average mental health status), or "languishing" (below average mental health), described in detail in Chapter 3. Building on theories of social stress (Meyer, 2003a; Pearlin et al., 1981) and social placement (Phelan et al., 2010), sexual orientation is expected to be associated with resilience. Specifically, it is hypothesized that respondents from sexual minority subgroups (i.e., lesbian/gay, bisexual, and HSM) will be less likely to be thriving, and more likely to be languishing, compared to heterosexual respondents. It is also expected that differences may emerge among sexual minority subgroups in terms of resilience status. While few explicit a-priori hypotheses are made, it is possible that smaller proportions of bisexual and HSM people will be thriving, and larger proportions will be languishing, compared to lesbian/gay people, given lower hypothesized connectedness to the LGB community.

Aim 4 will more specifically test these hypotheses. While Aim 1 (Study 1) will assess subgroup differences in social support, this study aim will assess whether social support mediates subgroup differences in resilience status. Building on the hypotheses made for Aim 3, it is expected that compared to heterosexual people, lesbian/gay, bisexual, and HSM people will have reduced access to social support, and that less social support will mediate subgroup differences in resilience status. Specifically, smaller proportions from sexual minority subgroups are

hypothesized to be thriving, and larger proportions are hypothesized to be languishing, compared to heterosexual respondents, which will be mediated by (i.e., explained by) lower levels of social support among sexual minority subgroups.

Figure 2.4 Conceptual Model for Study 2



Study 3: Understanding sexual orientation group differences in social stress and substance use disorders.

Rationale.

Misuse of alcohol, tobacco, and other drugs is a growing public health concern in the United States. Drug overdoses accounted for 72,000 deaths in 2017, more than triple the rate in 2000 (Ahmad, Rossen, Spencer, Warner, & Sutton, 2018; "Overdose Death Rates," 2018). A rapidly growing body of research has shown considerable disparities in substance use on the basis of sexual orientation (e.g., between lesbian, gay, bisexual [LGB] and heterosexual people) (Graham et al., 2011; Hatzenbuehler, Corbin, et al., 2008; Marshal et al., 2008, 2009; Talley et al., 2014). For instance, LGB people are disproportionately more likely than heterosexuals to report use and dependence on a wide range of both legal and illicit substances, including alcohol (Fish et al., 2018; Hatzenbuehler, Corbin, et al., 2008), tobacco (Blosnich et al., 2014; Fish et al., 2019; Lee et al., 2009; McCabe et al., 2018), marijuana, and other drugs (McCabe et al., 2009; NIDA, 2017; Watson et al., 2018).

A limited body of research has shown different sexual minority subgroups differ with respect to substance use behaviors on the basis of sexual identity (Boyd et al., 2019; Fish et al., 2018; Gattis et al., 2012; Hughes et al., 2015; McCabe et al., 2018; Talley et al., 2015). For instance, in an Australian national sample, "mainly heterosexual," (but not lesbian)-identified women were more likely to report at-risk drinking, and bisexual (but not lesbian)-identified women were more likely to report marijuana use, compared to heterosexual women (Hughes, Szalacha, et al., 2010). In addition, compared to their heterosexual peers, young gay (but not bisexual)-identified men reported greater odds of past-month cigarette smoking in a recent U.S. national sample (Schuler et al., 2018). It is thus important to consider how, and why, different

sexual minority subgroups experience differential health outcomes and behaviors, including substance use.

Social stress and substance use disparities.

Social stress has been linked to increased utilization of, and addiction to alcohol, tobacco, and other drugs (Frone, 1990; Rhodes & Jason, 1990), and chronic exposure to stress is associated with population disparities in substance use disorders (Turner, 2009; Williams & Jackson, 2005). For instance, increased job-, financial-, and family-derived stress are each associated with increased rates of coping through self-medication with alcohol and other drugs (Bray, Fairbank, & Marsden, 1999; Bray et al., 2010; Peirce, Frone, Russell, & Cooper, 1994). Further, minority stress refers to the socially-derived interpersonal stressors that sexual minorities face as a result of their real or perceived LGB identities, including stigma, discrimination, and victimization (Meyer, 2003a). Both minority stressors and more general stressors (e.g., financial burden) have been linked to substance use behaviors, and Minority Stress Theory describes how sexual minority people experience elevated rates of both types of stress, as well as fewer coping resources (Hatzenbuehler, Nolen-Hoeksema, et al., 2008; Hatzenbuehler, Phelan, et al., 2013; Meyer, 2003a, 2003b; Phelan et al., 2010).

Increasingly, research has indicated minority stress as a primary mechanism contributing to sexual minority disparities in substance use (Coulter et al., 2018; Goldbach et al., 2014; Hughes, McCabe, et al., 2010; McCabe et al., 2010), with for instance, homophobic bullying mediating sexual minority alcohol use disparities (Pollitt et al., 2018). Bullying and other victimization events that are not necessarily related to sexual orientation are also associated with sexual minority disparities in alcohol and marijuana use (Hatzenbuehler et al., 2011; Lowry et al., 2017; Phillips et al., 2017; Woodford et al., 2012). However, the degrees to which stressful

life events – stressors that both heterosexual and sexual minority people experience, but which sexual minorities experience at higher rates (e.g., family strains, being a victim of theft) – serve as primary mechanisms driving sexual minority disparities in substance use have been examined to a lesser extent, and to my knowledge, no studies have directly compared the effects of stressful life events and LGB discrimination on sexual minority disparities in substance use.

Study 3 addresses some of these gaps in the literature, and highlights avenues for future research by assessing sexual orientation group differences in substance use, and the degree to which stressful life events mediate disparities in substance use between heterosexuals and sexual minority subgroups. In addition, stressful life events and LGB discrimination are compared as mediators underlying differences in substance use across sexual minority subgroups. The study has three specific aims. Associated research questions and hypotheses are also presented.

Aim 5: To assess the prevalence of three past-year substance use disorders across sexual orientation groups.

- *Research Question 5.1:* Do sexual orientation groups meet Diagnostic and Statistical Manual (DSM)-V criteria for past-year alcohol, cannabis, and tobacco use disorders at differential rates?
  - ⇒ *Hypothesis 5.1.1:* Compared to heterosexuals, respondents from all sexual minority subgroups are expected to meet criteria for each disorder at higher rates. Additionally, compared to heterosexuals, lesbian/gay, bisexual, and HSM respondents will report experiencing more stressful life events.
  - ⇒ *Hypothesis 5.1.2:* I also hypothesize that sexual minority subgroups will differ from one another, with bisexual respondents reporting higher substance use rates than lesbian/gay

and bisexual respondents, consistent with prior research. While HSM respondents are expected to experience each SUD at higher rates than heterosexual respondents, on account of their non-heterosexual status, they might also be hypothesized to have lower rates of each SUD than lesbian/gay and bisexual respondents, given their heterosexual identities. Compared to HSM, lesbian/gay and bisexual respondents will report experiencing more LGB discrimination events. More perceived discrimination events will, in turn, mediate higher rates of disordered alcohol, cannabis, and tobacco use for lesbian/gay and bisexual respondents, compared to HSM.

Aim 6: To assess whether stressful life events mediate substance use disparities between heterosexuals and sexual minority subgroups.

- *Research Question 6.1:* Do more stressful life events mediate disparities in alcohol, cannabis, and tobacco use disorders between heterosexual and sexual minority (i.e., lesbian/gay, bisexual, HSM) respondents?
  - ⇒ *Hypothesis 6.1.1:* I hypothesize that greater numbers of stressful life events will mediate higher rates of disordered alcohol, cannabis, and tobacco use for sexual minority subgroups, compared to heterosexuals. Specifically, compared to heterosexuals, lesbian/gay, bisexual, and HSM respondents will all report more stressful life events, which will in turn mediate higher rates of alcohol, cannabis, and tobacco use disorders.

Aim 7: To simultaneously assess stressful life events and perceived LGB discrimination events as mediators of substance use differences between sexual minority subgroups.

- *Research Question 7.1:* Do more stressful life events mediate differences in disordered alcohol, cannabis, and tobacco use between HSM, lesbian/gay, and bisexual respondents?
  - ⇒ *Hypothesis 7.1.1:* I hypothesize that greater numbers of stressful life events will mediate higher rates of disordered alcohol, cannabis, and tobacco use for lesbian/gay and bisexual respondents, compared to HSM. Specifically, compared to HSM, lesbian/gay and bisexual respondents will report more stressful life events, which will in turn mediate higher rates of alcohol, cannabis, and tobacco use disorders.
- *Research Question 7.2:* Does a greater number of perceived LGB discrimination events mediate differences in disordered alcohol, cannabis, and tobacco use between HSM, lesbian/gay, and bisexual respondents?
  - ⇒ *Hypothesis 7.2.1:* I hypothesize more perceived discrimination events will, in turn, mediate higher rates of disordered alcohol, cannabis, and tobacco use for lesbian/gay and bisexual respondents, compared to HSM. Specifically, compared to HSM, lesbian/gay and bisexual respondents will report more LGB discrimination events, which will in turn mediate higher rates of alcohol, cannabis, and tobacco use disorders.
- *Research Question 7.3:* Do stressful life events and LGB discrimination events differentially mediate subgroup differences in disordered alcohol, cannabis, and tobacco use?
  - ⇒ *Hypothesis 7.3.1:* Given, on average, lesbian/gay people report greater LGB community connectedness than bisexual people, I hypothesize LGB discrimination will more strongly mediate SUD disparities between lesbian/gay and HSM respondents than between bisexual and HSM respondents (i.e., larger indirect effect for LGB discrimination than stressful life events). Conversely, stressful life events may more

strongly mediate SUD disparities between bisexual and HSM respondents, than between lesbian/gay and HSM respondents.

Conceptual Model, Study 3.

The conceptual model for Study 3 is depicted in Figure 2.5. The study has three aims. First, Aim 5 will assess differences in the prevalence of three past-year substance user disorders between sexual orientation subgroups. Given prior research, higher proportions of respondents from each sexual minority subgroup (i.e., lesbian/gay, bisexual, and HSM) are expected to meet criteria for past-year substance use disorders, compared to heterosexual respondents. Among sexual minorities respondents, subgroups may be expected to vary as well, with larger proportions of respondents possessing sexual minority identities (i.e., lesbian/gay, bisexual) meeting criteria for a past-year substance use disorder, compared to heterosexual-identified sexual minorities (HSM). While, to my knowledge, no previous studies have formally tested this question, I hypothesize that possessing a heterosexual identity will confer some degree of protection to HSM respondents, compared to lesbian/gay and bisexual respondents.

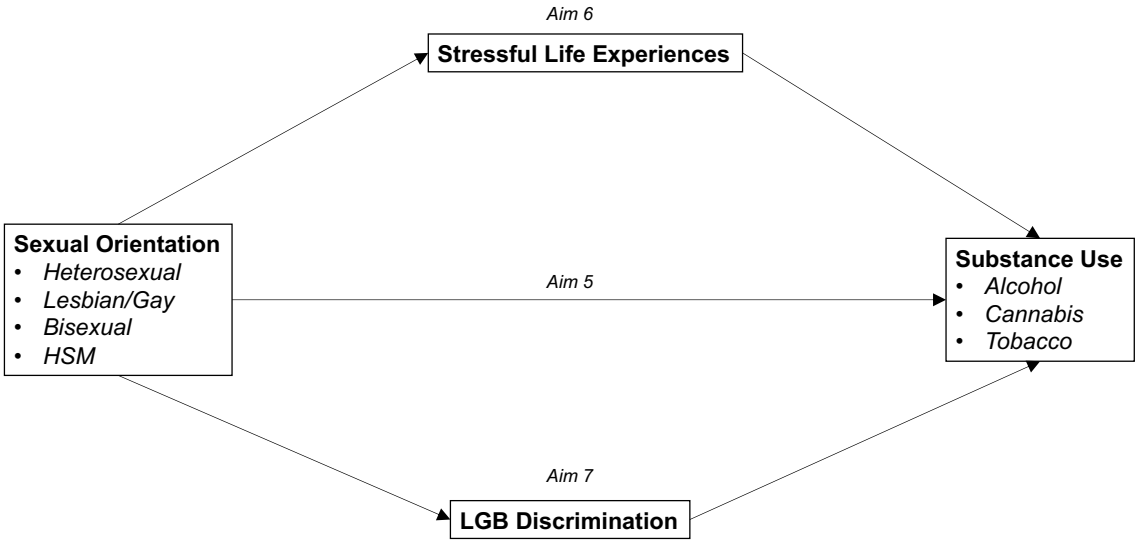
Aim 6 will assess the degree to which stressful life events mediate disparities in each substance use disorder between heterosexuals and each sexual minority subgroup. It is expected that, compared to heterosexual respondents, lesbian/gay, bisexual, and HSM respondents will report more past-year stressful life events, consistent with Minority Stress Theory. More stressful life events will in turn mediate higher rates of substance use for each of the sexual minority groups, relative to heterosexuals, consistent with prior research showing minority specific stressors (e.g., LGB discrimination) to be associated with higher rates of substance use among sexual minority populations.

Finally, Aim 7 will compare the degrees to LGB discrimination events and stressful life events mediate differences in disordered substance use among sexual minority subgroups. Given their heterosexual identities, HSM respondents will serve as the referent group for Aim 7 analyses. It is hypothesized that, compared to HSM respondents, lesbian/gay and bisexual respondents will report more LGB discrimination events, which will in turn mediate higher rates of disordered substance use. Similarly, lesbian/gay and bisexual respondents are hypothesized to report more stressful life events than HSM respondents, which will in turn mediate higher rates of disordered substance use. In path analysis, LGB discrimination and stressful life events will be tested simultaneously as mediators of disordered substance use between HSM, lesbian/gay, and bisexual respondents. It is hypothesized that LGB discrimination will more strongly predict disordered substance use than stressful life events, given lesbian/gay and bisexual respondents' non-heterosexual identities, and so likely greater perception of LGB discrimination.

A note about the LGB discrimination measure.

It should be noted that (described in more detail in Chapters 3 and 6), the LGB discrimination scale used for this aim is expected to assess subgroup differences in *perceived* LGB discrimination events more strongly than actual exposure to minority stress events. Given their heterosexual identities, HSM respondents may be expected to perceive fewer LGB discrimination events, regardless of actual exposure to them. Despite this limitation, I expect findings from this aim to provide vital information related to subgroup differences in experiences of, and perceptions of stress, and to provide useful information for future research.

Figure 2.5 Conceptual Model for Study 3



CHAPTER 3. Research Design and Methods

Study Design

This dissertation was completed using data from the National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III), a cross-sectional, nationally representative sample of civilian, non-institutionalized adults living in the United States collected in 2012-2013. NESARC-III was designed to collect information on alcohol use and disorders, as well as related physical and mental disabilities. NESARC-III is the third wave of the NIAAA-sponsored NESARC survey. Waves I and II of NESARC contain a panel of respondents following longitudinally. However, Wave III contains a new sample of respondents, not associated with earlier waves.

Strengths of NESARC-III.

Three major advantages inherent to the NESARC-III dataset include a sample that is large (N=36,309), recently-collected (2012-2013), and representative of the majority of United States residents, across a large age range. Given that sexual minorities comprise roughly 4-5% of the U.S. population (Gates & Newport, 2012; Ward et al., 2014), a larger overall sample size increases the sample of sexual minorities available for analysis, allowing for detailed statistical analyses to be performed. Further, given the extensive battery of questions related to sexual orientation, social stress and support, and mental health outcomes, the NESARC-III dataset provides a unique opportunity by which to conduct a theoretically-informed study of sociodemographic, behavioral, and psychosocial characteristics across several unique sexual orientation groups, and associated implications for mental health and substance use.

Study eligibility.

The NESARC-III target population was the noninstitutionalized, civilian population of U.S. adults aged 18 and over. As such, to be eligible, individuals were required to be 18 years or older at the time of screening, a resident of the 50 states, and to reside in a household or group housing setting (e.g., college dormitory, group home). Armed forces veterans were included in the sample, but active duty and institutionalized individuals were excluded from participation because they are not protected under NIH Certificates of Confidentiality (Grant et al., 2014). Eligibility and selection of participants for NESARC-III was assessed using a computer-assisted personal interviewing (CAPI) screener, available in several languages, including Spanish, Mandarin, Cantonese, Korean, and Vietnamese (Grant et al., 2014).

Sampling design.

A multi-stage probability sampling design was used to select a sample that was representative of the target population. The first stage included the selection of primary sampling units (PSUs), which largely consisted of individual counties. However, some rural counties were combined with neighboring counties to create effectively large PSUs. From over 3,100 counties in the United States, 2,349 PSUs were created for NESARC-III, from which 150 were selected using stratified proportional-to-size sampling. This procedure ensured that each PSU selected contained approximately equal numbers of households (Folsom, Potter, & Williams, 1987).

Secondary sampling units (SSUs) were then established within each of the PSUs using 2010 Census blocks housed within PSUs. SSUs were created using proprietary software developed by Westat, the survey research company hired to conduct NESARC-III. For NESARC-III, a PSU generally consisted of a single Census block, or a combination of neighboring blocks, with each block containing a minimum of 60 households. Each PSU

contained an average of 3.4 SSUs (Grant et al., 2014). SSUs were stratified by the proportion of racial/ethnic minority respondents (i.e., Hispanic, Black, or Asian) living with them.

In the third stage, 71,052 households were selected from within SSUs. Household addresses were obtained from a master address file created and maintained by the U.S. Postal Service. SSUs containing more than 59% minorities were categorized as "high minority" SSUs, those with 26-59% minorities were "moderate minority" SSUs, and those with less than 26% minorities were "low-minority" SSUs. Households in the high- and moderate-minority SSUs were oversampled, such that high-minority households were sampled at twice the rate, and moderate-minority households were sampled at 1.5 times the rate of low-minority households (Grant et al., 2014).

In the final stage, individuals meeting eligibility criteria were randomly selected from within chosen households to participate. In households with three or fewer eligible people, only 1 person was selected to participate, and two or more were selected in households with four or more eligible people. The final sample size was 36,309 (Grant et al., 2014).

Data collection procedures.

The survey was conducted between April 2012 and June 2013. Across the United States, sampled addresses were visited by approximately 1,000 trained Westat interviewers, who conducted interviews with respondents. After screening and consent, respondents participated in the Alcohol Use Disorder and Associated Disabilities Interview Schedule-5 (AUDADIS-5), the extensive survey component of NESARC-III. Data were collected via Computer-assisted personal interviewing (CAPI), which automated the presentation of relevant modules and questions required from each respondent, based on information presented in the screener and in prior questions. After completion of the AUDADIS-5 interview, participants were invited to

participate in future studies, and then asked to provide a saliva sample for DNA analysis (Grant et al., 2014).

Sample weighting and imputation.

As is common in many large epidemiologic surveys, the NESARC study team developed sampling weights for use in analysis to account for the complex sampling design, varying probabilities of selection into the study, and differential nonresponse rates. When used, the weights adjust for the sampling design and differential selection probabilities based on race and other sociodemographic characteristics, resulting in a nationally representative sample of U.S. adults over the age of 18.

The development of weights occurred in a series of steps. First, each household selected for the sample was assigned a "dwelling unit" (DU) weight. DU weights were equal to the inverse of a household's overall selection probability (Grant et al., 2014). DU weights were then adjusted for nonresponse to the screener. DU weights were then further adjusted to person-level weights, which reflected the probability of selecting an individual for the study, and nonresponse to the AUDADIS-5 interview. Weights were then post-stratified to known population counts derived from the 2012 American Community Survey (Grant et al., 2014).

Missing demographic data were then replaced with imputed values, utilizing sample weights and the following demographic variables: sex, age, ethnicity, and race. Data were imputed in two ways: using the "assignment method," if the true value could be assigned or deduced from other information in the screener or interview, or using a "hot deck" procedure, in which missing values were replaced with a value from a similar, randomly chosen respondent in the sample (Grant et al., 2014).

Data Access and Ethical Conduct of Research.

A limited access dataset is available to researchers upon request to the National Institute on Alcohol Abuse and Alcoholism (NIAAA). A data use agreement was executed by Dr. Dawn Upchurch, and the data were granted to use for this dissertation on March 23, 2017. The dissertation research was approved by the University of California, Los Angeles Office of the Human Research Protection Program.

Study Variables

Refer to Table 3.1 for complete details about each variable. The original question and response options available on the NESARC-III survey are recorded. Any modifications to the original questions are also described. Unless specified otherwise, each variable was used for all three studies.

Mental health.

Mental health status (Study 1) was measured using the 6-item mental health component summary score (MCS), derived from the 12-item short form health survey (SF-12), a well-validated measure of mental distress (Ware et al., 1996). Respondents were asked how often, in the past 4 weeks they "had a lot of energy," "physical health or emotional problems interfered with social activities," they "accomplished less than [they] would like as a result of emotional problems," they "did [their] work or other activities less carefully than usual because of emotional problems," they "felt calm and peaceful," and they "felt downhearted and depressed." Response options for each of the questions ranged from "none of the time" to "all of the time" on a 5-point Likert scale. A norm-based standardized score (range = 0-100, mean = 50, standard deviation = 10) was calculated by the NESARC team utilizing weights empirically derived from

the US population. A score of zero represents the lowest, while 100 represents the highest level of health (*Data Notes: National Epidemiologic Survey on Alcohol and Related Conditions-III (NESARC-III)*, n.d.; Ware et al., 1996). Scores were calculated by the NESARC-III study team. 17 respondents were missing a mental health status score.

Resilience status (Study 2) was assessed among respondents reporting two or more past-year stressful life events (details of stressful life events variable described below). Two stressful life events was chosen as the cutoff because the mean number of such events reported was 1.71. To best understand respondents' abilities to maintain mental health, despite experiencing stress (Herrman et al., 2011), mental health was assessed among those reporting higher than average stress. To calculate this variable, the SF-12 mental health score was first trichotomized as follows: "average" mental health (SF-12 score within 0.5 standard deviations of the mean [i.e., between 45 and 55]), "below average" mental health (SF-12 score more than 0.5 standard deviation below the mean [i.e., below 45]), or "above average" mental health (SF-12 score more than 0.5 standard deviations above the mean [i.e., above 55]). Among respondents reporting two or more stressful life events (mean = 1.71, median = 1), respondents were then assigned a resilience status score as follows: "thriving" (above average mental health), "average" (average mental health), or "languishing" (below average mental health). In total, 21,054 (57.99%) respondents were missing a resilience score because they did not experience 2 or more past-year stressful life events (N = 21,037), a mental health score (N = 5), or both (N = 12). Due to the large number of missing respondents, a multiple logistic regression was performed to assess how those reporting two or more stressful life events differed from those reporting one or fewer such events across several demographic characteristics (Appendix 1).[3]

[3] Appendix 1 displays results from a multiple logistic regression that assessed how respondents reporting experiencing two or more past-year stressful life events differed from those reporting one or fewer such events,

Substance use.

Each respondent was coded as meeting Diagnostic and Statistical Manual, version 5 (DSM-V) criteria (versus not) for each of several substance use disorders (SUD) in the prior 12 months: Alcohol use, cannabis use, and tobacco use disorders. Categorizations were made by the NESARC-III study team, using responses to multiple diagnostic questions in the AUDADIS-V interview (Grant et al., 2014). For each substance in the past 12 months, questions assessed amount and duration of consumption, desires and/or unsuccessful efforts to cut down or control use, time spent seeking the substance, cravings, failure to fulfill major roles or obligations due to use, continued use despite such failure and knowledge the effects of the substance on one's health. Additional symptoms assessed included tolerance to the substance, defined as a need for markedly increasing amounts of the substance to achieve intoxication or a markedly diminished effect with continued use, and symptoms of withdrawal. There were no missing values for any of the substance use variables.

Sexual orientation.

Three sexual orientation measures were present in the NESARC-III interview (sexual identity, attraction, behavior). S*exual identity* was assessed by asking respondents to choose the "category that best describes your sexual orientation." Response options were "heterosexual (straight)," "gay or lesbian," "bisexual," "not sure," and "unknown." *Sexual attraction* was assessed by asking respondents to report the "best description of your sexual attraction to other

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across several demographic characteristics: age, sex, race/ethnicity, nativity, education, income. Compared to those reporting one or fewer stressful life events, those reporting two or more events were younger on average, more likely to be Black or American Indian/Alaska Native than White, were less likely to be born in the United States and had lower incomes. In addition, compared to those reporting fewer stressful life events, respondents reporting two or more events had greater odds of completing some college than completing less than a high school education. By and large, these results highlight that disadvantaged social statuses are associated with higher exposure to stressful life events.

people." Response options were "only attracted to females," "mostly attracted to females," "equally attracted to females and males," "mostly attracted to males," "only attracted to males," and "unknown." Recent ("during the last 12 months [did you have] sex with only males, only females, or both?") and lifetime ("gender of sexual partners in [your] entire life") *sexual behavior* was also assessed. Response options for both behavior questions were "only males," "only females," both males and females," "unknown," and "never had sex." Respondents who reported they were "not sure," or who selected "unknown" to the sexual identity, attraction, and/or recent and lifetime behavior questions (N=513, 335, 16, and 365, respectively), or who reported not having sex (N=10,570 recent; N=908 lifetime) were marked as missing for the respective sexual orientation questions.

Respondents were assigned to one of four *sexual orientation groups* based on their responses to the identity, attraction, and behavior variables: 1) Heterosexual (heterosexual identity plus opposite-sex attractions and lifetime opposite-sex behaviors only; N=31,361), 2) Lesbian/gay (lesbian or gay identity, regardless of attractions or behaviors; N=586), 3) Bisexual (bisexual identity, regardless of attractions or behaviors; N=565), and 4) HSM (heterosexual identity plus current same/both-sex attractions and/or recent same-sex behaviors; N=2,074). The recency of same-sex sexual behavior was taken into account to distinguish heterosexual-identified respondents with only past same-sex experiences from those with ongoing same-sex sexuality (HSM). To serve as an unambiguous comparison group, however, those categorized as "heterosexual" were required to have reported opposite-sex, but no same-sex behaviors in their lifetimes. In total, 1,712 respondents were missing the required variables for assignment to a sexual orientation group. A multiple logistic regression was performed to assess how those

missing a sexual orientation group assignment differed from those assigned to a group across several demographic characteristics (Appendix 2).[4]

Social Stress.

Stressful life experiences (All studies) were assessed as a count of the number of times respondents had experienced one or more of 16 common stressors in the prior 12 months. Questions included whether respondents had "moved or anyone new came to live with them," had been "fired or laid off from a job," or were "unemployed and looking for work for greater than 1 month." Responses for each item were "yes," "no," or "unknown." All items were dichotomized (1= occurred versus 0 = did not occur). "Unknown" responses were set to missing, and a sum score was created (range 0-16, mean = 1.71, Std. Dev. = 1.91). In total, 6 respondents were missing a stressful life experiences score (i.e., were missing on all 16 individual stressful life events items). The top 5 stressful life events reported by respondents are included in Appendix 3.[5]

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[4] Appendix 2 displays results from a multiple logistic regression that assessed how those missing a sexual orientation group assignment differed from those assigned to a group across several demographic characteristics: age, sex, race/ethnicity, nativity, education, income. Compared to respondents assigned to a group, those not assigned to a group were younger, had higher odds of being female, Black, API/Hawaiian, or Hispanic, had lower educational attainment, and lower incomes. These findings highlight that future research might consider comprehensively assessing the sociodemographic characteristics, lifestyle behaviors, and psychosocial characteristics associated with non-response to sexual identity, attraction, and behavior questions. Younger age and lower educational attainment among non-responders, compared to those assigned to a group, may suggest a lack of understanding of one or more of the sexual orientation questions as contributing to non-response. It is also possible sexual orientation- related stigma prevents some respondents from responding to one or more of the sexual orientation items.

It should be noted that of the 1,712 respondents who were not assigned to a sexual orientation group, 287 (16.76%) were missing because they reported same-sex behavior prior to 12 months ago, but not in the past 12 months. This decision was made so that heterosexuals could serve as the most unambiguous comparison group possible. The remaining respondents were missing either the identity, attraction, and/or behavior variables necessary for assignment to a sexual orientation group.

[5] Appendix 3 reports the top five stressful life events endorsed among NESARC-III respondents. The top five such events were "Any family members or close friends died in last 12 months" (30.81%), "Moved/anyone new came to live with you in last 12 months" (22.49%), "Changed jobs, job responsibilities or work hours in last 12 months" (19.10%), "Unemployed and looking for work for >1 month in last 12 months" (16.28%), and "Have you had so much debt that you had no idea how to repay it in last 12 months" (14.81%).

LGB discrimination (Study 3). Sexual minority respondents (lesbian/gay, bisexual, HSM) were additionally asked how often they experienced any of 6 LGB discrimination events in the past year. Questions included whether respondents had been "called names," or experienced discrimination "in public, like on the street, in stores, or in restaurants," and while "obtaining health care or health insurance coverage" because they were assumed to be gay, lesbian, or bisexual. Responses for each item were "never," "almost never," "sometimes," "fairly often," "very often," and "unknown." 32,158 respondents were missing because they were heterosexual, reported only opposite-sex attraction, and either never had sex or only had sex with opposite-sex partners. All items were dichotomized (1= occurred [almost never or more] versus 0 = did not occur [never]). "Unknown" responses were set to missing, and a sum score was created (range 0-6, mean = 0.46, Std. Dev. = 1.24; N = 3,228).

Social Support.

Social support (Studies 1, 2) was assessed using the Interpersonal Support Evaluation List, a 12-item validated scale assessing availability of social support (Cohen, Mermelstein, Kamarck, & Hoberman, 1985). Questions include "[I] feel that there is no one to share [my] worries or fears with," "[I have] someone to turn to for advice on family problems," and "[It would] be difficult to find someone to watch my house if [I was] out of town." All response options ranged from "definitely false" to "definitely true." Items were reverse-coded as necessary. In accord with scale construction instructions, the scale was created as a mean score (range 1-4, mean = 3.47, Std. Dev. = 0.51), and respondents with more than 25% missing items (3 items) were marked as missing for the scale (N=65) (Cohen et al., 1985).

Covariates, all studies.

Sex was assessed dichotomously (male, female). *Race/ethnicity* was assessed categorically (non-Hispanic White, non-Hispanic Black, non-Hispanic American Indian/Alaska Native, non-Hispanic Asian/Native Hawaiian/Other Pacific Islander, Hispanic). *Nativity* status was assessed dichotomously (born a U.S. citizen vs. not). Respondents provided a numeric age, ranging from 18 to 89, or over age 90. *Education* (less than high school, completed high school, technical/trade school, completed college, more than college) and *current income* (less than $25,000, $25,000-$49,999, $50,000-$79,999, $80,000-$99,999, greater than $100,000) were coded as ordinal variables. As described above, the NESARC-III study team imputed demographic characteristics, and so there were no missing values for any of these characteristics.

Additional covariates, Study 1.

Sociodemographic characteristics.

Religious denomination was categorical (non-Catholic Christian, Catholic, Jewish, Muslim, Buddhist, Hindu, Other faith, and Unaffiliated) (N = 494 missing). *Religious importance* was assessed on a Likert scale ("very important" to "not important") (N = 63 missing). *Urbanicity* was dichotomous (Urban, Rural) and *Census region* was categorical (Northwest, Midwest, South, and West). There were no missing for the urbanicity and Census region variables.

Lifestyle characteristics.

Respondents' *smoking status* (current smoker: used at least 1 tobacco product in past 12 months; former smoker: used last tobacco product more than 12 months ago; non-smoker: did not use any tobacco products in lifetime) and *drinking status* (current drinker: drank at least 1 alcohol product in past 12 months; former drinker: drank last alcohol product more than 12

months ago; lifetime abstainer: did not drink any alcohol products in lifetime) were assessed. *Problems sleeping* were also assessed ("had problems falling asleep or staying asleep in last 12 months": yes, no; N = 124 missing). There were no missing for the smoking and drinking status variables.

Respondents recorded the moderate (e.g., walking, tennis) and vigorous (e.g., jogging, swimming) *physical activities* they engaged in, and the amount of time spent engaging in each type of exercise each week. They were then categorized based on federal guidelines for physical activity, which recommend engaging in ≥ 150 minutes of moderate activity/week, ≥ 75 minutes of vigorous activity/week, or ≥ 150 minutes of combined moderate and vigorous activity/week (DHHS, 2018). Respondents were categorized as meeting federal guidelines, as exercising but less than federal guidelines, or not exercising at all. In total, 697 respondents were missing the moderate and vigorous activity variables needed to compute physical activity, and so were imputed using a regression imputation. Specifically, missing values were predicted, and assigned, using an ordinal least squares regression, with sex, age, race, nativity, education, and income as independent variables.

Finally, body mass index (*BMI)* was calculated using respondents' reported height (feet: recorded range = 2 – 9 and inches: recorded range = 0 – 11) and weight (pounds: recorded range = 5 – 550). BMI was calculated as $703 * weight(lb) / height^2(in)$ (CDC, 2014), and a categorical variable was created: underweight, ≤ 18.5; healthy weight, 18.5 – 24.9; overweight, 25 – 29.9; obese, ≥30. In total, 543 respondents were missing the height and/or weight variables necessary to compute BMI, and an additional 8 respondents had resultant scores well outside the "normal" range (≤ 10 or ≥ 90; due to unlikely heights and/or weights). I imputed missing values using a

regression imputation; missing values were predicted, and assigned, using an ordinal least squares regression, with sex, age, race, nativity, education, and income as independent variables.

Analytic Approach

The specific analyses performed for each study are described below. Generally, however, bivariate analyses first assessed sexual orientation group differences across health outcomes (mental health status in Study 1, "thriving" and "languishing" resilience statuses in Study 2, and substance use outcomes in Study 3). Bivariate analyses were performed using Wald and design-adjusted *F* tests. For tests in which an overall difference was found, post hoc pairwise comparisons assessed differences between each of the subgroups, and Bonferroni-adjusted *p* values were calculated to adjust for multiple comparisons. Bonferroni adjustment is a conservative test that protects against the increased chance of committing a Type 1 error (i.e., the increased probability of rejecting a null hypothesis that is in fact true) when multiple tests are performed (Holland & Copenhaver, 1988).

For each study, multivariate analyses were then performed using linear (Aim 1) and logistic (Aims 2 and 3) regressions. Mediation was assessed using path analysis (Aims 2 and 3) (Lei & Wu, 2007). All analyses were performed separately by sex and employed sample weights, allowing for generalization to the U.S. population of adults. Path analyses were completed using MPlus Version 7 (Muthen & Muthen, 2015). All other analyses were completed using Stata version 14 (StataCorp, 2015).

A note about mediation analysis.

Several approaches exist for statistically assessing mediation. Baron and Kenny described the Causal Steps Approach to testing intervening variable effects (Baron & Kenny, 1986). They

propose a widely-used approach to assessing mediation, in which the potential mediating variable must first meet several conditions; namely, the mediator variable must be independently associated with the focal independent variable, as well as with the dependent variable. Further, when the mediating variable is added to a model with the independent and dependent variables, the association must lose statistical significance, demonstrating that the mediator is able to account for the original association. While it is still widely-used, Baron and Kenny's approach has been criticized as being overly-conservative (Hayes, 2009). Further, the assessment of indirect effects, commonly assessed using the Sobel Test in conjunction with Baron and Kenny's Causal Steps approach (Hayes, 2009), relies on the multiplication of model coefficients. This approach is limited in its ability to assess mediation in nonlinear, and nonparametric statistical models (Hayes, 2009).

Path analysis, via Structural Equations Modeling (SEM) provides a more direct way of assessing mediation, by estimating several regression models simultaneously, and is not prone to some of the limitations inherent to the above methods (Lei & Wu, 2007). As defined by Ullman (1996), SEM, "allows examination of a set of relationships between one or more independent variables, either continuous or discrete, and one or more dependent variables, either continuous or discrete." Path analysis also allows for the calculation of both direct and indirect effects between the independent and dependent variables. When calculated, indirect effects estimate the degree to which a relationship between two variables is mediated through a potential mediating variable, while direct effects estimate the degree to which the association is *not* mediated through the potential mediation variable. Indirect and direct effects were calculated in studies 2 and 3, and the specific mediating relationships examined are described below.

Study 1 Analyses.

First, mental health, sociodemographic, lifestyle, and psychosocial differences were assessed across all four sexual orientation groups using Wald and design-based *F* tests **(Aim 1)**. For tests in which an overall difference was found, post hoc pairwise comparisons assessed differences between each of the subgroups; Bonferroni-adjusted *p* values were calculated to adjust for multiple comparisons.

Next, sequential ("nested") ordinal linear regression models assessed whether there were disparities in mental health status (SF-12) between heterosexuals and each sexual minority group, and the degrees to which each set of characteristics (i.e., sociodemographic, lifestyle, and psychosocial characteristics), separately, and in combination, attenuated the mental health disparities **(Aim 2)**. Specifically, five models were estimated. First, Model 1 estimated the bivariate association between sexual identity and mental health. Next, Model 2 estimated the association between sexual identity and mental health, and included sociodemographic factors. Model 3 then estimated the association between sexual identity and mental health, and included lifestyle factors. Model 4 then estimated the association between sexual identity and mental health, and included psychosocial factors. Finally, Model 5 estimated the association between sexual identity and mental health, and included sociodemographic, lifestyle, and psychosocial factors.

All analyses were performed separately by sex and used survey weights, allowing for generalization to the US population of adults included in the sampling frame. After excluding those without mental health scores ($N = 17$), and subsequently those with missing sexual orientation group assignments ($N = 1{,}706$), the final analytic sample size for Study 1 was 34,586 (15,191 men and 19,395 women).

Study 2 Analyses.

First, bivariate differences in stressful life events, social support, and SF-12 mental health scores were assessed across all four sexual orientation groups. Bivariate differences were also assessed in resilience status, among those reporting two or more past-year stressful life events **(Aim 3)**. Design-adjusted *F* statistics were calculated for categorical variables, and adjusted Wald *F* statistics were calculated for continuous variables. Post-hoc comparisons then assessed whether each sexual minority group differed from heterosexuals.

Next, factors contributing to "thriving" and "languishing" resilience statuses were assessed using sequential multiple logistic regressions. First, Model 1 estimated the associations between sociodemographic characteristics, including sexual orientation, and the thriving and languishing outcomes. Social support was added to Model 2. Finally, path analyses were performed to assess the degrees to which social support mediated disparities between heterosexuals (referent group) and each sexual minority subgroup, in terms of thriving and languishing resilience status **(Aim 4)**. Indirect effects were calculated to assess the degrees to which the associations between sexual orientation and resilience were mediated by support, and direct effects estimated the degrees to which these associations were not mediated by support. For all path analyses, a significant indirect effect in the absence of a direct effect would signify complete mediation through social support, while the presence of both significant indirect and direct effects would signify partial, but not full mediation through social support.

All analyses were performed separately by sex and applied survey weights to allow for generalization to the U.S. population who were part of the sampling frame. Path analyses included sociodemographic characteristics for adjusted estimates. After excluding those without

a resilience score (N = 21,054) or a sexual orientation group assignment (N = 785), the final analytic sample for Study 2 was 14,470 (6,410 men and 8,060 women).

Study 3 Analyses.

First, bivariate differences in past-year alcohol, cannabis, and tobacco use disorders (SUDs) and stressful life events were assessed across all four sexual orientation groups (heterosexual, lesbian/gay, bisexual, HSM). Differences in SUDs, stressful life events, and LGB discrimination were also estimated across the three sexual minority subgroups (lesbian/gay, bisexual, HSM) **(Aim 5)**. Design-adjusted *F* statistics were calculated for categorical variables, and adjusted Wald *F* statistics were calculated for continuous variables. Post-hoc comparisons then assessed whether each sexual minority group differed from heterosexuals, and also whether lesbian/gay and bisexual respondents differed from HSM respondents for each characteristic.

Next, path analyses were performed to assess the degrees to which stressful life events mediated disparities in SUDs between heterosexuals (referent group) and each sexual minority subgroup **(Aim 6)**. Additional path analyses then assessed the degrees to which stressful life events and LGB discrimination mediated differences in SUDs between HSM (referent group), gay/lesbian, and bisexual respondents **(Aim 7)**. Indirect effects were calculated to assess the degrees to which the associations between sexual orientation and SUDs were mediated by stress, and direct effects estimated the degrees to which these associations were not mediated by stress. For all Aims 6 and 7 analyses, a significant indirect effect in the absence of a direct effect would signify complete mediation through stress, while the presence of both significant indirect and direct effects would signify that stress partially, but did not fully attenuate the association between sexual orientation group and SUDs.

All analyses were performed separately by sex and applied survey weights to allow for generalization to the U.S. population who were part of the sampling frame. Path analyses included covariates for adjusted estimates. Respondents were excluded if they could not be assigned to a sexual orientation group (N = 1,712). The final analytic sample size for Study 3 was 34,597 (15,198 men and 19,399 women).

Table 3.1. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
Health Outcomes				
Mental Health Status	SF-12, Norm-Based Mental Summary Score. 6 items used to create score: 1. During the past 4 weeks, how often have you had a lot of energy? 2. During the past 4 weeks, how often did physical health or emotional problems interfere with social activities? 3. During the past 4 weeks, how often have you accomplished less that you would like as a result of emotional problems? 4. During the past 4 weeks, how often did you do your work or other activities less carefully than usual because of emotional problems? 5. During the past 4 weeks, how often did you feel calm and peaceful? 6. During the past 4 weeks, how often have you felt downhearted and depressed?	1: None of the time 2: A little of the time 3: Some of the time 4: Most of the time 5: All of the time 9: Unknown	Final norm-based mental health summary score was constructed by NESARC, using weights empirically derived from the US population. Allowable range: 0-100 Obtained range: 2.1 - 77.3	1
Mental Health Resilience	N/A	N/A	1: **Thriving** (2+ Stressful Life Events, SF-12 ≥ 60) 2: **Average** (2+ Stressful Life Events, SF-12: 45-60) 3: **Languishing** (2+ Stressful Life Events, SF-12 <45)	2
Alcohol Use	Past-year DSM-5 alcohol use disorder	0: No 1: Yes	N/A	3

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
Cannabis Use	Past-year DSM-5 cannabis use disorder	0: No 1: Yes	N/A	3
Tobacco Use	Past-year DSM-5 tobacco use disorder	0: No 1: Yes	N/A	3
Sexual Orientation				
Sexual Identity	Category that best describes your sexual orientation	1: Heterosexual (straight) 2: Gay or lesbian 3: Bisexual 4: Not sure 9: Unknown	1: **Heterosexual** (straight) 2: **Gay or lesbian** 3: **Bisexual** *Missing: Not sure or unknown*	N/A
Sexual Attraction	Best description of your sexual attraction to other people	1: Only attracted to females 2: Mostly attracted to females 3: Equally attracted to females and males 4: Mostly attracted to males 5: Only attracted to males 9: Unknown	1: **Opposite-sex attraction only** (female + only attracted to males OR male + only attracted to females) 2: **Same/both-sex attraction** (female + mostly attracted to males-only attracted to females OR male + mostly attracted to females- only attracted to males) *Missing: Unknown*	N/A
Sexual Behavior, Lifetime	Gender of sexual partners in entire life	1: Only males 2: Only females 3: Both males and females 4: Never had sex 9: Unknown	1: **Opposite-sex behavior only** (female + only males OR male + only females) 2: **Same/both-sex behavior** (female + only females or both males and females OR male + only males or both males and females) *Missing: Never had sex or unknown*	N/A
Sexual Behavior, Past 12 months	During the last 12 month had sex with only males, only females, or both	1: Only males 2: Only females 3: Both males and females	1: **Opposite-sex behavior only** (female + only males OR male + only females)	N/A

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
		9: Unknown Missing: N/A, did not have sex or unknown if had sex in the past 12 months	2: **Same/both-sex behavior** (female + only females or both males and females OR male + only males or both males and females) *Missing: Never had sex or unknown*	
Sexual Orientation Group	N/A	N/A	1: **Heterosexual** (heterosexual identity + opposite-sex attraction and opposite-sex lifetime behaviors only) 2: **Lesbian/Gay** (lesbian/gay identity) 3: **Bisexual** (bisexual identity) 4: **Heterosexual-identified sexual minority** (heterosexual identity + same-sex attraction and/or same-sex behavior, past 12 months)	All
Sociodemographic Variables				
Sex/Gender	Sex, calculated by NESARC	1: Male 2: Female	N/A	All
Age	Age, calculated by NESARC	Range: 18-89 90: ≥ 90	N/A	All
Race/Ethnicity	Race/Ethnicity, calculated by NESARC	1: Non-Hispanic White 2: Non-Hispanic Black 3: Non-Hispanic American Indian/Alaska Native 4: Non-Hispanic Asian/Pacific Islander/Alaska Native 5: Hispanic	N/A	All
Nativity	Born in United States, calculated by NESARC	1: Born in US	N/A	All

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
		2: Not born in US		
Education	Highest grade or year of school completed	1: No formal schooling 2: Completed grade K-2 3: Completed grade 3-4 4: Completed grade 5-6 5: Completed grade 7 6: Completed grade 8 7: Completed grade 9-11 8: Completed high school 9: Graduate equivalency degree (GED) 10: Some college 11: Completed associate or other technical 2-year degree 12: Completed college (bachelor's degree) 13: Some graduate or professional studies 14: Completed masters' degree of equivalent or higher degree	1: **< High school** (responses 1-7) 2: **Completed high school** (responses 8-11) 3: **Completed bachelors** (response 12) 4: **Completed more than bachelors** (responses 13-14)	All
Household Income	Total household income in last 12 months (including any income from food stamps)	1: <5000 2: 5000-7999 3: 8000-9999 4: 10000-12999 5: 13000-14999 6: 15000-19999 7: 20000-24999 8: 25000-29999 9: 30000-34999 10: 35000-39999 11: 40000-49999 12: 50000-59999	1: **<$25,000** (responses 1-7) 2: **$25,000-$49,999** (responses 8-11) 3: **$50,000-$79,999** (responses 12-14) 4: **$80,000-$99,999** (responses 15-16) 5: **≥ $100,000** (responses 17-21)	All

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
		13: 60000-69999 14: 70000-79999 15: 80000-89999 16: 90000-99999 17: 100000-109999 18: 110000-119999 19: 120000-149999 20: 150000-199999 21: 200000 +		
Religious importance	How important are religious or spiritual beliefs?	1: Not at all important 2: Not very important 3: Somewhat important 4: Very important 9: Unknown	1: Not at all important 2: Not very important 3: Somewhat important 4: Very important *Missing: Unknown*	1
Religious denomination	Religious affiliation	56 response options	1: Christian, not Catholic 2: Catholic 3: Other faith 4: Unaffiliated	1
Urbanicity	Urbanicity, calculated by NESARC	1: Urban 2: Rural	N/A	1
Census region	Census region, calculated by NESARC	1: Northeast 2: Midwest 3: South 4: West	N/A	1
Lifestyle Behaviors				
Smoking Status	Tobacco use status, calculated by NESARC	1: Non-smoker 2: Current smoker 3: Former smoker	N/A	1
Drinking Status	Alcohol use status, calculated by NESARC	1: Lifetime abstainer 2: Current drinker 3: Former drinker	N/A	1
Problems Sleeping	Had problems falling asleep or staying asleep in last 12 months	1: Yes 2: No	0: No 1*: Yes*	1

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
		9. Unknown	*Missing: Unknown*	
Physical Activity	<u>Light/moderate physical activity:</u> In last 12 months, usually did light or moderate activities? How long usually did these activities each time? <u>Vigorous activity:</u> In last 12 months, usually did vigorous activities? How long usually did these activities each time?	<u>Light/moderate physical activity:</u> Light/Moderate: range (every day – never) Time: range (1-600 minutes) <u>Vigorous activity:</u> Vigorous range (every day – never) Time: range (1-600 minutes)	1: Does not exercise 2: Meets guidelines 3: Exercises, but does not meet guidelines *Categorized based on federal guidelines: https://health.gov/ paguidelines/2008/*	1
BMI	Weight (Pounds) Height (Feet/inches)	Weight: range 57-550 Height = range 2-7 feet, 0-11 inches	1: **Underweight** (<18.5) 2: **Healthy weight** (18.5-24.9) 3: **Overweight** (25-29.9) 4: **Obese** (>30) *BMI= 703 * weight(lb) / height2(in2)*	1
Psychosocial Variables				
Stressful Life Experiences	<u>16 items: In the past 12 months:</u> 1: Moved/anyone new came to live with you 2: Fired or laid off from job 3: Unemployed and looking for work for >1 month 4: Had trouble with boss or coworker 5: Changed jobs, job responsibilities or work hours 6: Got separated or divorced or broke off steady relationship	<u>All items:</u> 1: Yes 2: No 9: Unknown	Set “unknown” to missing Created count score, range: 0-16	All

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
	7: Had problems with neighbor, friend or relative 8: Declared bankruptcy 9: Had trouble with police or law 10: Were a victim of theft 11: You or a family member were a victim of property destruction 12: Any family members or close friends died 13: Any family members or close friends physically assaulted 14: Any family member or friend had trouble with police 15: You have at any time been homeless 16: You have had some much debt that you had no idea how to repay it			
LGB Discrimination	<u>6 items:</u> 1: How often [have you] experienced discrimination obtaining health care or health insurance coverage because [you were] assumed to be gay, lesbian, or bisexual during the last 12 months? 2: How often [have you] experienced discrimination in how treated when obtained health care because [you were] assumed to be gay, lesbian, or bisexual during the last 12 months? 3: How often [have you] experienced discrimination in public, like on the street, in stores, or in restaurants, because [you were] assumed to be gay, lesbian, or bisexual during the last 12 months? 4: How often [have you] experienced discrimination in any other situation because	<u>All items:</u> 1: Never 2: Almost never 3: Sometimes 4: Fairly often 9: Unknown	Set "unknown" to missing All items dichotomized (occurred vs. did not occur) Created count score, range: 0-6	3

Table 3.1, continued. Analytic Variables				
Construct	**NESARC-III Variable**	**Response Options**	**Constructed Variable**	**Aim**
	[you were] assumed to be gay, lesbian, or bisexual during the last 12 months? 5: How often were you called names because [you were] assumed gay/bisexual in last 12 months? 6: How often were you made fun of, picked on shoved, hit, or threatened with harm because [you were] assumed gay/bisexual in last 12 months?			
Social Support	<u>12 items:</u> 1: Would have a hard time finding someone to take a day trip with me 2: Feel that there is no one to share worries and fears with 3: Would be able to find someone to help with chores if sick 4: Someone to turn to for advice on family problems 5: Could easily find someone to go to movie on spur of the moment 6: Someone I could turn to for personal problems 7: Don't often get invited to do things with others 8: Would be difficult to find someone to watch house if out of town 9: Could easily find lunch companion 10: Someone would get me if stranded 10 miles from home 11: Would be difficult to get advice from someone for a family crisis 12: Would have a hard time finding someone to help me move	<u>All items:</u> 1: Definitely false 2: Probably false 3: Probably true 4: Definitely true 9: Unknown	Reverse-coded items 1, 2, 7, 8, 11, 12 Set "don't know" to missing Created mean score, range: 0-4	1, 2

CHAPTER 4. Results and Discussion for Study 1

Study Description

Study 1 assessed how sexual orientation subgroups vary across a wide range of sociodemographic, lifestyle, and psychosocial characteristics. Next, this study assessed how underlying differences across these characteristics are associated with subgroup variations in mental health status. Results are presented directly below each of the study's two aims.

Aim 1: To understand how sexual orientation groups vary across a wide range of sociodemographic characteristics, lifestyle behaviors, and psychosocial factors.

- *Research Question 1.1:* Do sexual orientation groups differ significantly from one another across sociodemographic characteristics (e.g., age, race/ethnicity, education), lifestyle behaviors (e.g., alcohol use, smoking status, exercise status), and sociodemographic factors (e.g., stressful life events, social support)?

Results, Aim 1

Table 4.1 presents bivariate differences in mental health, sociodemographic, lifestyle, and psychosocial across sexual orientation groups, among men. Adjusted Wald tests were performed to calculate p-values for continuous variables, and design-based F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) gay, (c) bisexual, and (d) HSM men different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts. Among men, several mental health, sociodemographic, lifestyle, and psychosocial differences

were found by sexual identity group; specific pairwise differences are highlighted below. Please refer to Table 4.1 for the details of each comparison. All pairwise differences reported are significant at the $p < 0.05$ level.

Compared to all sexual minority groups, heterosexual men had higher ("better") mental health scores. Specifically, the mean mental health score for heterosexual men was 52.12, while the mean scores among sexual minority subgroups ranged from 48.51 (gay) to 50.58 (HSM). There were also several sociodemographic differences between groups, with significant global differences for all such characteristics except race/ethnicity ($p = 0.22$). For instance, gay (mean age: 42.70) and bisexual (39.34) men were younger than heterosexual (46.46) and HSM (46.94) men, on average. Compared to heterosexual and HSM men, greater proportions of gay men (90.95%) were born in the United States, and greater proportions also completed more than a college degree (22.85%). Greater proportions of heterosexuals reported household incomes of $100,000 or more per year (21.76%), compared to bisexual (11.28%) and HSM men (15.66%). Greater proportions of heterosexual (46.51%) and HSM (50.54%) men reported than religion was "very important" to them, compared to gay (29.87%) or bisexual (34.55%) men. Smaller proportions of heterosexual men (78.20%) lived in urban areas of the U.S. than both gay (87.51%) and HSM men (85.58%).

Several lifestyle differences were also present between sexual identity groups among men. For instance, smaller proportions of HSM men (27.29%) were current smokers, compared to all other groups (range: 33.80% among heterosexuals to 50.00% among bisexuals). Meanwhile, greater proportions of gay men were current drinkers (87.88%) and reported problems sleeping (37.37%), compared to both heterosexual (77.34% and 22.55%, respectively) and HSM men (76.54% and 23.43%, respectively). While there were no significant differences

in physical activity between groups (p=0.10), smaller proportions of heterosexuals were a healthy weight (28.04%), compared to both gay (38.68%) and bisexual (42.21%) men.

Finally, psychosocial differences were present between sexual identity groups among men. Gay (mean: 2.17 events) and bisexual men (mean: 2.75) reported more stressful life experiences in the prior year, on average, than heterosexual (mean: 1.59) or HSM (mean: 1.63) men. In addition, while perceived social support was high among all groups, heterosexual men (mean: 3.52/4.00) reported more support than all other sexual minority groups, which ranged from 3.27/4.00 among bisexuals to 3.42/4.00 among gay men.

Table 4.1. Mental Health, Sociodemographic, Lifestyle, and Psychosocial Characteristics by Sexual Identity Group, Males, NESARC-III, 2012-2013

	Heterosexual	Gay	Bisexual	HSM	P-Value
N	N=13,946	N=321	N=144	N=780	
Weighted %	92.52%	1.84%	0.84%	4.79%	
Mental Health					
SF-12 Mental Health Component Score, range 0-100 (mean)	52.12 (0.12)$_{bcd}$	48.51 (0.64)$_{ad}$	49.26 (1.09)$_{a}$	50.58 (0.43)$_{ab}$	<0.01
Sociodemographic Characteristics					
Age (mean)	46.46 (0.24)$_{bc}$	42.70 (1.06)$_{ad}$	39.34 (1.71)$_{ad}$	46.94 (0.81)$_{bc}$	<0.01
Race/Ethnicity (%)					0.22
White	66.89 (0.83)	74.05 (2.47)	66.90 (5.17)	64.76 (2.15)	
Black	11.07 (0.63)	10.07 (1.66)	11.58 (3.77)	12.36 (1.09)	
American Indian/Alaska Native	1.34 (0.12)	0.59 (0.45)	0.81 (0.47)	1.30 (0.52)	
API/Hawaiian	5.38 (0.48)	3.23 (1.08)	5.86 (2.74)	7.68 (1.26)	
Hispanic	15.33 (0.71)	12.06 (1.92)	14.85 (2.76)	13.90 (1.50)	
Born in US (%)					0.02
Yes	83.64 (0.60)$_{b}$	90.95 (1.63)$_{ad}$	86.77 (3.56)	82.09 (1.66)$_{b}$	
No	16.36 (0.60)$_{b}$	9.05 (1.63)$_{ad}$	13.23 (3.56)	17.91 (1.66)$_{b}$	
Education (%)					0.01
<High school	13.33 (0.51)$_{b}$	6.25 (1.44)$_{acd}$	15.79 (3.90)$_{b}$	13.13 (1.54)$_{b}$	
High school	27.14 (0.60)$_{b}$	19.80 (2.67)$_{a}$	20.91 (4.10)	24.42 (1.88)	
Some college	30.90 (0.66)	32.92 (2.99)	34.63 (4.68)	33.08 (1.93)	
Bachelors	13.80 (0.49)	18.18 (2.61)	13.96 (3.43)	14.54 (1.72)	
More than college	14.83 (0.57)$_{b}$	22.85 (2.79)$_{ad}$	14.71 (3.99)	14.84 (1.64)$_{b}$	
Household income (%)					<0.01
< $25,000	23.06 (0.62)$_{cd}$	27.17 (3.13)	37.48 (4.91)$_{a}$	27.88 (1.98)$_{a}$	
$25,000-49,999	25.30 (0.48)	25.88 (2.98)	28.13 (5.37)	29.92 (1.95)	
$50,000-79,999	20.95 (0.49)	21.79 (2.79)	16.21 (0.44)	18.73 (1.79)	
$80,000-99,999	8.94 (0.31)	7.03 (1.67)	6.90 (2.71)	7.82 (1.14)	
$100,000 +	21.76 (0.75)$_{cd}$	18.13 (2.83)	11.28 (3.62)$_{a}$	15.66 (2.09)$_{a}$	
Religious importance (%)					<0.01
Not important	10.08 (0.39)$_{b}$	17.01 (2.29)$_{a}$	18.11 (4.30)	10.72 (1.35)	
Not very important	11.09 (0.32)$_{b}$	19.65 (2.91)$_{ad}$	10.60 (3.34)	8.84 (1.25)$_{b}$	
Somewhat important	32.33 (0.51)	33.48 (3.60)	36.74 (4.52)	29.90 (1.80)	
Very important	46.51 (0.83)$_{bc}$	29.87 (3.08)$_{ad}$	34.55 (4.65)$_{ad}$	50.54 (2.13)$_{bc}$	
Religious denomination (%)					<0.01
Christian, not Catholic	55.14 (0.99)$_{b}$	38.35 (3.38)$_{ad}$	44.33 (4.99)	51.60 (2.17)$_{b}$	
Catholic	26.46 (0.87)$_{b}$	19.22 (2.39)$_{a}$	21.13 (3.97)	26.79 (2.04)	
Jewish	1.52 (0.18)$_{b}$	5.31 (1.47)$_{ac}$	0.64 (0.46)$_{b}$	1.80 (0.46)	
Muslim	1.11 (0.12)$_{c}$	0.36 (0.36)	0.00 (0.00)$_{ad}$	0.76 (0.30)$_{c}$	
Buddhist	1.20 (0.11)	1.89 (0.97)	0.41 (0.42)$_{d}$	1.97 (0.57)$_{c}$	

Table 4.1, continued. Mental Health, Sociodemographic, Lifestyle, and Psychosocial Characteristics by Sexual Identity Group, Males, NESARC-III, 2012-2013

	Heterosexual	Gay	Bisexual	HSM	P-Value
Hindu	0.80 (0.09)$_{bd}$	0.13 (0.13)$_{a}$	2.61 (1.97)	0.17 (0.12)$_{a}$	
Other faith	2.42 (0.19)$_{b}$	8.82 (1.98)$_{ad}$	4.01 (1.57)	2.20 (0.63)$_{b}$	
Unaffiliated	11.34 (0.40)$_{bc}$	25.92 (2.89)$_{ad}$	26.86 (4.73)$_{a}$	14.71 (1.69)$_{b}$	
Urbanicity (%)					<0.01
Urban	78.20 (1.49)$_{bd}$	87.51 (3.02)$_{a}$	83.64 (5.65)	85.58 (2.06)$_{a}$	
Rural	21.80 (1.49)$_{bd}$	12.49 (3.02)$_{a}$	16.36 (5.65)	14.42 (2.06)$_{a}$	
Census region (%)					<0.01
Northeast	18.00 (0.80)$_{b}$	27.08 (3.06)$_{a}$	22.24 (4.59)	17.55 (1.86)	
Midwest	21.74 (0.60)	15.65 (2.56)	22.20 (3.85)	21.20 (1.86)	
South	37.24 (0.95)$_{d}$	30.08 (2.87)	29.95 (5.09)	31.00 (1.96)$_{a}$	
West	23.02 (0.87)$_{d}$	27.19 (3.61)	25.60 (4.30)	30.25 (2.03)$_{a}$	
Lifestyle Characteristics					
Smoking Status (%)					<0.01
Current Smoker	33.80 (0.59)$_{cd}$	37.03 (3.38)$_{d}$	50.00 (5.33)$_{ad}$	27.29 (1.79)$_{abc}$	
Former Smoker	21.69 (0.56)$_{c}$	18.28 (2.83)	10.41 (2.85)$_{a}$	18.34 (1.84)	
Non-Smoker	44.50 (0.80)$_{d}$	44.69 (3.61)	39.60 (5.21)	54.38 (2.50)$_{a}$	
Drinking Status (%)					<0.01
Current Drinker	77.34 (0.63)$_{b}$	87.88 (1.83)$_{ad}$	80.22 (4.09)	76.54 (1.92)$_{b}$	
Former Drinker	15.86 (0.47)$_{bc}$	9.24 (1.63)$_{ad}$	7.33 (2.51)$_{a}$	14.48 (1.51)$_{b}$	
Lifetime abstainer	6.80 (0.38)$_{b}$	2.88 (0.75)$_{acd}$	12.45 (3.58)$_{b}$	8.98 (1.24)$_{b}$	
Problems Sleeping (%)					<0.01
No	77.45 (0.60)$_{b}$	62.63 (3.19)$_{ad}$	71.59 (5.38)	76.57 (1.82)$_{b}$	
Yes	22.55 (0.60)$_{b}$	37.37 (3.19)$_{ad}$	28.41 (5.38)	23.43 (1.82)$_{b}$	
Physical Activity (%)					0.10
Does not exercise	9.06 (0.39)	6.54 (1.49)	10.26 (2.73)	11.96 (1.21)	
Meets guidelines	72.93 (0.59)	71.94 (3.59)	70.57 (4.89)	67.69 (2.01)	
Exercises, but does not meet guidelines	18.02 (0.43)	21.53 (3.15)	19.17 (4.98)	20.35 (1.84)	
BMI (%)					<0.01
Underweight (≤18.5)	0.66 (0.08)	0.67 (0.40)	3.25 (1.64)	2.06 (0.61)	
Healthy weight (18.5-24.9)	28.04 (0.56)$_{bc}$	38.68 (3.45)$_{a}$	42.21 (4.64)$_{a}$	32.21 (1.91)	
Overweight (25-29.9)	41.29 (0.48)$_{cd}$	42.48 (3.53)$_{c}$	27.62 (5.20)$_{ab}$	35.57 (1.77)$_{a}$	
Obese (≥30)	30.00 (0.53)$_{b}$	18.17 (2.69)$_{ad}$	26.92 (4.52)	30.17 (2.11)$_{b}$	
Psychosocial Characteristics					
Stressful life experiences, range 0-16 (mean)	1.59 (0.24)$_{bc}$	2.17 (0.15)$_{ad}$	2.75 (0.31)$_{ad}$	1.63 (0.07)$_{bc}$	<0.01
Social support, range 1-4 (mean)	3.52 (0.01)$_{bcd}$	3.42 (0.03)$_{ac}$	3.27 (0.06)$_{ab}$	3.39 (0.02)$_{a}$	<0.01

Note. Table presents weighted means and percentages. Adjusted Wald tests were performed to calculate p-values for continuous variables, and design-based F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) gay, (c) bisexual, and (d) HSM men different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts.

Table 4.2 presents bivariate differences in mental health, sociodemographic, lifestyle, and psychosocial across sexual orientation groups, among women. Adjusted Wald tests were performed to calculate p-values for continuous variables, and design-based F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) gay, (c) bisexual, and (d) HSM men different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts. Several mental health, sociodemographic, lifestyle, and psychosocial differences were also found by sexual identity group among women; specific pairwise differences are highlighted below. Please refer to Table 2 for the details of each comparison. All pairwise differences reported are significant at the $p<0.05$ level.

Bisexual women had the lowest ("worst") mental health (mean: 44.11) of all sexual orientation groups, and heterosexual women (mean: 50.26) had higher ("better") scores than both bisexual and HSM (mean: 47.89) women. Several sociodemographic differences also existed between sexual identity groups. For instance, bisexuals were the youngest (mean age: 31.22), and heterosexuals were the oldest (mean age: 48.37), on average. Greater proportions of bisexual women were Black (17.29%), compared to heterosexual (12.37%) and HSM women (11.64%). Further, smaller proportions of lesbian (1.69%) and bisexual (1.44%) women were API/Hawaiian, compared to heterosexual (5.57%) and HSM (7.19%) women. Greater proportions of lesbian (93.36%) and bisexual (93.25%) women were born in the U.S., compared to heterosexual (84.08%) and HSM (84.47%) women. Compared to other groups, a greater proportion of lesbian women completed more than high school (20.48%; other groups ranged from 9.55% of bisexual women to 14.04% of heterosexual women). However, compared to all other groups, greater proportions of bisexual women had household incomes of less than $25,000

per year (43.85%; other groups ranged from 27.24% among lesbians/gay women to 33.14% of HSM women). Compared to all other groups, greater proportions of heterosexual women reported that religion was "very important" to them (61.82%), were Christian (62.56%), and lived in rural areas of the U.S (22.32%).

Several lifestyle differences were also present between sexual identity groups among women. Smaller proportions of heterosexual women were current smokers (20.57%) or drinkers (68.86%), compared to all other groups, which ranged from 28.47% of HSM women to 45.65% of bisexual women who smoked and from 73.25% of HSM women to 84.87% of lesbian/gay women who drank alcohol. A greater proportion of bisexual women reported problems sleeping (41.26%) than heterosexual (31.05%) or HSM women (32.54%). Compared to heterosexual (61.56%) and HSM (63.30%) women, greater proportions of lesbian (75.50%) and bisexual (72/16%) women met guidelines for exercise. Smaller proportions of lesbian women (0.27%) were underweight, compared to other groups, which ranged from 2.11% of heterosexual women to 3.64% of bisexual women.

Finally, psychosocial differences were present between sexual identity groups among women. Heterosexuals reported the fewest (mean: 1.54) and bisexuals reported the most (mean: 3.20) number of past-year stressful life experiences. In addition, lesbian women reported more social support (mean: 3.60/4.00) than all other groups (range: 3.36/4.00 among bisexual women to 3.53/4.00 among heterosexual women).

Table 4.2. Mental Health, Sociodemographic, Lifestyle, and Psychosocial Characteristics by Sexual Identity Group, Females, NESARC-III, 2012-2013

	Heterosexual	Lesbian	Bisexual	HSM	P-Value
N	N=17,415	N=265	N=421	N=1,294	
Weighted %	90.24%	1.24%	1.94%	6.58%	
			Mental Health		
SF-12 Mental Health Component Score, range 0-100 (mean)	50.26 (0.10)$_{cd}$	48.87 (0.80)$_{c}$	44.11 (0.79)$_{abd}$	47.89 (0.35)$_{ac}$	<0.01
			Sociodemographic Characteristics		
Age (mean)	48.37 (0.23)$_{bcd}$	39.50 (1.05)$_{acd}$	31.22 (0.79)$_{abd}$	45.21 (0.79)$_{abc}$	<0.01
Race/Ethnicity (%)					<0.01
White	66.11 (0.87)	58.63 (3.78)	64.19 (2.70)	65.78 (1.77)	
Black	12.37 (0.77)$_{c}$	17.23 (2.82)	17.29 (2.12)$_{ad}$	11.64 (1.07)$_{c}$	
American Indian/Alaska Native	1.70 (0.18)	2.48 (1.16)	3.84 (1.32)	1.39 (0.34)	
API/Hawaiian	5.57 (0.52)$_{bc}$	1.69 (0.84)$_{ad}$	1.44 (0.67)$_{ad}$	7.19 (0.85)$_{bc}$	
Hispanic	14.25 (0.72)	19.98 (2.64)	13.24 (1.74)	14.00 (1.21)	
Born in US (%)					<0.01
Yes	84.08 (0.52)$_{bc}$	93.36 (1.62)$_{ad}$	93.25 (1.77)$_{ad}$	84.47 (1.25)$_{bc}$	
No	15.92 (0.52)$_{bc}$	6.64 (1.62)$_{ad}$	6.75 (1.77)$_{ad}$	15.53 (1.25)$_{bc}$	
Education (%)					<0.01
<High school	12.53 (0.46)$_{b}$	5.85 (1.53)$_{acd}$	14.52 (1.91)$_{b}$	12.80 (1.31)$_{b}$	
High school	24.71 (0.67)	25.09 (3.55)	26.76 (2.73)	25.30 (1.65)	
Some college	34.48 (0.53)$_{c}$	35.77 (3.69)	42.24 (3.16)$_{a}$	34.10 (1.74)	
Bachelors	14.24 (0.55)$_{c}$	12.81 (2.28)	6.93 (1.48)$_{ad}$	15.01 (1.33)$_{c}$	
More than college	14.04 (0.51)$_{c}$	20.48 (2.88)$_{cd}$	9.55 (1.78)$_{ab}$	12.79 (1.18)$_{b}$	
Household income (%)					<0.01
< $25,000	29.30 (0.68)$_{c}$	27.24 (3.29)$_{c}$	43.85 (2.53)$_{abd}$	33.14 (1.62)$_{c}$	
$25,000-49,999	26.09 (0.51)	24.03 (3.15)	25.55 (2.53)	26.50 (1.50)	
$50,000-79,999	19.03 (0.45)	20.15 (3.18)	14.25 (2.19)	18.58 (1.32)	
$80,000-99,999	8.80 (0.30)	10.96 (2.39)	6.57 (1.71)	7.17 (0.96)	
$100,000 +	16.78 (0.63)$_{c}$	17.62 (2.64)	9.78 (2.34)$_{a}$	14.59 (1.41)	
Religious importance (%)					<0.01
Not important	4.69 (0.21)$_{bcd}$	13.01 (2.58)$_{a}$	15.84 (2.31)$_{a}$	11.03 (1.22)$_{a}$	
Not very important	6.58 (0.32)$_{cd}$	11.86 (2.23)	12.61 (1.87)$_{a}$	10.23 (0.99)$_{a}$	
Somewhat important	26.91 (0.56)	31.15 (3.25)	32.51 (3.18)	29.88 (1.60)	
Very important	61.82 (0.74)$_{bcd}$	43.98 (3.76)$_{a}$	39.04 (3.05)$_{a}$	48.85 (1.89)$_{a}$	
Religious denomination (%)					<0.01
Christian, not Catholic	62.56 (0.96)$_{bcd}$	46.24 (3.85)$_{a}$	54.00 (3.24)$_{a}$	54.35 (1.95)$_{a}$	
Catholic	24.85 (0.87)$_{cd}$	24.00 (3.43)$_{c}$	12.67 (1.94)$_{abd}$	20.06 (1.58)$_{ac}$	
Jewish	1.36 (0.12)	1.65 (0.99)	1.43 (0.72)	1.51 (0.41)	
Muslim	0.84 (0.09)$_{b}$	0.18 (0.18)$_{a}$	0.33 (0.20)	0.87 (0.31)	

Table 4.2, continued. Mental Health, Sociodemographic, Lifestyle, and Psychosocial Characteristics by Sexual Identity Group, Females, NESARC-III, 2012-2013

	Heterosexual	Lesbian	Bisexual	HSM	P-Value
Buddhist	1.03 (0.11)	2.09 (1.26)	1.62 (0.67)	1.98 (0.39)	
Hindu	0.53 (0.09)$_{b}$	0.00 (0.00)$_{a}$	0.47 (0.47)	0.59 (0.26)	
Other faith	2.19 (0.14)$_{bcd}$	7.42 (2.11)$_{a}$	8.12 (1.21)$_{ad}$	5.26 (0.74)$_{ac}$	
Unaffiliated	6.64 (0.28)$_{bcd}$	18.42 (2.91)$_{a}$	21.37 (2.78)$_{a}$	15.38 (1.49)$_{a}$	
Urbanicity (%)					<0.01
Urban	77.68 (1.72)$_{bcd}$	90.11 (2.85)$_{a}$	86.28 (2.24)$_{a}$	83.06 (2.32)$_{a}$	
Rural	22.32 (1.72)$_{bcd}$	9.89 (2.85)$_{a}$	13.72 (2.24)$_{a}$	16.94 (2.32)$_{a}$	
Census region (%)					0.01
Northeast	18.36 (0.55)	22.96 (3.58)	20.81 (2.51)	17.96 (1.64)	
Midwest	21.50 (0.59)$_{b}$	14.81 (2.45)$_{a}$	22.65 (2.87)	20.62 (1.86)	
South	37.89 (1.08)$_{d}$	34.07 (3.68)	33.31 (3.19)	33.21 (1.86)$_{a}$	
West	22.25 (1.08)$_{d}$	28.17 (3.77)	23.24 (2.74)	28.21 (1.90)$_{a}$	
Lifestyle Characteristics					
Smoking Status (%)					<0.01
Current Smoker	20.57 (0.52)$_{bcd}$	36.66 (3.72)$_{a}$	45.65 (3.17)$_{ad}$	28.47 (1.63)$_{ac}$	
Former Smoker	17.04 (0.45)$_{c}$	19.97 (3.29)$_{c}$	8.75 (2.12)$_{abd}$	18.38 (1.29)$_{c}$	
Non-Smoker	62.33 (0.64)$_{bcd}$	43.37 (3.83)$_{a}$	45.6 (3.21)$_{a}$	53.15 (1.66)$_{a}$	
Drinking Status (%)					<0.01
Current Drinker	68.86 (0.77)$_{bcd}$	84.87 (2.36)$_{ad}$	86.41 (1.79)$_{ad}$	73.25 (1.81)$_{abc}$	
Former Drinker	17.40 (0.45)$_{bc}$	10.93 (2.03)$_{ad}$	8.73 (1.38)$_{ad}$	17.00 (1.32)$_{bc}$	
Lifetime abstainer	13.74 (0.58)$_{bcd}$	4.20 (1.50)$_{ad}$	4.86 (1.32)$_{ad}$	9.74 (1.07)$_{abc}$	
Problems Sleeping (%)					<0.01
No	68.95 (0.62)$_{c}$	63.72 (3.56)	58.74 (3.11)$_{ad}$	67.46 (1.82)$_{c}$	
Yes	31.05 (0.62)$_{c}$	36.28 (3.56)	41.26 (3.11)$_{ad}$	32.54 (1.82)$_{c}$	
Physical Activity (%)					<0.01
Does not exercise	13.40 (0.50)$_{bc}$	4.77 (1.33)$_{ad}$	6.64 (1.56)$_{ad}$	12.86 (1.07)$_{bc}$	
Meets guidelines	61.56 (0.58)$_{bc}$	75.50 (3.10)$_{ad}$	72.16 (2.52)$_{ad}$	63.3 (1.59)$_{bc}$	
Exercises, but does not meet guidelines	25.03 (0.41)	19.73 (3.11)	21.20 (2.41)	23.84 (1.52)	
BMI (%)					0.05
Underweight (≤18.5)	2.11 (0.14)$_{b}$	0.27 (0.27)$_{acd}$	3.64 (1.08)$_{b}$	3.05 (0.66)$_{b}$	
Healthy weight (18.5-24.9)	37.65 (0.58)	30.73 (3.46)	39.01 (3.21)	35.51 (1.37)	
Overweight (25-29.9)	30.24 (0.45)	31.35 (3.50)	27.79 (2.34)	30.68 (1.43)	
Obese (≥30)	30.01 (0.60)	37.65 (3.71)	29.56 (2.94)	30.77 (1.59)	
Psychosocial Characteristics					
Stressful life experiences, range 0-16 (mean)	1.54 (0.02)$_{bcd}$	2.50 (0.13)$_{acd}$	3.20 (0.16)$_{abd}$	2.04 (0.07)$_{abc}$	<0.01
Social support, range 1-4 (mean)	3.53 (0.01)$_{bcd}$	3.60 (0.3)$_{acd}$	3.36 (0.03)$_{ab}$	3.40 (0.02)$_{ab}$	<0.01

Note. Table presents weighted means and percentages. Adjusted Wald tests were performed to calculate p-values for continuous variables, and design-based F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) lesbian, (c) bisexual, and (d) HSM women different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts.

Aim 2: To assess whether group differences in sociodemographic characteristics, lifestyle behaviors, and psychosocial characteristics are associated with mental health disparities between heterosexuals and sexual minority subgroups.

- *Research Question 2.1:* Do sexual orientation groups differ significantly from one another by mental health status?
- *Research Question 2.2:* Are group differences across sociodemographic, lifestyle, and psychosocial characteristics associated with group differences in mental health status?

Results, Aim 2

Table 4.3 presents results from a series of weighted sequential ordinary least squares (OLS) regression models, which assessed the roles of sociodemographic, lifestyle, and psychosocial factors in attenuating the association between sexual identity group and mental health status, among men. Specific causal relationships between variables were not assessed; instead, these analyses assessed how underlying subgroup differences across broad categories of characteristics (i.e., sociodemographic characteristics, lifestyle behaviors, psychosocial factors) were associated with differences in health. Model 1 presents the bivariate association between sexual identity and mental health. Sociodemographic, lifestyle, and psychosocial characteristics were added sequentially in Models 2, 3, and 4, respectively. All covariates were included in Model 5. Below, I describe how the addition of the covariates attenuated the associations between sexual identity and mental health.

Among men, all sexual minority groups had lower ("worse") mental health scores, compared to heterosexuals (Model 1, all $p < 0.05$), with gay men having the greatest disparity, and HSM men having the smallest (though still significant) disparity (Model 1).

Sociodemographic characteristics were added in Model 2. Compared to White and U.S.-born men, respectively, Hispanic men ($p < 0.05$) and non-U.S. born men ($p < 0.001$) had higher mental health scores. Higher educational attainment was associated with better mental health, as was higher income (all $p < 0.05$). Compared to Christian (non-Catholic) men, men of "other" faith ($p < 0.001$) and religiously unaffiliated men ($p < 0.01$) had worse mental health. Finally, men residing in rural areas had higher mental health scores than those living in urban areas ($p < 0.05$). The mental health disparity between bisexual and heterosexual men was attenuated after accounting for sociodemographic differences (Model 1: B = -2.86, CI = -5.06, -0.66, $p < 0.05$; Model 2: B = -1.99, CI = -4.18, 0.20, $p > 0.05$).

Lifestyle characteristics were added in Model 3. Current smokers had lower, and former smokers had higher mental health scores, compared to non-smokers (both $p < 0.001$). Former drinkers had worse mental health than lifetime abstainers ($p < 0.01$), and those reporting problems sleeping also had worse mental health than those reporting no such problems ($p < 0.001$). Compared to those who did not exercise at all, both men meeting guidelines and those who exercised, but did not meet guidelines had higher mental health scores (both $p < 0.001$). Psychosocial characteristics were added in model 4, and more stressful life events were associated with reduced mental health status, while increased social support was associated with higher mental health (both $p < 0.001$).

Neither lifestyle (Model 3) nor psychosocial (Model 4) characteristics alone fully attenuated the mental health disparities between gay, HSM, and heterosexual men. However, the disparity between heterosexual and HSM men was attenuated after accounting for sociodemographic, lifestyle, and psychosocial characteristics in combination (Model 1: B = -1.54, CI = -2.38, -0.69, $p < 0.001$; Model 5: B = -0.73, CI = -1.51, 0.06, $p > 0.05$). Despite the

wide range of sociodemographic, lifestyle, and psychosocial differences present between gay men and heterosexual men, none of these groups of factors could fully attenuate the disparity among gay men. However, the full range of factors attenuated the disparity approximately 45% (Model 1: B= -3.60, CI= -4.84, -2.37, $p < 0.001$; Model 5: B= -2.00, CI= -3.00, -0.99, $p < 0.001$).

Table 4.3. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Males, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
Sexual identity (ref= Heterosexual)					
Gay	-3.60 (-4.84, -2.37)***	-3.13 (-4.28, -1.98)***	-2.83 (-4.00, -1.66)***	2.50 (-3.55, -1.44)***	-2.00 (-3.00, -0.99)***
Bisexual	-2.86 (-5.06, -0.66)*	-1.99 (-4.18, 0.20)	-2.07 (-4.07, -0.08)*	-0.31 (-2.29, 1.67)	-0.01 (-1.90, 1.87)
HSM	-1.54 (-2.38, -0.69)***	-1.25 (-2.10, -0.40)**	-1.45 (-2.26, -0.63)**	-0.83 (-1.63, -0.04)*	-0.73 (-1.51, 0.06)
Sociodemographic Characteristics					
Age		0.00 (-0.01, 0.02)			0.01 (0.00, 0.03)**
Race/Ethnicity (ref=White)					
Black		-0.04 (-0.59, 0.51)			0.07 (-0.46, 0.60)
American Indian/Alaska Native		0.10 (-1.49, 1.68)			0.82 (-0.66, 2.30)
API/Hawaiian		-0.61 (-1.41, 0.18)			-0.45 (-1.17, 0.28)
Hispanic		0.77 (0.09, 1.46)*			0.93 (0.32, 1.53)**
Born in US (ref=Yes)					
No		1.67 (1.07, 2.27)***			0.82 (0.28, 1.36)**
Education (ref= Less than high school)					
High school		0.82 (0.10, 1.54)*			0.38 (-0.32, 1.08)
Some college		1.05 (0.32, 1.78)**			0.45 (-0.22, 1.12)
Bachelors		1.76 (0.98, 2.55)***			0.95 (0.23, 1.68)*
More than college		1.86 (1.06, 2.66)***			0.95 (0.24, 1.66)**
Household income (ref= Less than $25,000)					

Table 4.3, continued. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Males, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
$25,000-49,999		2.03 (1.54, 2.52)***			0.80 (0.36, 1.23)***
$50,000-79,999		2.87 (2.31, 3.42)***			1.17 (0.65, 1.70)***
$80,000-99,999		3.53 (2.90, 4.15)***			1.48 (0.89, 2.07)***
$100,000 +		3.38 (2.77, 3.98)***			1.07 (0.52, 1.63)***
Religious importance (ref= Not important)					
Not very important		0.77 (-0.01, 1.54)			0.57 (-0.14, 1.29)
Somewhat important		0.10 (-0.80, 1.00)			0.01 (-0.76, 0.78)
Very important		0.49 (-0.37, 1.34)			0.05 (-0.68, 0.78)
Religious denomination (ref= Christian, not Catholic)					
Catholic		-0.10 (-0.55, 0.34)			-0.31 (-0.73, 0.11)
Other faith		-1.38 (-2.11, -0.65)***			-0.87 (-1.51, -0.24)**
Unaffiliated		-0.96 (-1.64, -0.28)**			-0.12 (-0.79, 0.54)
Urbanicity (ref=Urban)					
Rural		0.62 (0.03, 1.21)*			0.28 (-0.28, 0.84)
Census region (ref=Northeast)					
Midwest		0.01 (-0.72, 0.73)			-0.20 (-0.88, 0.48)
South		0.21 (-0.51, 0.92)			0.00 (-0.65, 0.66)

Table 4.3, continued. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Males, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
West		0.00 (-0,74, 0.73)			-0.18 (-0.89, 0.53)
Lifestyle Characteristics					
Smoking Status (ref= Non-Smoker)					
Current Smoker			-2.09 (-2.51, -1.67)***		-0.81 (-1.21, -0.42)***
Former Smoker			0.84 (0.42, 1.26)***		0.79 (0.35, 1.22)***
Drinking Status (ref= Lifetime abstainer)					
Current Drinker			-0.20 (-0.76, 0.37)		-0.41, -0.99, 0.16)
Former Drinker			-1.06 (-1.77, -0.35)**		-1.19 (-1.91, -0.48)**
Problems Sleeping (ref= No)					
Yes			-5.20 (-5.72, -4.67)***		-4.11 (-4.59, -3.63)***
Physical Activity (ref= Does not exercise)					
Meets guidelines			3.47 (2.72, 4.22)***		3.05 (2.31, 3.79)***
Exercises, but does not meet guidelines			2.05 (1.20, 2.90)***		1.65 (0.84, 2.47)***
BMI (ref= Underweight)					
Healthy weight (18.5-24.9)			0.17 (-2.17, 2.52)		-0.52 (-2.72, 1.68)
Overweight (25-29.9)			0.71 (-1.67, 3.09)		-0.49 (-2.72, 1.74)

Table 4.3, continued. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Males, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
Obese (>30)			0.16 (-2.25, 2.56)		-0.90 (-3.16, 1.35)
Psychosocial Characteristics					
Stressful life experiences				-1.05 (-1.15, -0.96)***	-0.83 (-0.94, -0.72)***
Social support				5.35 (4.89, 5.81)***	4.53 (4.06, 5.00)***

Table 4.4 presents results from a series of sequential regression analyses, assessing the roles of sociodemographic, lifestyle, and psychosocial factors in attenuating the association between sexual identity group and mental health score, among women. Model 1 presents the bivariate association between sexual identity and mental health. Sociodemographic, lifestyle, and psychosocial characteristics were added sequentially in Models 2, 3, and 4, respectively. All covariates were included in Model 5. Below, I describe how the addition of the covariates attenuated the associations between sexual identity and mental health.

Bisexual and HSM women had lower mental health scores than heterosexuals (Model 1, both $p < 0.001$), However, mental health scores were not significantly different between lesbian and heterosexual women. Sociodemographic, lifestyle, and psychosocial characteristics were added sequentially in Models 2, 3, and 4, respectively. In terms of sociodemographic characteristics (Model 2), older age was associated with increased mental health ($p < 0.001$). Further, both Black and Hispanic women had higher mental health scores than White women (both $p < 0.05$), and non-U.S. born women had better mental health than U.S.-born women ($p < 0.001$). Higher educational attainment and income were also associated with better mental health (all $p < 0.001$). Compared to Christian (non-Catholic) women, those of "other" faith had lower mental health scores. In terms of lifestyle characteristics (Model 3), current smokers had worse mental health than non-smokers ($p < 0.001$), and similarly, current and former drinkers had lower mental health than lifetime abstainers ($p < 0.05$ and $p < 0.01$, respectively). Women reporting problems sleeping had worse mental health than those who did not ($p < 0.001$). Finally, women meeting exercise guidelines, as well as those who exercised but did not meet guidelines, had better mental health than those who did not exercise at all (both $p < 0.001$). In terms of psychosocial characteristics (Model 4), more stressful life events were associated with worse

mental health, and increased social support was associated with better mental health (both $p < 0.001$).

Despite the wide range of sociodemographic, lifestyle, and psychosocial differences present between bisexual and HSM women, and heterosexual women, none of these groups of factors fully attenuated the mental health disparities for these groups, separately (Models 2-4) or in combination (Model 5). However, the full range of factors attenuated the disparity nearly 75% for bisexual women (Model 1: B = -6.16, CI = -7.72, -4.59, $p < 0.001$; Model 5: B = -1.59, CI = -3.09, -0.10, $p < 0.05$) and roughly 70% for HSM women (Model 1: B = -2.37, CI = -3.06, -1.68, $p < 0.001$; Model 5: B = -0.69, CI = -1.28, -0.10, $p < 0.05$).

Table 4.4. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Females, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
Sexual identity (ref= Heterosexual)					
Lesbian/Gay	-1.39 (-2.95, 0.17)	-0.83 (-2.34, 0.69)	-0.60 (-2.03, 0.84)	-0.30 (-1.72, 1.12)	0.11 (-1.22, 1.44)
Bisexual	-6.16 (-7.72, -4.59)***	-4.27 (-5.78, -2.75)***	-4.74 (-6.17, -3.32)***	-2.58 (-4.14, -1.03)**	-1.59 (-3.09, -0.10)*
HSM	-2.37 (-3.06, -1.68)***	-1.95 (-2.64, -1.26)***	-1.95 (-2.56, -1.33)***	-0.83 (-1.46, -0.21)**	-0.69 (-1.28, -0.10)*
Sociodemographic Characteristics					
Age		0.06 (0.04, 0.07)***			0.05 (0.04, 0.06)***
Race/Ethnicity (ref=White)					
Black		0.54 (0.04, 1.05)*			0.39 (-0.09, 0.88)
American Indian/Alaska Native		-0.05 (-1.39, 1.29)			1.94 (0.75, 3.14)**
API/Hawaiian		0.66 (-0.19, 1.51)			0.02 (-0.69, 0.74)
Hispanic		0.76 (0.09, 1.43)*			0.56 (-0.08, 1.21)
Born in US (ref=Yes)					
No		1.83 (1.23, 2.43)***			0.74 (0.23, 1.24)**
Education (ref= Less than high school)					
High school		2.17 (1.44, 2.89)***			1.31 (0.71, 1.91)***
Some college		2.32 (1.54, 3.10)***			1.46 (0.82, 2.09)***
Bachelors		3.18 (2.40, 3.95)***			1.44 (0.79, 2.09)***
More than college		2.90 (2.09, 3.71)***			1.31 (0.55, 2.06)**

Table 4.4, continued. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Females, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
Household income (ref= Less than $25,000)					
$25,000-49,999		1.58 (1.09, 2.07)***			0.68 (0.23, 1.12)**
$50,000-79,999		2.27 (1.68, 2.86)***			0.73 (0.19, 1.27)**
$80,000-99,999		2.71 (2.03, 3.39)***			0.60 (-0.02, 1.22)
$100,000 +		3.16 (2.46, 3.86)***			0.96 (0.38, 155)**
Religious importance (ref= Not important)					
Not very important		0.56 (-0.39, 1.51)			0.58 (-0.15, 1.31)
Somewhat important		-0.03 (-0.98, 0.93)			-0.39 (-1.17, 0.40)
Very important		0.30 (-0.61, 1.22)			-0.49 (-1.24, 0.25)
Religious denomination (ref= Christian, not Catholic)					
Catholic		0.28 (-0.16, 0.73)			-0.16 (-0.57, 0.25)
Other faith		-0.82 (-1.50, -0.13)*			-0.56 (-1.21, 0.09)
Unaffiliated		-0.32 (-1.10, 0.47)			-0.21 (-0.87, 0.45)
Urbanicity (ref=Urban)					
Rural		0.48 (-0.04, 1.01)			0.11 (-0.42, 0.63)
Census region (ref=Northeast)					

Table 4.4, continued. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Females, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
Midwest		0.53 (-0.13, 1.20)			0.10 (-0.43, 0.62)
South		0.08 (-0.57, 0.73)			-0.35 (-0.85, 0.15)
West		0.28 (-0.36, 0.92)			-0.07 (-0.56, 0.43)
Lifestyle Characteristics					
Smoking Status (ref= Non-Smoker)					
Current Smoker			-4.21 (-4.67, -3.76)***		-2.29 (-2.69, -1.88)***
Former Smoker			0.17 (-0.33, 0.66)		-0.21 (-0.71, 0.29)
Drinking Status (ref= Lifetime abstainer)					
Current Drinker			-0.54 (-1.04, -0.03)*		-0.34 (-0.86, 0.18)
Former Drinker			-0.88 (-1.53, -0.24)**		-0.82 (-1.45, -0.18)*
Problems Sleeping (ref= No)					
Yes			-4.91 (-5.37, -4.45)***		-3.90 (-4.32, -3.48)***
Physical Activity (ref= Does not exercise)					
Meets guidelines			2.23 (1.67, 2.78)***		2.14 (1.58, 2.70)***
Exercises, but does not meet guidelines			1.30 (0.66, 1.94)***		1.18 (0.54, 1.83)***
BMI (ref= Underweight)					

Table 4.4, continued. Assessing the Roles of Sociodemographic, Lifestyle, and Psychosocial Factors in Attenuating the Association Between Sexual Identity Group and Mental Health, Females, Sequential Multiple Linear Regression Models, NESARC-III (2012-2013)

	Model 1: Gross Effects, B (95% CI)	Model 2: Sociodemographics, B (95% CI)	Model 3: Lifestyle, B (95% CI)	Model 4: Psychosocial, B (95% CI)	Model 5: Sociodemographics + Lifestyle + Psychosocial, B (95% CI)
Healthy weight (18.5-24.9)			1.36 (-0.01, 2.73)		0.66 (-0.58, 1.90)
Overweight (25-29.9)			1.07 (-0.31, 2.45)		0.38 (-0.89, 1.64)
Obese (>30)			0.05 (-1.37, 1.46)		-0.31 (-1.63, 1.01)
Psychosocial Characteristics					
Stressful life experiences				-1.56 (-1.68, -1.45)***	-1.20 (-1.32, -1.08)***
Social support				5.86 (5.48, 6.24)***	5.22 (4.82, 5.62)***

Discussion

Using nationally representative data, this study highlights the importance of examining subgroup differences within the diverse and heterogeneous sexual minority population. When examined separately, subgroup differences in mental health were evident, with, for instance, bisexual women having the lowest mental health (SF-12) scores, and lesbian women having no statistical disparity, compared to heterosexual women. Had lesbian and bisexual women been combined into a single analytic group, as is commonly done, these differences would have been obscured.

This study also found that while most sexual minority subgroups had poorer mental health, compared to heterosexuals, there were wide-ranging subgroup differences across several sociodemographic, lifestyle, and psychosocial characteristics. While this study did not assess the specific causal mechanisms contributing to disparities in mental health, these findings do suggest that *different* factors may be associated with the mental health disparities that exist between different subgroups. For instance, the disparity between bisexual and heterosexual men was fully attenuated after accounting for sociodemographic characteristics alone. This suggests that underlying differences in social placement may be associated with, at least in part, bisexual men's lower mental health statuses, compared to heterosexual men. However, while many such differences were present between heterosexual, gay, and HSM men, they were not able to attenuate the mental health disparities experienced by HSM or gay men alone.

Alternately, accounting for sociodemographic, lifestyle, and psychosocial characteristics fully attenuated the disparity between HSM and heterosexual men, suggesting the disparity may be driven via a different mechanism. Specifically, while HSM men did not report more stressful life experiences than heterosexual men, they did report less perceived social support, possibly

limiting their ability cope with stress when it arises (Frost et al., 2016). Finally, despite the existence of several sociodemographic, lifestyle, and psychosocial characteristic differences between heterosexuals and gay men, bisexual women, or HSM women, the observed mental health disparities were not attenuated after controlling for the wide range of characteristics included in this study. While the included factors likely contribute to disparities in mental health among these groups, as evidenced by partial reductions in the magnitudes of the disparities between Model 1 and Model 5 (Table 3), they are incomplete. For example, ample research has demonstrated that minority stress is an important factor underlying sexual minority mental health disparities (Hatzenbuehler, Phelan, et al., 2013; Meyer, 2003a), but no such measures were available for these comparative analyses. Additional research should explore the unique factors and mechanisms by which mental health disparities are reinforced for diverse sexual minority subgroups.

Finally, sociodemographic, lifestyle, and psychosocial factors are not associated with mental health independently of one another (Jackson et al., 2010). Individual risk factors may interact in unique combinations, and through different mechanisms of action, to influence mental health differently for sexual minority subgroups, and further, for individual sexual minorities. As such, it is possible that competing risk and resilience factors "offset" one another within groups, to a degree. For example, I did not find significantly differently mental health scores between lesbian and heterosexual women, which was unexpected. While lesbian women reported several risk factors for poor mental health (compared to heterosexual women, greater proportions of lesbian women were current smokers, drinkers, and reported problems sleeping), they also reported several resilience factors (greater proportions of lesbian women completed high school, and reported greater social support, compared to heterosexuals), possibly compensating for, to a

degree, increased risk for mental health problems. To maximize population health intervention efforts, more research is needed to understand the specific mechanisms by which sexual identity-based mental health disparities emerge, and the potentially unique resilience factors that help to offset them.

Study-Specific Limitations.

This study showed underlying sociodemographic, lifestyle, and psychosocial factors were associated with sexual minority subgroup mental health disparities. However, these data are cross-sectional, and this study was not designed to assess the specific causal mechanisms by which individual factors account for mental health disparities across groups, and so should be interpreted with caution. This is an area requiring further investigation, ideally using longitudinal data.

Conclusions.

This study showed that when examined separately, there are wide-ranging sexual orientation group differences across sociodemographic, lifestyle, and psychosocial characteristics. Underlying subgroup differences across each of these factors may contribute to mental health in unique ways for sexual minority subgroups. Further research should assess the specific social and behavioral mechanisms underlying sexual minority mental health disparities.

CHAPTER 5. Results and Discussion for Study 2

Study Description

Study 2 examined how sexual orientation groups differ with respect to social stress, support, mental health status, and resilience. The study also assessed how/whether social support mediates any subgroup differences in resilience status which emerge. Results are presented directly below each of the study's two aims.

Aim 3: To assess whether, and how, sexual orientation groups vary with regard to resilience status.

- Research Question 3.1: Do sexual orientation groups vary with regard to mental health resilience status, among those reporting two or more past-year stressful life events?

Results, Aim 3

Table 5.1 reports sexual orientation group differences in stressful life events (categorical: 0-1 versus 2 or more), social support, and mental health status (categorical: below average, average, above average). Adjusted Wald tests were performed to calculate p-values for continuous variables, and design-adjusted F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) lesbian/gay, (c) bisexual, and (d) HSM respondents differed significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts.

Among men, gay and bisexual identified respondents experienced stressful life events at higher rates than heterosexual and HSM men. Specifically, 53.18% of gay men and 65.97% of

bisexual men experienced 2 or more stressful life events in the past year, compared to 39.44% of heterosexual men and 40.75% of HSM men. There were also significant differences in terms of mental health status. Compared to gay (30.18%) and HSM (39.67%) men, a greater proportion of heterosexual men (45.84%) had "above average" mental health scores, at least 0.5 standard deviations above the mean. Heterosexual men also reported greater social support (mean = 3.52), compared to all sexual minority groups.

Among women, greater proportions of lesbian/gay (61.87%), bisexual (69.66%), and HSM (49.87%) reported 2 or more past-year stressful life events, compared to heterosexual women (37.79%). Greater proportions of heterosexual (38.12%) women were also more likely to have "above average" mental health, at least 0.5 standard deviations above the mean, compared to lesbian/gay (28.92%), bisexual (20.98%), and HSM (28.16%) women. However, in terms of social support, lesbian/gay women reported the most (mean = 3.60), and bisexual women reported the least social support (mean = 3.36).

Table 5.2 shows sexual orientation group differences in resilience status (i.e., in mental health status, among those reporting two or more past-year stressful life events) **(Aim 3)**. Interestingly, among men, while a significant global difference in resilience status was found across sexual orientation groups ($p<0.05$), post-hoc comparisons indicated there was only a significant difference in proportions of heterosexual (25.60%) and gay (36.84%) who were languishing. While heterosexual (35.33%) and HSM (35.43%) were more likely to be thriving than gay (27.56%) and bisexual (24.41%) men, this difference was not significant.

Among women, there was also a significant global difference in resilience status across sexual orientation groups ($p<0.01$). Compared to bisexual (53.50%) and HSM (45.04%) women, a smaller proportion of heterosexual women (36.11%) who experienced two or more past-year

stressful life events were languishing. Conversely, a larger proportion of heterosexual women (26.36%) were thriving, compared to bisexual (15.09%) and HSM (20.02%) women.

Table 5.1. Stressful Life Events, Mental Health, and Social Support by Sexual Identity Group, NESARC-III, 2012-2013

	Heterosexual	Lesbian/Gay	Bisexual	HSM	P-Value
N (Weighted %), Women	17,418 (90.24)	265 (1.24)	422 (1.94)	1,294 (6.58)	
N (Weighted %), Men	13,951 (92.51)	321 (1.84)	144 (0.84)	782 (4.81)	
Men					
Number of Stressful Life Events, past year					<0.01
0-1	60.56 (0.59)$_{b,c}$	46.82 (3.56)$_{a,d}$	34.03 (5.37)$_{a,d}$	59.25 (1.71)$_{b,c}$	
2+	39.44 (0.59)	53.18 (3.56)	65.97 (5.37)	40.75 (1.71)	
SF-12 Mental Health Component Score (0.5 SD)					<0.01
Below average	18.83 (0.44)$_{b,d}$	31.81 (3.09)$_{a}$	24.67 (4.86)	25.52 (1.99)$_{a}$	
Average	35.33 (0.55)	38.01 (3.18)	42.34 (5.65)	34.82 (2.21)	
Above average	45.84 (0.60)$_{b,d}$	30.18 (3.10)$_{a,d}$	32.98 (5.35)	39.67 (2.43)$_{a,b}$	
Social support, range 1-4 (mean)	3.52 (0.01)$_{b,c,d}$	3.42 (0.03)$_{a,c}$	3.27 (0.06)$_{a,b}$	3.39 (0.02)$_{a}$	<0.01
Women					
Number of Stressful Life Events, past year					<0.01
0-1	62.21 (0.57)$_{b,c,d}$	38.13 (3.50)$_{a,d}$	30.34 (3.13)$_{a,d}$	50.13 (1.90)$_{a,b,c}$	
2+	37.79 (0.57)	61.87 (3.50)	69.66 (3.13)	49.87 (1.90)	
SF-12 Mental Health Component Score (0.5 SD)					<0.01
Below average	25.42 (0.41)$_{c,d}$	32.74 (3.31)$_{c}$	45.70 (3.30)$_{a,b,d}$	34.66 (1.66)$_{a,c}$	
Average	36.46 (0.53)	38.34 (3.39)	33.32 (2.99)	37.18 (1.61)	
Above average	38.12 (0.57)$_{b,c,d}$	28.92 (3.46)$_{a}$	20.98 (2.54)$_{a,d}$	28.16 (1.38)$_{a,c}$	
Social support, range 1-4 (mean)	3.53 (0.01)$_{b,c,d}$	3.60 (0.3)$_{a,c,d}$	3.36 (0.03)$_{a,b}$	3.40 (0.02)$_{a,b}$	<0.01

Note. Table presents weighted means and percentages. Adjusted Wald tests were performed to calculate p-values for continuous variables, and design-adjusted F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) lesbian, (c) bisexual, and (d) HSM women different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts.

Table 5.2. Resilience Status by Sexual Identity Group, NESARC-III, 2012-2013

	Heterosexual	Lesbian/Gay	Bisexual	HSM	P-Value
N (Weighted %), Women	5,818 (91.27)	171 (2.45)	94 (1.38)	327 (4.90)	
N (Weighted %), Men	6,944 (86.33)	164 (1.95)	297 (3.41)	655 (8.31)	
			Men		
Resilience Status (0.5 SD)					0.05
Languishing	25.60 (0.72)$_{b}$	36.84 (4.60)$_{a}$	28.31 (6.41)	30.21 (3.18)	
Average	39.07 (0.84)	35.60 (3.64)	47.29 (6.83)	34.36 (3.31)	
Thriving	35.33 (0.79)	27.56 (3.90)	24.41 (5.50)	35.43 (3.29)	
			Women		
Resilience Status (0.5 SD)					<0.01
Languishing	36.11 (0.76)$_{c,d}$	40.39 (4.52)	53.50 (3.89)$_{a}$	45.04 (2.40)$_{a}$	
Average	37.53 (0.83)	37.66 (4.54)	31.41 (3.70)	34.94 (2.52)	
Thriving	26.36 (0.79)$_{c,d}$	21.95 (4.05)	15.09 (2.49)$_{a}$	20.02 (2.03)$_{a}$	

Note. Table presents weighted means and percentages. Design-adjusted F tests were performed to calculate p-values for categorical variables. For tests in which an overall difference was found, post-hoc comparisons assessed whether (a) heterosexual, (b) lesbian, (c) bisexual, and (d) HSM women different significant from one another (Bonferroni-adjusted $p < 0.05$), reported as subscripts.

Aim 4: To assess whether group differences in social support mediate group differences in resilience status.

- Research Question 4.1: Is social support associated with "thriving" and "languishing" resilience status, among respondents reporting two or more past-year stressful life events?

Results, Aim 4

Table 5.3 presents results from sequential logistic regression analyses, which assessed the degrees to which several characteristics were associated with "thriving" resilience status, versus "average" or "languishing" statuses, among men and women reporting two or more past-year stressful life events. First, several sociodemographic characteristics were assessed in Model 1. Social support was added to Model 2. In all models, sexual minority subgroups (i.e., lesbian/gay, bisexual, HSM) were compared to heterosexual respondents.

Among men, in Model 1, sexual orientation was not associated with thriving. Hispanic men had higher odds of thriving, compared to White men (OR = 1.35, 95% CI = 1.11, 1.16). Those with higher incomes also had higher odds of thriving, compared to those with lower incomes (e.g., compared to those earning less than $25,000, those earning $100,000 or more had 1.46 times the odds of thriving [95% CI = 1.15, 1.86]). Social support was added to Model 2 and was strongly associated with thriving (OR = 3.12, 95% CI = 2.72, 3.58). While Hispanic race/ethnicity remained significantly associated with thriving (OR = 1.40, 95% CI = 1.14, 1.72), after including social support, several income categories became nonsignificant, indicating social support attenuated the effect of income on thriving, to some degree.

Among women, sexual orientation was associated with thriving, with bisexual (OR = 0.61, 95% CI = 0.41, 0.91) and HSM (OR = 0.75, 95% CI = 0.58, 0.97) women having lower

odds of thriving, compared to heterosexual women. Race/ethnicity was also associated with thriving, with Black (OR = 1.34, 95% CI = 1.16, 1.56) and Hispanic (OR = 1.30, 95% CI = 1.10, 1.55) women having greater odds of thriving, compared to White women. Income was also associated with thriving, with those earning more having greater odds of thriving than those earning less (e.g., compared to those earning less than $25,000, those earning $100,000 or more had 1.51 times the odds of thriving [95% CI = 1.19, 1.92]. Finally, small, but significant age effects were found, with older respondents having higher odds of thriving than younger participants (OR = 1.01, 95% CI = 1.01, 1.02). Social support was added to Model 2, and was strongly associated with thriving (OR = 3.52, 95% CI = 2.97, 4.18). The effect of sexual orientation on thriving was attenuated after including social support, suggesting that sexual orientation group differences in social support accounted for disparities in thriving between bisexual and HSM women, and heterosexual women. However, the effects of race/ethnicity, income, and age on thriving remained after social support was added to the model.

Table 5.3. Assessing the Roles of Sociodemographic Characteristics and Social Support in Contributing to Thriving Among U.S. Adults, Sequential Multiple Logistic Regression Models, NESARC-III (2012-2013)

	Thriving, OR (95% CI)			
	Men (N=2,273)		Women (N=2,137)	
	Model 1	Model 2	Model 1	Model 2
Sexual orientation (ref = Heterosexual)				
Lesbian/gay	0.72 (0.49, 1.05)	0.75 (0.52, 1.08)	0.81 (0.50, 1.30)	0.75 (0.47, 1.18)
Bisexual	0.61 (0.34, 1.10)	0.71 (0.40, 1.29)	0.61 (0.41, 0.91)*	0.71 (0.48, 1.06)
HSM	1.06 (0.79, 1.42)	1.14 (0.84, 1.53)	0.75 (0.58, 0.97)*	0.85 (0.65, 1.11)
Race/Ethnicity (ref = White)				
Black	1.10 (0.91, 1.33)	1.11 (0.91, 1.36)	1.34 (1.16, 1.56)***	1.34 (1.15, 1.56)***
AI/AN	0.91 (0.54, 1.54)	1.08 (0.64, 1.81)	0.96 (0.63, 1.47)	1.02 (0.67, 1.55)
API/Hawaiian	1.01 (0.71, 1.44)	1.04 (0.73, 1.49)	0.91 (0.62, 1.35)	0.93 (0.63, 1.37)
Hispanic	1.35 (1.11, 1.66)**	1.40 (1.14, 1.72)**	1.30 (1.10, 1.55)**	1.31 (1.09, 1.57)**
Born in U.S. (ref = Yes)				
No	1.02 (0.84, 1.24)	1.07 (0.87, 1.32)	1.11 (0.91, 1.36)	1.21 (1.00, 1.48)
Education (ref = Less than high school)				
High school	1.05 (0.85, 1.31)	1.00 (0.79, 1.27)	1.17 (0.94, 1.47)	1.08 (0.86, 1.36)
Some college	0.90 (0.74, 1.10)	0.82 (0.66, 1.01)	1.23 (0.99, 1.53)	1.08 (0.87, 1.34)
Bachelors	0.99 (0.73, 1.34)	0.90 (0.65, 1.23)	1.06 (0.83, 1.37)	0.92 (0.70, 1.19)
More than college	0.99 (0.76, 1.29)	0.92 (0.70, 1.22)	0.93 (0.70, 1.23)	0.80 (0.60, 1.05)
Household income (ref = Less than $25,000)				
$25,000-49,999	1.10 (0.93, 1.31)	1.01 (0.85, 1.20)	1.30 (1.12, 1.51)**	1.22 (1.03, 1.44)*
$50,000-79,999	1.34 (1.12, 1.61)**	1.18 (0.97, 1.43)	1.40 (1.13, 1.73)**	1.27 (1.03, 1.57)*
$80,000-99,999	1.70 (1.34, 2.17)***	1.44 (1.13, 1.83)**	1.32 (0.96, 1.82)	1.13 (0.82, 1.56)
$100,000 +	1.46 (1.15, 1.86)**	1.19 (0.93, 1.52)	1.51 (1.19, 1.92)**	1.27 (1.00, 1.61)*
Age	1.00 (0.99, 1.00)	1.00 (1.00, 1.01)	1.01 (1.01, 1.02)***	1.02 (1.01, 1.02)***
Social Support		3.12 (2.72, 3.58)***		3.52 (2.97, 4.18)***

***p<0.001; **p<0.01; *p<0.05

Similar to the prior analyses, Table 5.4 presents results from sequential logistic regression analyses, which assessed the degrees to which several characteristics were associated with "languishing" resilience status, versus "average" or "thriving" resilience status, among men and women reporting two or more past-year stressful life events. In all models, sexual minority subgroups (i.e., lesbian/gay, bisexual, HSM) were compared to heterosexual respondents.

First, several sociodemographic characteristics were assessed in Model 1. Social support was added to Model 2. Among men, in Model 1, gay men had greater odds of languishing, compared to heterosexual men (OR = 1.80, 95% CI = 1.21, 2.70). Higher educational attainment was also associated with lower odds of languishing (e.g., compared to men reporting less than a high school education, those reporting more than a college degree had 0.53 times the odds of languishing [95% CI = 0.39, 0.72]). Higher income was similarly associated with lower odds of languishing (e.g., compared to those earning less than $25,000, those earning $100,000 or more had 0.40 times the odds of thriving [95% CI = 0.31, 0.52]). Small, but significant age effects were found, with older respondents having higher odds of languishing than younger participants (OR = 1.01, 95% CI = 1.01, 1.02). Social support was added to Model 2, and higher social support was strongly associated with lower odds of languishing (OR = 0.36, 95% CI = 0.32, 0.42). However, including social support in the model did not attenuate the effects of any sexual orientation, education, income, or age on languishing status.

Among women, sexual orientation was similarly associated with languishing, with bisexual (OR = 1.84, 95% CI = 1.34, 2.52) and HSM (OR = 1.45, 95% CI = 1.19, 1.77) women having higher odds of languishing, compared to heterosexual women. Those born outside the U.S. also had lower odds of languishing than those born inside the U.S. (OR = 0.81, 95% CI = 0.66, 0.99). Higher educational attainment was associated with lower odds of languishing (e.g.,

compared to men reporting less than a high school education, those reporting more than a college degree had 0.54 times the odds of languishing [95% CI = 0.43, 0.69]). Higher income was similarly associated with lower odds of languishing (e.g., compared to those earning less than $25,000, those earning $100,000 or more had 0.52 times the odds of thriving [95% CI 0.40, 0.66]). Social support was added to Model 2, and more social support was strongly associated with lower odds of languishing (OR = 0.33, 95% CI = 0.29, 0.38). However, similar to men, including social support in the model largely did not attenuate the effects of the other characteristics associated with languishing status.

Table 5.4. Assessing the Roles of Sociodemographic Characteristics and Social Support in Contributing to Languishing Among U.S. Adults, Sequential Multiple Logistic Regression Models, NESARC-III (2012-2013)

	Languishing, OR (05% CI)			
	Men (N=1,886)		Women (N=3,365)	
	Model 1	Model 2	Model 1	Model 2
Sexual orientation (ref = Heterosexual)				
Lesbian/gay	1.80 (1.21, 2.70)**	1.70 (1.15, 2.51)**	1.26 (0.85, 1.86)	1.36 (0.92, 2.01)
Bisexual	1.17 (0.62, 2.20)	0.96 (0.49, 1.89)	1.84 (1.34, 2.52)***	1.60 (1.11, 2.32)*
HSM	1.19 (0.87, 1.65)	1.11 (0.79, 1.56)	1.45 (1.19, 1.77)***	1.30 (1.05, 1.59)*
Race/Ethnicity (ref = White)				
Black	0.89 (0.75, 1.06)	0.88 (0.74, 1.05)	0.98 (0.85, 1.12)	0.99 (0.85, 1.15)
AI/AN	0.74 (0.45, 1.23)	0.61 (0.34, 1.09)	0.93 (0.64, 1.35)	0.85 (0.54, 1.33)
API/Hawaiian	1.12 (0.71, 1.75)	1.07 (0.68, 1.71)	0.73 (0.49, 1.10)	0.70 (0.46, 1.06)
Hispanic	0.96 (0.78, 1.18)	0.93 (0.75, 1.16)	0.89 (0.75, 1.05)	0.89 (0.75, 1.06)
Born in U.S. (ref = Yes)				
No	0.90 (0.71, 1.13)	0.86 (0.67, 1.09)	0.81 (0.66, 0.99)*	0.73 (0.59, 0.90)**
Education (ref = Less than high school)				
High school	0.87 (0.71, 1.06)	0.92 (0.74, 1.13)	0.80 (0.67, 0.95)*	0.86 (0.72, 1.03)
Some college	0.85 (0.70, 1.03)	0.93 (0.75, 1.14)	0.64 (0.55, 0.75)***	0.73 (0.62, 0.86)***
Bachelors	0.56 (0.41, 0.78)**	0.62 (0.45, 0.87)**	0.55 (0.43, 0.71)***	0.65 (0.50, 0.84)***
More than college	0.53 (0.39, 0.72)***	0.56 (0.41, 0.78)***	0.54 (0.43, 0.69)***	0.63 (0.50, 0.80)***
Household income (ref = Less than $25,000)				
$25,000-49,999	0.75 (0.64, 0.88)**	0.81 (0.69, 0.96)*	0.72 (0.62, 0.84)***	0.77 (0.66, 0.90)***
$50,000-79,999	0.62 (0.52, 0.75)***	0.71 (0.59, 0.86)***	0.62 (0.52, 0.74)***	0.68 (0.57, 0.81)***
$80,000-99,999	0.41 (0.29, 0.58)***	0.49 (0.34, 0.69)***	0.66 (0.49, 0.89)**	0.79 (0.58, 1.07)
$100,000 +	0.40 (0.31, 0.52)***	0.49 (0.37, 0.64)***	0.52 (0.40, 0.66)***	0.60 (0.47, 0.78)***
Age	1.01 (1.01, 1.02)***	1.01 (1.00, 1.01)**	1.00 (1.00, 1.01)	1.00 (0.99, 1.00)
Social Support		0.36 (0.32, 0.42)***		0.33 (0.29, 0.38)***

***p<0.001; **p<0.01; *p<0.05

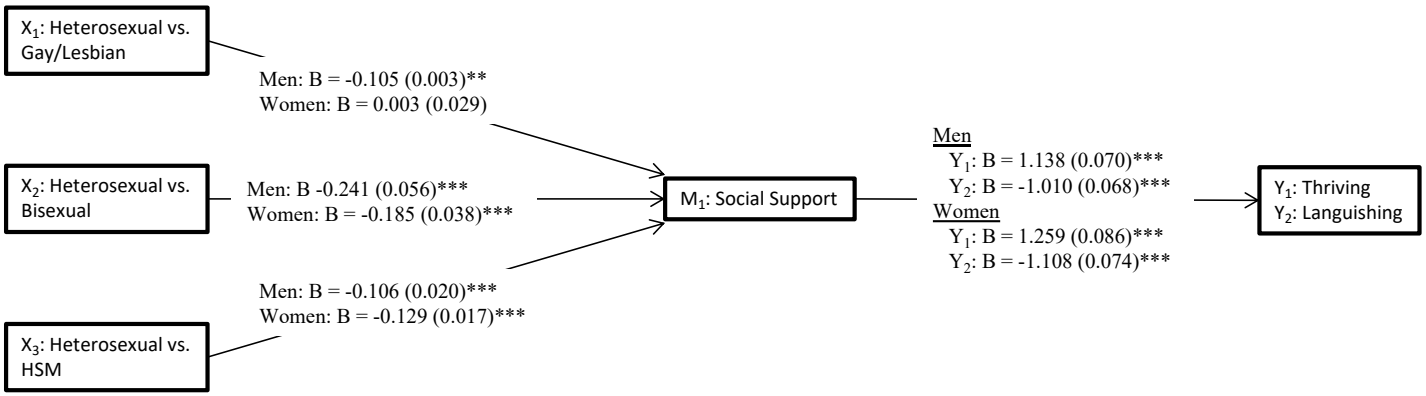
- Research Question 4.2: Do sexual orientation groups vary with regard to perceived levels of social support, and does social support mediate group differences in resilience status?

Figure 5.1 presents path analyses that assessed whether social support mediated sexual orientation group differences in thriving (versus average or languishing) and languishing (versus average or thriving) resilience statuses, among respondents reporting two or more past-year stressful life events. Gay/lesbian, bisexual, and HSM men and women were compared to heterosexuals in all models. Among men, gay, bisexual, and HSM men all reported lower levels of social support than heterosexual men, and higher levels social support was associated thriving, while lower levels of social support was associated with languishing. Further, for gay, bisexual, and HSM men, there were negative indirect effects through social support for thriving, and positive indirect effects though social support and languishing statuses, indicating that while few subgroup population disparities existed in logistic regression analyses, differences in support did mediate lower rates of thriving, and higher rates of languishing, for sexual minority men, relative to heterosexual men. However, there was a positive direct effect between sexual orientation and languishing, indicating that social support did not fully mediate these disparities.

Among women, bisexual and HSM women reported less social support than heterosexual women, and higher levels of social support were associated with thriving, while lower levels of social support were associated with languishing. Further, for both bisexual and HSM women, there were negative indirect effects through social support for thriving, and positive indirect effects though social support and languishing statuses. However, there were also positive direct effects between sexual orientation and languishing status, for both bisexual and HSM women,

relative to heterosexual women, indicating that social support did not fully mediate these disparities.

Figure 5.1. Mediating Effect of Social Support on the Associations Between Sexual Orientation Group and Thriving and Languishing Mental Health, Weighted Path Analyses, NESARC III, 2012-2013.



Thriving

Men

Direct Effects

$X_1 \rightarrow Y_1$:	B = -0.288 (0.184)
$X_2 \rightarrow Y_1$:	B = -0.336 (0.298)
$X_3 \rightarrow Y_1$:	B = 0.129 (0.151)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$:	B = -0.120 (0.038)**
$X_2 \rightarrow M_1 \rightarrow Y_1$:	B = -0.274 (0.064)***
$X_3 \rightarrow M_1 \rightarrow Y_1$:	B = -0.121 (0.025)***

Women

Direct Effects

$X_1 \rightarrow Y_1$:	B = -0.290 (0.230)
$X_2 \rightarrow Y_1$:	B = -0.241 (0.201)
$X_3 \rightarrow Y_1$:	B = -0.163 (0.133)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$:	B = 0.042 (0.036)
$X_2 \rightarrow M_1 \rightarrow Y_1$:	B = -0.234 (0.046)***
$X_3 \rightarrow M_1 \rightarrow Y_1$:	B = -0.163 (0.025)***

Languishing

Men

Direct Effects

$X_1 \rightarrow Y_2$:	B = 0.531 (0.196)**
$X_2 \rightarrow Y_2$:	B = -0.041 (0.343)
$X_3 \rightarrow Y_2$:	B = 0.101 (0.172)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_2$:	B = 0.106 (0.035)**
$X_2 \rightarrow M_1 \rightarrow Y_2$:	B = 0.243 (0.062)***
$X_3 \rightarrow M_1 \rightarrow Y_2$:	B = 0.107 (0.022)***

Women

Direct Effects

$X_1 \rightarrow Y_2$:	B = 0.306 (0.198)
$X_2 \rightarrow Y_2$:	B = 0.473 (0.187)*
$X_3 \rightarrow Y_2$:	B = 0.259 (0.104)*

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_2$:	B = -0.037 (0.032)
$X_2 \rightarrow M_1 \rightarrow Y_2$:	B = 0.205 (0.040)***
$X_3 \rightarrow M_1 \rightarrow Y_2$:	B = 0.143 (0.022)***

***p<0.001; **p<0.01; *p<0.05

Discussion

Compared to heterosexual men and women, sexual minority men and women generally reported higher rates of exposure to stress; larger proportions of gay and bisexual men, and lesbian/gay, bisexual, and HSM women reported two or more past-year stressful life events, compared to heterosexual men and women, respectively. Sexual minority respondents also had poorer mental health, with gay and HSM men, and lesbian/gay, bisexual, and HSM women being less likely to have above average mental health, compared to heterosexual respondents. It is interesting to note that mental health disparities were concentrated in the upper- and lower-extremes of the mental health spectrum; while no sexual orientation group differences were found in terms of "average" mental health, sexual minority people generally had below-average mental health at higher rates, and above-average mental health at lower rates, compared to heterosexuals, for both men and women. These findings are consistent with ample previous research documenting disparities in stress and mental health for sexual minority people (Blosnich et al., 2014; Fingerhut et al., 2010; Graham et al., 2011; Lewis et al., 2003; Ueno, 2005; Wight et al., 2012).

Despite broad disparities in stress exposure and mental health status, there were fewer bivariate and multivariate differences in resilience status between heterosexual and sexual minority respondents than expected. This finding highlights that stress has deleterious effects on mental health, among those who experience it, regardless of identity. However, some important differences in terms of resilience did emerge between groups. Among respondents reporting two or more past-year stressful life events, greater proportions of gay men, bisexual women, and HSM women were languishing, compared to heterosexual men and women, respectively. Bisexual and HSM women reporting two or more stressful life events were also less likely to be

thriving than heterosexual women. These findings suggest there are important differences between heterosexuals and key sexual minority groups' abilities to manage and overcome chronic stress. This is consistent with previous research related to minority stress and health disparities (Meyer, 2003a), but offers a more nuanced examination of this process, and suggests broad sexual minority disparities may be driven by specific subgroups that are particularly at risk.

Prior research suggests sociodemographic and relational characteristics are highly associated with one's ability to overcome, and thrive when exposed to stress (Phelan et al., 2010; Waller, 2001), which these results support. Indeed, in multivariate analyses, increased household income was associated with greater likelihood of thriving, while both higher income and educational attainment were associated with lower odds of languishing, among both men and women who reported multiple past-year stressors. Further, Hispanic men and women, and Black women had increased odds of thriving, compared to White men and women, while non-U.S.-born women had lower odds of languishing, compared to those born in the U.S. In sequential logistic regression analyses, of all the characteristics examined, social support was most strongly associated with resilience status.

Bisexual and HSM women, and men from all sexual minority groups reported having less social support available to them, compared heterosexual people, and less perceived social support mediated subgroup disparities in terms of thriving and resilience statuses. Conversely, lesbian/gay women reported having more social support than women from all other sexual orientation groups, including heterosexuals, and in path analyses, lesbian/gay women were the only sexual minority group for which social stress did not mediate thriving or languishing resilience status.

It is possible that many sexual minorities lack access to many of the same coping resources that heterosexuals enjoy for dealing with stress, including family support, educational and financial resources, culturally competent social services. However, it is also possible that sexual minorities utilize alternate resilience factors not available to heterosexuals (e.g., "gay community") (Frost & Meyer, 2012; Lambe et al., 2017). While this study assessed subgroup differences in access to general social support, future research should assess how different types of support are identified and mobilized by diverse sexual orientation subgroups when faced with stress.

In their study of resilience among older LGBT adults, Fredriksen-Goldsen (2017) found identity affirmation positively predicted access to social resources and improved mental health. It is possible subgroup differences in social support identified in this study were related to subgroup differences in identity affirmation. For instance, research finds bisexual people report stigma from both heterosexual and lesbian/people, often report feeling less affirmed in their identities than lesbian/gay people (Movement Advancement Project, 2016). It is also possible HSM people differ from LGB-identified people in terms of identity affirmation; they may either feel greater affirmation, given their heterosexual identities, or they may in fact feel less affirmation, given their identity differs from their attractions or behaviors. Future research should assess these questions further.

Study-Specific Limitations.

This study has key limitations. First, despite the large size of the NESARC-III sample, sample size concerns restricted my ability to calculate a categorical measure of resilience status as originally intended – using 1.0 standard deviation cutoffs (i.e., respondents having mental health scores 1.0 standard deviations below the mean would be categorized as having "below

average" mental health, while those with mental health scores 1.0 standard deviations above the mean would be categorized as having "above average" mental health). When this more restrictive cutoff was used, fewer than 50 respondents from each sexual minority subgroup were categorized as "thriving," and so a 0.5 standard deviation cutoff for mental health was instead used to determine resilience status of respondents.

In addition, these data are cross-sectional. Since respondents' resilience scores were calculated using contemporaneous measures of stress (number past-year stressful life events) and mental health (current SF-12 mental health score), the causal association between stress and mental health could not be examined in this study. As such, I was unable to assess the psychosocial mechanisms linking stress to mental health status (e.g., social support was not assessed as a moderator of the association between stress and mental health). Similarly, while support was assessed as a mediator of the association between sexual orientation group and resilience status, future research, using longitudinal data, should assessed the likely bidirectional relationship between support and resilience status.

Conclusions.

This study showed there are broad disparities in exposure to stress and mental health status between heterosexuals and several sexual minority subgroups. There were also sexual minority disparities with regard to mental health resilience, among those reporting multiple past-year stressors, though these differences were more modest. This finding highlights the deleterious effects of stress on mental health, regardless of sexual minority status, but also suggests that specific subgroups (e.g., gay men, bisexual women, and HSM women) are constrained in their abilities to overcome stressors when they do occur, compared to heterosexual people. This study also demonstrates that social support is a powerful correlate of mental health

resilience, and further demonstrates that sexual orientation disparities in social support underlie sexual minorities' abilities to overcome disparities in social stress.

CHAPTER 6. Results and Discussion for Study 3

Study Description

Study 3 assessed subgroup differences across three substance use disorders (SUD), and the degree to which stressful life events mediate disparities in substance use between heterosexuals and sexual minority subgroups. In addition, stressful life events and LGB discrimination were compared as mediators underlying differences in substance use across sexual minority subgroups. Results are presented directly below each of the study's three aims.

Aim 5: To assess the prevalence of three past-year substance use disorders across sexual orientation groups.

- *Research Question 5.1:* Do sexual orientation groups meet Diagnostic and Statistical Manual (DSM)-V criteria for past-year alcohol, cannabis, and tobacco use disorders at differential rates?

Results, Aim 5

Table 5.1 presents sexual orientation differences in past-year SUDs (alcohol, cannabis, tobacco), stressful life events, and LGB discrimination. Among men, greater proportions of gay (26.63%) and bisexual men (31.40%) met criteria for alcohol use disorder, compared to both heterosexuals (17.62%) and HSM men (14.83%). A greater proportion of bisexual men also met criteria for cannabis use disorder (9.65%), compared to heterosexual men (3.44%). A greater proportion of bisexual men (40.80%), and a smaller proportion of HSM men (19.22%) met criteria for tobacco use disorder, compared to heterosexual men (23.56%), and greater

proportions of both gay (29.99%) and bisexual men also met criteria for tobacco use disorder, compared to HSM men. Compared to both heterosexual (mean: 1.59) and HSM men (mean: 1.63), gay (mean: 2.17) and bisexual men (mean: 2.75) reported more stressful life events. Among the sexual minority groups, gay (mean: 1.28) and bisexual men (mean: 0.71) reported more LGB discrimination events than HSM men (mean: 0.10).

Among women, greater proportions of HSM (19.25%, 4.53%, 21.57%), lesbian/gay (24.85%, 6.79%, 27.27%), and bisexual women (29.67%, 8.59%, 36.26%) met criteria for alcohol, cannabis, and tobacco use disorders, respectively, compared to heterosexual women (9.04%, 1.16%, 16.11%). Lesbian/gay women did not statistically differ from HSM women across any of these comparisons, but greater proportions of bisexual women met criteria for alcohol and tobacco use disorders, compared to HSM women. Compared to heterosexual women (mean: 1.54), HSM (mean: 2.04), lesbian/gay (mean: 2.50), and bisexual (mean: 3.20) women reported more stressful life events. Lesbian/gay (mean: 1.31) and bisexual (mean: 0.61) women also reported more LGB discrimination events than HSM women (mean: 0.13). All comparisons reported were significant at $p<0.05$.

Table 6.1. Substance Use and Social Stress Characteristics by Sexual Orientation Group, NESARC-III, 2012-2013

	Heterosexual	HSM	Lesbian/Gay	Bisexual	Full Sample (P-Value)	Sexual Minorities (P-Value)
N (Weighted %), Men	13,951 (92.51)	782 (4.81)	321 (1.84)	144 (0.84)		
N (Weighted %), Women	17,418 (90.24)	1,294 (6.58)	265 (1.24)	422 (1.94)		
			Men			
Substance Use						
Alcohol Use Disorder, % (SE)	17.62 (0.42)$_{b, c}$	14.83 (1.46)$_{d, e}$	26.63 (2.69)	31.40 (5.47)	<0.001	<0.001
Cannabis Use Disorder, % (SE)	3.44 (0.18)$_{c}$	4.29 (0.91)	3.10 (0.89)	9.65 (2.94)	0.004	0.011
Tobacco Use Disorder, % (SE)	23.56 (0.57)$_{a, c}$	19.22 (1.58)$_{d, e}$	29.99 (3.56)	40.80 (5.54)	<0.001	<0.001
Social Stress						
Stressful Life Events, range 0-16, mean (SE)	1.59 (0.02)$_{b, c}$	1.63 (0.07)$_{d, e}$	2.17 (0.15)	2.75 (0.31)	<0.001	<0.001
LGB Discrimination, range 0-6, mean (SE)	-	0.10 (0.03)$_{d, e}$	1.28 (0.10)	0.71 (0.16)	-	<0.001
			Women			
Substance Use						
Alcohol Use Disorder, % (SE)	9.04 (0.36)$_{a, b, c}$	19.25 (1.58)$_{e}$	24.85 (2.50)	29.67 (3.04)	<0.001	0.002
Cannabis Use Disorder, % (SE)	1.16 (0.11)$_{a, b, c}$	4.53 (1.02)	6.79 (2.29)	8.59 (1.79)	<0.001	0.100
Tobacco Use Disorder, % (SE)	16.11 (0.45)$_{a, b, c}$	21.57 (1.42)$_{e}$	27.27 (3.48)	36.26 (3.16)	<0.001	<0.001
Social Stress						
Stressful Life Events, range 0-16, mean (SE)	1.54 (0.02)$_{a, b, c}$	2.04 (0.07)$_{d, e}$	2.50 (0.13)	3.20 (0.16)	<0.001	<0.001
LGB Discrimination, range 0-6, mean (SE)	-	0.13 (0.04)$_{d, e}$	1.31 (0.12)	0.61 (0.08)	-	<0.001

Table presents weighted means and percentages. Design-adjusted F statistics were calculated for categorical variables, and adjusted Wald F statistics were calculated for continuous variables. Post-hoc comparisons assessed whether (a) HSM, (b) lesbian/gay, and (c) bisexual respondents differed significantly from heterosexuals, and whether (d) lesbian/gay and (e) bisexual respondents differed significantly from HSM respondents, reported as subscripts.

Aim 6: To assess whether stressful life events mediate substance use disparities between heterosexuals and sexual minority subgroups.

- *Research Question 6.1:* Do more stressful life events statistically mediate disparities in alcohol, cannabis, and tobacco use disorders between heterosexual and sexual minority (i.e., lesbian/gay, bisexual, HSM) respondents?

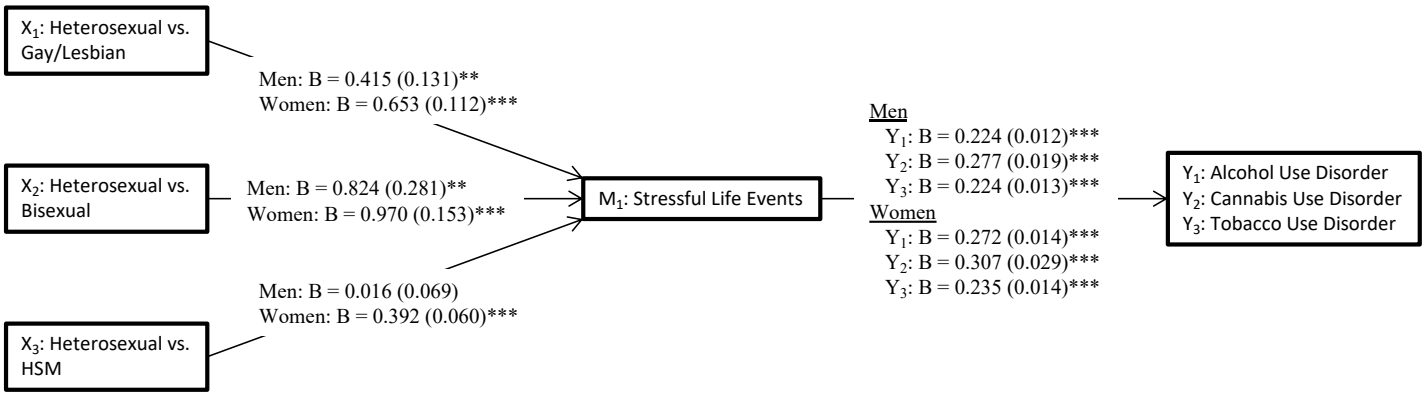
Results, Aim 6

Figure 6.1 presents path analyses that assessed whether stressful life events mediated sexual minority disparities in each SUD. Gay/lesbian, bisexual, and HSM men and women were compared to heterosexuals in all models. Among men, gay and bisexual men, but not HSM men reported more stressful life events than heterosexual men, and more stressful life events were associated with higher rates of each SUD. For gay and bisexual men, there were indirect effects through stressful life events for each SUD, indicating that stressful life events mediated sexual orientation SUD disparities. When accounting for the indirect effect via stressful life events, the direct effects between gay and bisexual identity and each SUD were null, except for alcohol use disorder among gay men, indicating that stressful life events did not fully mediate this disparity. For HSM men, there were no indirect effects through stressful life events for any SUD, but there was an inverse direct effect between HSM status and tobacco use disorder, indicating a lower rate of disordered use for HSM men, compared to heterosexual men.

Among women, all sexual minority subgroups reported more stressful life events than heterosexuals, and more stressful life events was also associated with higher rates each SUD. There were positive indirect effects through stressful life events for all substance use outcomes among all sexual minority subgroups. However, with the exception of cannabis use disorder

among bisexual women, there were also positive direct effects between each sexual minority group and each SUD, indicating stressful life events did not fully mediate these disparities.

Figure 6.1. Mediating Effect of Stressful Life Events on the Associations Between Sexual Orientation Group and Substance Use Disorders, Weighted Path Analyses, NESARC III, 2012-2013.



Alcohol Use Disorder

Men

Direct Effects

$X_1 \rightarrow Y_1$: B = 0.322 (0.130)*
$X_2 \rightarrow Y_1$: B = 0.322 (0.232)
$X_3 \rightarrow Y_1$: B = -0.207 (0.124)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.093 (0.030)**
$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.184 (0.062)**
$X_3 \rightarrow M_1 \rightarrow Y_1$: B = 0.044 (0.015)

Women

Direct Effects

$X_1 \rightarrow Y_1$: B = 0.721 (0.151)***
$X_2 \rightarrow Y_1$: B = 0.516 (0.164)**
$X_3 \rightarrow Y_1$: B = 0.670 (0.100)***

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.178 (0.031)***
$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.264 (0.044)***
$X_3 \rightarrow M_1 \rightarrow Y_1$: B = 0.107 (0.017)***

Cannabis Use Disorder

Men

Direct Effects

$X_1 \rightarrow Y_2$: B = -0.504 (0.310)
$X_2 \rightarrow Y_2$: B = 0.345 (0.471)
$X_3 \rightarrow Y_2$: B = 0.242 (0.244)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_2$: B = 0.115 (0.038)**
$X_2 \rightarrow M_1 \rightarrow Y_2$: B = 0.228 (0.078)**
$X_3 \rightarrow M_1 \rightarrow Y_2$: B = 0.004 (0.019)

Women

Direct Effects

$X_1 \rightarrow Y_2$: B = 1.153 (0.395)**
$X_2 \rightarrow Y_2$: B = 0.730 (0.283)**
$X_3 \rightarrow Y_2$: B = 1.106 (0.258)***

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_2$: B = 0.201 (0.037)***
$X_2 \rightarrow M_1 \rightarrow Y_2$: B = 0.298 (0.055)***
$X_3 \rightarrow M_1 \rightarrow Y_2$: B = 0.121 (0.022)***

Tobacco Use Disorder

Men

Direct Effects

$X_1 \rightarrow Y_3$: B = 0.263 (0.180)
$X_2 \rightarrow Y_3$: B = 0.445 (0.258)
$X_3 \rightarrow Y_3$: B = -0.325 (0.109)**

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_3$: B = 0.093 (0.029)***
$X_2 \rightarrow M_1 \rightarrow Y_3$: B = 0.185 (0.063)**
$X_3 \rightarrow M_1 \rightarrow Y_3$: B = 0.004 (0.016)

Women

Direct Effects

$X_1 \rightarrow Y_3$: B = 0.488 (0.186)**
$X_2 \rightarrow Y_3$: B = 0.292 (0.154)
$X_3 \rightarrow Y_3$: B = 0.184 (0.090)*

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_3$: B = 0.153 (0.029)***
$X_2 \rightarrow M_1 \rightarrow Y_3$: B = 0.228 (0.035)***
$X_3 \rightarrow M_1 \rightarrow Y_3$: B = 0.092 (0.015)***

***p<0.001; **p<0.01; *p<0.05

Aim 7: To simultaneously assess stressful life events and perceived LGB discrimination events as mediators of substance use differences between sexual minority subgroups.

- *Research Question 7.1:* Do more stressful life events mediate differences in disordered alcohol, cannabis, and tobacco use between HSM, lesbian/gay, and bisexual respondents?
- *Research Question 7.2:* Does a greater number of perceived LGB discrimination events mediate differences in disordered alcohol, cannabis, and tobacco use between HSM, lesbian/gay, and bisexual respondents?
- *Research Question 7.3:* Do stressful life events and LGB discrimination events differentially mediate subgroup differences in disordered alcohol, cannabis, and tobacco use?

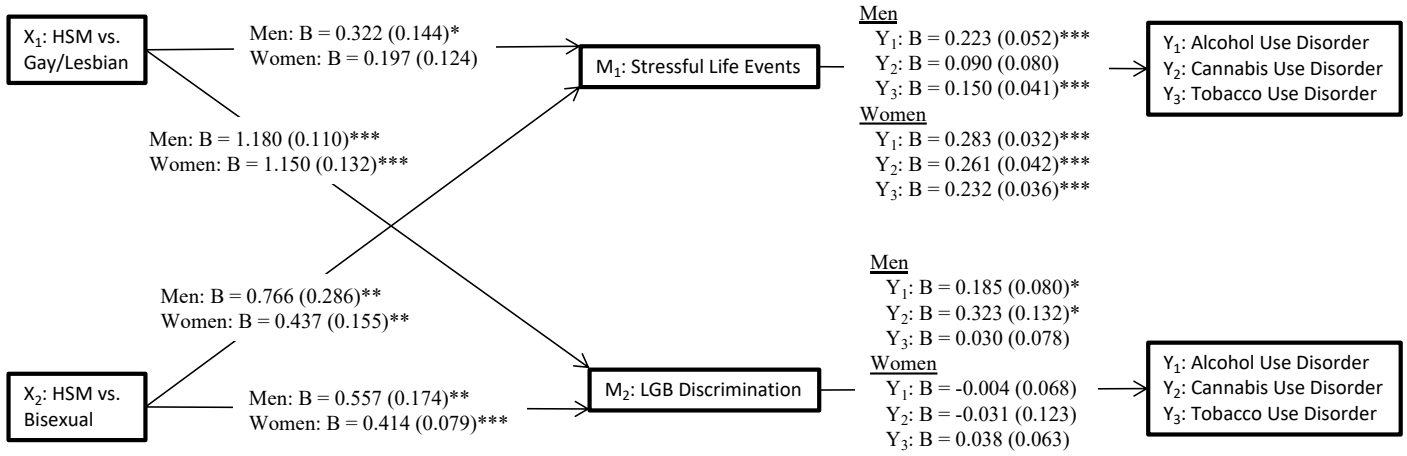
Results, Aim 7

Figure 6.2 presents path analyses that assessed whether stressful life events and/or LGB discrimination events mediated differences in SUDs among sexual minority subgroups. Gay/lesbian and bisexual men and women were compared to HSM respondents in all models. Among men, gay and bisexual men reported more stressful life events and LGB discrimination than HSM men. Higher rates of both stressful life events and LGB discrimination were also associated with higher rates of SUDs. There were indirect effects on alcohol use disorder through both stressful life events and LGB discrimination, for both gay and bisexual men. For gay men, the magnitude of the indirect effect through LGB discrimination was larger than through stressful life events. However, for bisexual men, the magnitude of the indirect effect through stressful life events was larger than through LGB discrimination. There were no direct effects between gay or bisexual identity and alcohol use disorder. There was an indirect effect between gay identity and cannabis use disorder through LGB discrimination, as well as an inverse direct

effect. There was an indirect effect between bisexual identity and tobacco use disorder through stressful life events, as well as a positive direct effect.

Among women, lesbian/gay women reported more LGB discrimination and bisexual women reported more stressful life events and LGB discrimination, compared to HSM women. However, although stressful life events was associated with higher rates of each SUD, LGB discrimination was not. There were indirect effects for bisexual women and each SUD through stressful life events. There were no direct effects after accounting for stress. There were no direct or indirect effects through stress for gay/lesbian women, compared to HSM women.

Figure 6.2. Mediating Effect of Stressful Life Events and LGB Discrimination on the Associations Between Sexual Minority Group and Substance Use Disorders, Weighted Path Analyses, NESARC III, 2012-2013.



Alcohol Use Disorder

Men

Direct Effects

$X_1 \rightarrow Y_1$: B = 0.064 (0.201)
$X_2 \rightarrow Y_1$: B = 0.238 (0.279)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.072 (0.034)*
$X_1 \rightarrow M_2 \rightarrow Y_1$: B = 0.218 (0.099)*

$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.170 (0.075)*
$X_2 \rightarrow M_2 \rightarrow Y_1$: B = 0.103 (0.048)*

Women

Direct Effects

$X_1 \rightarrow Y_1$: B = 0.098 (0.200)
$X_2 \rightarrow Y_1$: B = -0.073 (0.202)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.056 (0.035)
$X_1 \rightarrow M_2 \rightarrow Y_1$: B = -0.004 (0.078)

$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.124 (0.048)*
$X_2 \rightarrow M_2 \rightarrow Y_1$: B = -0.002 (0.028)

Cannabis Use Disorder

Men

Direct Effects

$X_1 \rightarrow Y_1$: B = -1.404 (0.534)**
$X_2 \rightarrow Y_1$: B = 0.001 (0.444)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.029 (0.029)
$X_1 \rightarrow M_2 \rightarrow Y_1$: B = 0.381 (0.153)*

$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.069 (0.064)
$X_2 \rightarrow M_2 \rightarrow Y_1$: B = 0.180 (0.093)

Women

Direct Effects

$X_1 \rightarrow Y_1$: B = -0.191 (0.544)
$X_2 \rightarrow Y_1$: B = -0.215 (0.388)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.051 (0.032)
$X_1 \rightarrow M_2 \rightarrow Y_1$: B = -0.036 (0.142)

$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.114 (0.047)*
$X_2 \rightarrow M_2 \rightarrow Y_1$: B = -0.013 (0.052)

Tobacco Use Disorder

Men

Direct Effects

$X_1 \rightarrow Y_1$: B = 0.456 (0.245)
$X_2 \rightarrow Y_1$: B = 0.674 (0.336)*

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.048 (0.025)
$X_1 \rightarrow M_2 \rightarrow Y_1$: B = 0.036 (0.091)

$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.115 (0.050)*
$X_2 \rightarrow M_2 \rightarrow Y_1$: B = 0.017 (0.043)

Women

Direct Effects

$X_1 \rightarrow Y_1$: B = 0.189 (0.207)
$X_2 \rightarrow Y_1$: B = 0.163 (0.180)

Indirect Effects

$X_1 \rightarrow M_1 \rightarrow Y_1$: B = 0.046 (0.207)
$X_1 \rightarrow M_2 \rightarrow Y_1$: B = 0.043 (0.072)

$X_2 \rightarrow M_1 \rightarrow Y_1$: B = 0.101 (0.040)*
$X_2 \rightarrow M_2 \rightarrow Y_1$: B = 0.016 (0.026)

***p<0.001; **p<0.01; *p<0.05

Discussion

By and large, stark disparities were evident between heterosexual and sexual minority populations, across alcohol, cannabis, and tobacco use disorders. Indeed, all sexual minority groups among women and bisexual men experienced each SUD at higher rates than heterosexuals. These results also suggest sexual minorities experience higher rates of stressful life events than heterosexuals, and stressful life events mediated SUD disparities for all sexual minority subgroups with the exception of HSM men. These findings are consistent with stress theories, which suggest increased exposure to stress is associated with detriments in health and health behaviors, including substance use (Frone, 1990; Rhodes & Jason, 1990) and that minority groups experience disparities in health resulting from increased exposure to stress (Goldbach et al., 2014; Meyer, 2003a). These findings also highlight the importance of stressful life events, in addition to LGB discrimination, in contributing to disparities in SUD for some sexual minorities.

Several differences in substance use and stress experiences were also evident *between* sexual minority subgroups, providing insights into the mechanisms driving subgroup differences in SUDs. First, gay men and bisexual men and women reported more stressful life events, and gay/lesbian, and bisexual men and women also reported more LGB discrimination events than HSM respondents. In many cases, group differences in stressful life events and/or LGB discrimination mediated group differences in SUDs, suggesting stress is a powerful correlate of substance use, and that reducing subgroup disparities in stress exposure would curb disparities in substance use.

Comparing stress mechanisms.

Although these results suggest sexual minority populations report greater exposure to both LGB discrimination and stressful life events, different types of stress may underlie, or more

strongly influence subgroup differences in substance use. For instance, among both gay and bisexual men, stressful life events and LGB discrimination were each associated with higher rates of alcohol use disorder. Interestingly though, the magnitudes of the indirect effects suggest that LGB discrimination may be a stronger mediator of the disparity for gay men, while stressful life events may be a stronger mediator of the disparity for bisexual men. Further, differences in disordered cannabis use between gay and HSM men were mediated through perceived LGB discrimination, while differences in disordered tobacco use between bisexual and HSM men were mediated through stressful life events. Few differences were found between sexual minority women; elevated rates of disordered alcohol, cannabis, and tobacco use among bisexual women, compared to HSM were mediated through stressful life events. These results suggest that both LGB discrimination and stressful life events are important determinants of LGB health disparities, but that interventions designed to mitigate LGB discrimination (e.g., enactment of anti-LGBT bias trainings in substance abuse treatment facilities) may be particularly relevant for addressing disordered substance use among lesbian/gay populations.

Importance of identity.

It is important to note that in both bivariate and multivariate analysis, lesbian/gay and especially bisexual participants had the most pronounced disparities in SUDs. HSM women also had marked SUD disparities compared to heterosexual women, although the magnitudes of these differences were somewhat smaller than for LGB-identified minorities. For example, compared to heterosexual women, approximately twice as many HSM women had a past-year alcohol use disorder, while roughly 2.5 times as many lesbian/gay women, and over 3 times as many bisexual women had the same disorder. Among men, HSM men had similar, and in some cases (i.e., tobacco), lower rates of SUD, compared to heterosexuals. There were also marked

differences in stress exposure among sexual minority subgroups, with HSM men and women reporting fewer instances of both stressful life events and LGB discrimination events, compared to lesbian/gay and bisexual respondents. Taken together, these findings may suggest that among sexual minorities, possessing an LGB identity confers an additional degree of vulnerability compared to HSM, especially among men. However, this question requires more investigation.

Indeed, a growing body of research shows different sexual minority populations share common experiences with regard to stress and health disparities (Fish et al., 2018; Graham et al., 2011; Krueger et al., 2018; Krueger & Upchurch, 2019), yet the magnitudes and types of stress may vary by subgroup. Stressors such as discrimination in healthcare settings may more directly impact sexual minorities who identify as LGB, compared to HSM, or those who present with traditional gender roles (Gordon & Meyer, 2008). As such, it is possible that on average, HSM experience less LGB discrimination (e.g., discrimination resulting from utilizing an LGB identity), or at least perceive that they do. Therefore, the exposure and salience of stressful life events vs. LGB discrimination in shaping substance use behaviors may vary between different subgroups of sexual minorities. Together, these findings highlight the importance of assessing the independent mechanisms contributing to SGM health disparities, separately by sexual orientation group, when possible. Without doing so, health outcomes and determinants that are unique to specific subgroups will be obscured.

Study-Specific Limitations.

This study has several limitations. First, the LGB discrimination variable that was used should be interpreted with caution. The original scale items were written in a way that might resonate more strongly with LGB-identified than heterosexual-identified sexual minorities (e.g., "how often were you called names *because [you were] assumed to be gay, lesbian, or bisexual*").

As such, the resultant scale likely measured subgroup differences in *perceived* minority stress events more strongly than actual exposure to minority stress events. Second, this study considered how specific *types* of stressors (i.e., stressful life events vs. LGB discrimination) mediated SUD disparities, but future studies should examine the prevalence and impact of specific stressors (e.g., death in the family vs. job stress) on substance use behaviors in more detail. Third, these results also highlight the need to examine alternate mechanisms driving sexual orientation SUD disparities, possibly outside of stress frameworks – particularly among women, for whom direct effects between sexual identity and SUDs remained, even in path analyses which assessed for indirect paths through stress. Finally, these data are cross-sectional, limiting my ability to draw inferences about the causal nature of the associations we presented.

Conclusions.

This study showed wide-ranging differences in the rates of past-year alcohol, cannabis, and tobacco use disorders across four distinct sexual orientation groups. Several SUD disparities were evident between heterosexual and sexual minority groups overall. There were, however, important distinctions between sexual minority subgroups. We also assessed two distinct stress mechanisms contributing to between- (heterosexual vs. sexual minority) and within-group (among sexual minorities) differences in SUD. We found appreciable subgroup variations in experiences of stress and the association between different types of stress and SUDs. Future research should continue to assess how specific stressors contribute to sexual orientation disparities in substance use in addition to other alternate mechanisms that contribute to sexual orientation disparities in substance use.

CHAPTER 7: Discussion

Discussion of major findings

Study 1.

Sexual minority disparities in mental health are well-documented, yet on surveys, measures of sexual orientation are often overly-simplistic, limiting researchers' abilities to assess variability across a range of health and social conditions, among diverse subgroups of the sexual minority population. As such, relatively little is known about differences, and similarities, that exist across subgroups of the broader sexual minority population. Using a nationally-representative sample, this study was able to address this gap in the literature, and its purpose was twofold. First, the study aimed to assess how distinct sexual orientation groups differ from one another across a wide range of characteristics. Second, while ample research has demonstrated that many such sociodemographic, lifestyle, and psychosocial factors are important predictors of health overall, very little is known about whether, or how subgroup differences across these factors may be related to health. As such, the study aimed to assess how any subgroup variability was associated with subgroup differences in mental health status.

Wide variability was found between four distinct sexual orientation groups, across a broad range of sociodemographic characteristics, lifestyle behaviors and attributes, and psychosocial experiences. Broadly, compared to heterosexual people, sexual minority populations varied considerably with respect to a number of characteristics, including indicators of socioeconomic status, religiosity, substance use and other health behaviors, and experiences of stress. However, post-hoc analyses highlighted that bisexual men and women generally had the deepest disparities – especially with regard to income, substance use behaviors, and experiences

with social stress. This study also found that variance across broad categories of characteristics were associated with subgroup differences in health status, and these findings support both theoretical frameworks that informed this dissertation – social conditions as fundamental causes, as well as theories of social stress (Link & Phelan, 1995; Meyer, 2003a; Pearlin et al., 1981). From a fundamental causes perspective, sexual orientation groups were shown to occupy several marginalized statuses, and so it is not surprising that sexual minority subgroups had reduced mental health statuses, relative to heterosexual people. Despite marked subgroup variability across sociodemographic and lifestyle characteristics, sexual minority groups reported fairly consistent disparities in exposure to social stress, and also reported less access to social support, except for lesbian women. This finding is consistent with Minority Stress Theory, which suggests sexual minority disparities in mental health result from increased exposure to social stress, which are exacerbated by reduced access to social supports and other positive coping resources (Meyer, 2003a).

This study was largely exploratory. Because a wide variety of characteristics were studied, the explicit purpose of this study was not to formally assess causality between any one characteristic and mental health status. However, it will be important for future research to specifically assess the likely complex causal mechanisms (e.g., sociodemographic, lifestyle behavioral, and psychosocial) contributing to the marked reductions in mental health that exist for many sexual minority populations, relative to heterosexual people.

Study 2.

Study 2 built on Study 1 by examining sexual orientation group differences in mental health status, among those reporting multiple (two or more) past-year stressful life experiences

("resilience"). The links between social stress and mental health detriments are well-known (Aneshensel, 1992; Hammen, 2005; Lewis et al., 2003; McLaughlin et al., 2010; Pechtel & Pizzagalli, 2011), and resilience refers, generally, to one's ability to adapt to, and potentially overcome the negative effects of stress on health (Fletcher & Sarkar, 2013). This study demonstrated that sexual minority people experience broad disparities, compared to heterosexual people, and that sexual minority subgroups also vary with respect to social stress exposure and mental health outcomes.

However, while disparities were also evident with respect to mental health resilience, these results were somewhat more modest. Specifically, among respondents reporting multiple (two or more) past-year stressful life events, only gay men, bisexual women, and HSM women reductions in mental health status, compared to heterosexual people. This finding supports theories of general stress by underscoring the negative effects of stress on health population-wide (Aneshensel, 1992; Pearlin et al., 1981), regardless of sexual orientation. However, this finding also suggests sexual orientation is indeed a fundamental cause of health inequities (Hatzenbuehler, Phelan, et al., 2013; Link & Phelan, 2014; Phelan et al., 2014); it highlights the added burden that sexual minority status (i.e., a sexual minority identity, same-sex attraction, and/or same-sex behavior) places on peoples' experiences of, and abilities to overcome stress – especially on particular sexual minority subgroups. Additional research is needed to better-understand why these particular subgroups may be at elevated risk. In Study 1, gay men reported less social support than both heterosexual and bisexual men, and bisexual and HSM women also reported less social support than heterosexual and lesbian women, suggesting social support may contribute to these findings.

Indeed, Study 2 also contributes to knowledge about the importance of social support for maintaining mental health. Positive social supports are thought to buffer against the harmful effects of stress on health (Bariola et al., 2015; Bos et al., 2008; Kwon, 2013; Mereish & Poteat, 2015; Ozbay et al., 2007). While this study did not assess social support in this way – as a buffer – it did demonstrate that sexual orientation groups differ from one another with respect to the availability of, and their access to, social support. Specifically, compared to heterosexual people, people from all sexual minority subgroups, except lesbian women, reported reductions in social support, compared to heterosexual men and women. Further, for all sexual minority groups except lesbian women, who reported greater access to social support than heterosexual women, subgroup disparities in resilience status were mediated through social support. Specifically, despite the absence of differences in resilience status between several sexual orientation groups (e.g., between bisexual or HSM men and heterosexual men), reductions in social support mediated lower rates of thriving, and higher rates of languishing for sexual minority subgroups, compared to heterosexual populations, when they did occur. This offers a potential avenue to public health researchers and practitioners. Interventions that foster social support and community connectedness may be especially beneficial for subgroups exposed to multiple stressors, yet who are at greatest risk for languishing mental health.

Study 3.

Study 3 contributed to a distinct, but related area in which broad sexual minority health disparities exist – substance use. Ample prior research has shown sexual minority people are more likely than heterosexuals to smoke, drink alcohol, and to use a range of both legal and illicit substances (Blosnich et al., 2014; Fish et al., 2018, 2019; Hatzenbuehler, Corbin, et al.,

2008; Lee et al., 2009; McCabe et al., 2009, 2018; NIDA, 2017; Watson et al., 2018), which are driven at least in part, by increased exposure to social stress (Coulter et al., 2018; Goldbach et al., 2014; Hughes, McCabe, et al., 2010; McCabe et al., 2010). However, relatively little is still known about subgroup differences in the occurrence of substance use disorders, or the mechanisms driving any such differences. This study highlighted that indeed, gay and bisexual men, and lesbian/gay, bisexual, and HSM women experience alcohol, cannabis, and tobacco use disparities at higher rates than heterosexual men and women, respectively, consistent with prior research. However, there were also several significant differences among sexual minority subgroups with respect to the occurrence of disordered substance use, with lesbian/gay and bisexual people experiencing these disparities at higher rates than HSM people.

There were also stark sexual orientation groups differences in terms of exposure to stressful life experiences, as well as perceived exposure to LGB discrimination, with many sexual minority subgroups reporting more stressful life events than heterosexual people, and lesbian/gay and bisexual people reporting more LGB discrimination events than HSM people. These findings are important because they suggest that the exposure and salience of stressful life events vs. LGB discrimination in shaping substance use behaviors may vary between different subgroups of sexual minorities, with heterosexual identity providing some degree of protection – real and/or perceived – in terms of stress exposure. Further, in addition to LGB discrimination, stressful life events also appear to drive sexual minority disparities in substance use. This finding adds to the existing research, which has tended to focus on minority stress-specific mechanisms driving these disparities. Together, these findings highlight the importance of assessing the independent mechanisms contributing to sexual minority health disparities, separately by sexual orientation group, when possible.

Synthesis.

Several themes emerged across all three dissertation studies. First is that accurate, careful measurement of sexual orientation is vital to move the field forward. Sexual minorities are commonly studied as a singular population (e.g., LGBs), and indeed, many sexual minorities share common experiences and concerns with regard to stigma and discrimination, and also experience reduced mental health, on average, compared to heterosexuals (Graham et al., 2011). However, this study highlights the importance of examining subgroup differences within the diverse and heterogeneous sexual minority population. When examined separately, subgroup differences in mental health status and substance use were evident. By disaggregating LGB-identified sexual minorities into monosexual (lesbian/gay) and bisexual subgroups, researchers and practitioners will be better able to understand, and ultimately address the unique health and social challenges faced by sexual minority people.

Further, current recommendations stress the importance of including multiple dimensions of sexual orientation (i.e., identity, attraction, and behavior) on surveys when possible, allowing for greater specificity of research findings, as well as greater consistency across studies (The Williams Institute, 2009). Sexual identity, attraction, and behavior intersect in ways that create "hidden," and sizeable, subpopulations of sexual minorities. For instance, results from this dissertation show the HSM population is roughly 60% larger than the combined gay/bisexual population among men, and roughly 80% larger than the combined population of lesbian and bisexual women. However, despite their relatively large sizes, HSM people are frequently miscategorized or excluded altogether from relevant research on the basis of their heterosexual identities (Korchmaros, Powell, & Stevens, 2013; Lindley et al., 2012). Reliance on single-

indicator measures of sexual orientation ultimately masks the true extent of sexual minority health disparities. This point also has clinical relevance; it may be especially important for practitioners to assess clients' sexual identities, attractions, and behaviors in order to identify those most at risk for (as well as the unique factors associated with) reduced mental health and increased substance use.

In addition to enumerating key differences in mental health and substance use across four distinct sexual orientation groups, this dissertation formally assessed key psychosocial mechanisms underlying those health differences (i.e., social support was assessed as a mediator of group differences in resilience to stress in Study 2, while two types of social stress were assessed as mediators of group differences across three past-year substance use disorders in Study 3). These findings offer tangible avenues for public health and clinical intervention. For example, substance use disparities were driven largely through stressful life events for bisexual, versus HSM sexual minorities, while they were driven more strongly through higher rates of perceived LGB discrimination for lesbian/gay, versus HSM sexual minorities. This finding may imply that different interventions should be tailored to address health disparities among specific subgroups of the sexual minority population. While Study 1 did not formally assess causal mechanisms driving sexual minority subgroup disparities in mental health, it did highlight how different patterns of sociodemographic, lifestyle, and psychosocial factors attenuate subgroup disparities in mental health. While social stress is often used as an explanatory framework to describe sexual minority health disparities, this study highlights several avenues for future research, and additionally suggests alternate mechanisms, outside of stress frameworks, may be beneficial for understanding sexual minority health.

Finally, there is ample discourse – in public, and among academics – that things are "getting better" for sexual minority people, and indeed, recent shifts in public opinion, policies, and many laws have dramatically improved the lives of sexual minority people over the past few decades. For instance, the overturn of the "Don't Ask Don't Tell" in 2011 now allows sexual minority people to serve openly in the U.S. military (Johnson, Rosenstein, Buhrke, & Haldeman, 2015). Sexual minority people were awarded the right to marry nationwide in 2015 (Gates & Brown, 2015), and public opinion for sexual minority people in the United States has doubled in the past three decades (Flores, 2014). However, despite these gains, this dissertation highlighted the stark disparities that still exist between heterosexual and sexual minority people, in both mental health and substance use. These disparities in health stem both from structural disadvantages (e.g., as of this writing, it is still legal to fire employees on the basis of sexual orientation in many U.S. states), and also interpersonal stressors, as highlighted in this dissertation. Ample works is still needed to understand where disparities still exist, and to meaningfully address them through targeted interventions.

Limitations and Strengths

This dissertation highlighted the limitations of prior research, including heavy reliance on community-derived convenience samples, and lack of inclusive measures for assessing sexual minority status. However, despite advocating for careful measurement of sexual orientation and other constructs, this series of studies was also limited by the availability of items in the NESARC-III dataset. For example, the measure of sexual identity included response options for "gay or lesbian, "bisexual," and "heterosexual (straight)," but did not include alternate sexual minority identity labels (e.g., queer, pansexual). Recent research suggests the use of such

"emerging" identity labels has increased in recent years, especially among youths (Galupo, Davis, Grynkiewicz, & Mitchell, 2014; Morgan, 2012). Future surveys should consider including a greater diversity of sexual minority identities as response options on their sexual identity questions. In addition to the incomprehensive measure of sexual identity, a sizeable proportion of respondents (N = 1,712, 4.7%) were excluded from analysis because they lacked the identity, attraction, and/or behavior variables necessary for inclusion in a sexual orientation group.

Additionally, Study 3 relied heavily on imperfect measures of LGB discrimination. Given the wording of these items (e.g., "How often [did you] experience discrimination in public, like on the street, in stores or in restaurants, because [you were] assumed to be gay, lesbian or bisexual in last 12 months?"), different subgroups of sexual minorities might be expected to endorse these types of discrimination at different rates. While identifying subgroup differences in rates of perceived LGB discrimination was a valuable endeavor, future iterations of this survey should consider amending these questions.

Also, while there are many benefits to using large, nationally-representative samples for epidemiologic analysis, they have limitations for research with minority populations. For instance, national samples commonly do not include questions that allow for assessing the distinctive mechanisms theorized to be crucial to sexual minority health (i.e., minority stress). As such, while flawed, the LGB discrimination items included in this dataset offered a valuable opportunity to assess sexual orientation subgroup differences in health (i.e., substance use disorders), and multiple stress mechanisms, using a nationally representative sample.

Further, (and likely related to sexual minority disparities in stress exposure and mental health status), I was limited in my ability to measure resilience as I had originally hoped. I created a categorical measure of mental health status, among those reporting multiple (two or

more) past-year stressful life events (resilience). I had planned to categorize respondents into one of three resilience categories ("thriving:" mental health status that was 1 standard deviation above the mean; "average:" mental health status within 1 standard deviation of the mean; "languishing:" mental health status less than 1 standard deviation below the mean). However, there were too few sexual minority respondents occupying the "top" mental health category ("thriving"), among those reporting multiple stressors. As such, I expanded the categories using 0.5 standard deviation cutoffs (e.g., "thriving:" mental health 0.5 standard deviations above the mean). While a 0.5 standard deviation difference is appreciable, I was unable to compare subgroup differences at more "extreme ends" of the resilience spectrum.

Finally, this dissertation was conducted using cross-sectional data, yet each of the three studies implied causal relationships between variables, to varying degrees. While this is not problematic on its own, when longitudinal data do not exist to formally assess causality, it is vital to rely on existing research and theory to guide the specific analyses and claims that can be made, which was done. However, there is ample opportunity for future research to assess the myriad causal mechanisms studied in this dissertation, using longitudinal data.

Despite the limitations highlighted, this dissertation expanded upon existing theory and research by disaggregating diverse subgroups of the sexual minority population. Together, these studies showed key differences across a broad range of characteristics, and associated implications for differences in health across subgroups. Further, while researchers are increasingly disaggregating monosexual (lesbian and gay) from bisexual sexual minorities in analysis, this dissertation included a third group of sexual minority respondents – those who do not utilize a sexual minority label – in each analysis, contributing to increased knowledge about an understudied group that is often excluded from research about sexual minority populations.

Future research and implications for public health

Studies from this dissertation highlighted several avenues for future research. First, the availability of nationally representative data on sexual minority populations has allowed for improvement in estimating the health profiles, health disparities, and even the size of sexual minority populations. These studies have been vital to improving health policies and other legal protections for sexual minority people. Much work still remains, however. To appreciably improve sexual minority population health, it is vital to more readily explore the unique health concerns and mechanisms contributing to health outcomes among sexual minority people, and not simply in relation to heterosexual people. Critical next steps include improved methods of estimating risk and resilience within the sexual minority population overall, and across distinct subgroups. Additional next steps include better-identifying the unique mechanisms that contribute to subgroup differences across myriad indicators of mental, behavioral, and physical health, and validation and testing of measures across diverse subgroups of the sexual minority population.

Additional research should focus on emerging and newly-reclaimed identities used by sexual minority people, including "queer" and "pansexual." Recent research suggests the use of such "emerging" identity labels has increased in recent years, especially among youths (Galupo et al., 2014; Morgan, 2012). However, large-scale, population-based studies are unable to be as responsive to these demographic shifts as are smaller, community-driven studies, and often rely on measures that capture historically "traditional" sexual minority identities (e.g., lesbian, gay, or bisexual identities). As such, population-based probability surveys may fail to capture the full sexual minority population (Igartua et al., 2009; Vrangalova & Savin-Williams, 2012).

Finally, while relatively little is known about the distinguishing features and health profiles of specific sexual minority subgroups, considerably less is known about various subgroups of the gender minority population. Future research should focus on identifying how the sociodemographic, behavioral, psychosocial, and health profiles differ between cisgender men and women, transgender men and women, and genderqueer people. Understanding how, and in what ways gender minority populations vary from the cisgender population – and from one another – will allow for further research and interventions to document, and ultimately address the mechanisms driving the considerable disparities in health that are experienced by gender minority people (Graham et al., 2011).

Conclusion

This dissertation highlighted the complex and multidimensional nature of sexual orientation, and demonstrated that inconsistent, and incomplete measurement of this construct has substantial implications for the field of sexual orientation population health research. Together, these studies showed that when examined separately, sexual orientation groups exhibit wide-ranging sociodemographic, lifestyle, and psychosocial profiles, characteristics which have considerable implications for health. By studying subgroups separately, the unique disparities faced by sexual minority subpopulations, and the mechanisms driving them become clear, and tailored interventions can be developed to improve health across all sexual minority populations.

APPENDICES

Appendix 1. Multiple logistic regression assessing factors associated with reporting two or more stressful life events

	OR (95% CI)
Age	0.97 (0.96, 0.97)***
Sex (ref = Male)	
Female	0.99 (0.94, 1.04)
Race (ref = White)	
Black	1.20 (1.07, 1.33)**
AI/AN	1.82 (1.42, 2.33)***
API/Hawaiian	0.88 (0.75, 1.03)
Hispanic	1.07 (0.97, 1.18)
Born in U.S. (ref = Yes)	
No	0.52 (0.47, 0.57)***
Education (ref = Less than high school)	
High school	0.96 (0.87, 1.05)
Some college	1.13 (1.03, 1.23)**
Bachelors	0.95 (0.85, 1.06)
More than college	1.06 (0.93, 1.19)
Household income (ref = Less than $25,000)	
$25,000-49,999	0.84 (0.78, 0.91)***
$50,000-79,999	0.66 (0.61, 0.72)***
$80,000-99,999	0.57 (0.50, 0.65)***
$100,000 +	0.53 (0.47, 0.59)***

***p<0.001; **p<0.01; *p<0.05

Appendix 2. Multiple logistic regression assessing factors associated with not being assigned to a sexual orientation group (N = 1,712)

	OR (95% CI)
Age	0.96 (0.96, 0.97)***
Sex (ref = Male)	
Female	1.29 (1.13, 1.48)***
Race (ref = White)	
Black	0.74 (0.60, 0.91)**
AI/AN	1.14 (0.73, 1.78)
API/Hawaiian	1.95 (1.55, 2.47)***
Hispanic	0.77 (0.63, 0.95)**
Born in U.S. (ref = Yes)	
No	0.84 (0.68, 1.02)
Education (ref = Less than high school)	
High school	0.79 (0.63, 1.00)*
Some college	0.81 (0.65, 0.99)*
Bachelors	0.72 (0.55, 0.94)**
More than college	0.68 (0.50, 0.92)**
Household income (ref = Less than $25,000)	
$25,000-49,999	0.69 (0.58, 0.82)***
$50,000-79,999	0.62 (0.52, 0.75)***
$80,000-99,999	0.56 (0.43, 0.73)***
$100,000 +	0.57 (0.44, 0.73)***

***p<0.001; **p<0.01; *p<0.05

Appendix 3. Top Five Stressful Life Events Endorsed by NESARC-III Respondents

	% Endorsed
Any family members or close friends died in last 12 months	30.81
Moved/anyone new came to live with you in last 12 months	22.49
Changed jobs, job responsibilities or work hours in last 12 months	19.10
Unemployed and looking for work for >1 month in last 12 months	16.28
Have you had so much debt that you had no idea how to repay it in last 12 months	14.81

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