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Association Between Receptivity to Tobacco Advertising and Progression to Tobacco Use in Youth and Young Adults in the PATH Study

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IMPORTANCE Cigarette marketing contributes to initiation of cigarette smoking among young people, which has led to restrictions on use of cigarette advertising. However, little is known about other tobacco advertising and progression to tobacco use in youth and young adults.

OBJECTIVE To investigate whether receptivity to tobacco advertising among youth and young adults is associated with progression (being a susceptible never user or ever user) to use of the product advertised, as well as conventional cigarette smoking.

DESIGN, SETTING, AND PARTICIPANTS The Population Assessment of Tobacco and Health (PATH) Study at wave 1 (2013-2014) and 1-year follow-up at wave 2 (2014-2015) was conducted in a US population-based sample of never tobacco users aged 12 to 24 years from wave 1 of the PATH Study (N = 10 989). Household interviews using audio computer-assisted self-interviews were conducted.

EXPOSURES Advertising for conventional cigarettes, electronic cigarettes (e-cigarettes), cigars, and smokeless tobacco products at wave 1.

MAIN OUTCOMES AND MEASURES Progression to susceptibility or ever tobacco use at 1-year follow-up in wave 2.

RESULTS Of the 10 989 participants (5410 male [weighted percentage, 48.3%]; 5579 female [weighted percentage, 51.7%]), receptivity to any tobacco advertising at wave 1 was high for those aged 12 to 14 years (44.0%; 95% confidence limit [CL], 42.6%-45.4%) but highest for those aged 18 to 21 years (68.7%; 95% CL, 64.9%-72.2%). e-Cigarette advertising had the highest receptivity among all age groups. For those aged 12 to 17 years, susceptibility to use a product at wave 1 was significantly associated with product use at wave 2 for conventional cigarettes, e-cigarettes, cigars, and smokeless tobacco products. Among committed never users aged 12 to 17 years at wave 1, any receptivity was associated with progression toward use of the product at wave 2 (conventional cigarettes: adjusted odds ratio [AOR], 1.43; 95% CL, 1.23-1.65; e-cigarettes: AOR, 1.62; 95% CL, 1.41-1.85; cigars: AOR, 2.01; 95% CL, 1.62-2.49; and smokeless (males only): AOR, 1.42; 95% CL, 1.07-1.89) and with use of the product (conventional cigarettes: AOR, 1.54; 95% CL, 1.03-2.32; e-cigarettes: AOR, 1.45; 95% CL, 1.19-1.75; cigars: AOR, 2.07; 95% CL, 1.26-3.40). Compared with those not receptive to any product advertising, receptivity to e-cigarette advertising, but not to cigarette advertising, was independently associated with those aged 12 to 21 years having used a cigarette at wave 2 (AOR, 1.60; 95% CL, 1.08-2.38).

CONCLUSIONS AND RELEVANCE Receptivity to tobacco advertising was significantly associated with progression toward use in adolescents. Receptivity was highest for e-cigarette advertising and was associated with trying a cigarette.

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The US Surgeon General[1] has concluded that cigarette advertising promotes the initiation of cigarette smoking. In the United States, 82% of adult smokers try their first cigarette before age 18 years and 93% before age 21 years,[1(p238)] which is the minimum age to purchase tobacco in 2 states and in more than 215 localities.[2] Within 4 years of first smoking, 30% to 50% of adolescents progress to established use[3,4]; the associated dependence continues for many years.[3-5] Restrictions on cigarette marketing introduced in 1998[6] coincided with the start of a long-term decline in high school seniors ever smoking (65%-28% in 2016).[7] Exposure to marketing of noncigarette tobacco products (particularly electronic cigarettes [e-cigarettes]) has grown rapidly,[8-10] as has use of these products.[11-15] As e-cigarette advertising models vaping, a behavior similar to cigarette smoking, it has been hypothesized that e-cigarette advertising could promote conventional cigarette smoking.[16,17]

The initiation process has been best described for cigarette smoking. In the United States, progression from being a committed never smoker begins with the development of a cognitive susceptibility to smoke in late childhood/adolescence[18] followed by trial and increased frequency of use.[1,4,10] Effective marketing encourages product use with messages that elicit a positive (receptive) response from those viewing the advertisement.[19] Communication and advertising theories[20,21] propose levels of receptivity with higher levels more predictive of future use. Receptivity to cigarette advertising increases the probability that committed never smokers will become susceptible and then try a cigarette (ie, progress toward use).[10,16,17,22,23] In this article, we report whether this pattern holds across other tobacco products.

The Population Assessment of Tobacco and Health (PATH) Study measured receptivity to advertising for cigarettes, e-cigarettes, smokeless tobacco, and cigars among respondents aged 12 to 24 years at wave 1.[24] As first use is mainly complete by age 21 years, we report whether receptivity among never users also peaks by age 21 years. Because individuals can be receptive to advertising for multiple products, we report the most frequent combinations across tobacco products. Because the PATH Study measured susceptibility only among participants aged 12 to 17 years at wave 1, we use this subpopulation to test whether susceptibility to use of each product at wave 1 is associated with product use at 1-year follow-up in wave 2 and examine how receptivity to product advertising indicates progression toward product use. Finally, among those most at risk of starting smoking (individuals aged 12-21 years), we explore whether receptivity to e-cigarette advertising was significantly associated with trying a conventional cigarette at wave 2.

Methods

Participants and Procedures
Data were collected in the PATH Study,[25] a nationally representative, longitudinal study of the noninstitutionalized, civilian US population aged 12 years or older. Details of the study design are presented elsewhere.[26,27] The PATH Study oversampled adult tobacco users, young adults (aged 18-24 years), and African American adults. Participants were selected using data collected from an in-person household screener. Audio computer-assisted self-interviews in English or Spanish collected self-report information on tobacco-use patterns and associated health behavior. Population and replicate weights adjust for the study design characteristics and nonresponse at waves 1 and 2.

The PATH Study was conducted by Westat, a contract research organization, and approved by its institutional review board, and the study plan and procedures were approved by the Office of Management and Budget. Written informed consent was obtained from adult respondents and written assent was obtained from youth after written informed consent from a parent. The study provided incentives to thank respondents for participating in the study.[25]

Wave 1 interviews were conducted from September 12, 2013, to December 14, 2014; the weighted response rate for the household screener was 54.0%. Among screened households, the overall weighted response rate at wave 1 was 74.0% for the adult interview (n = 32 320) and 78.4% for the youth interview (age 12-17 years, n = 13 651). Wave 2 interviews were conducted as close as possible to the 1-year anniversary of each respondent's wave 1 interview (weighted response rate: adult interview, 83.2%; youth interview, 87.3%).[26,27]

Measures
Ever Use of Tobacco Products
Both waves of the adult and youth questionnaires asked respondents if they had ever used a cigarette, even 1 or 2 puffs. Respondents were shown separate pictures for e-cigarettes, various types of cigars, smokeless tobacco, pipe, hookah, dissolvable products, and bidis and/or kreteks and asked if they had ever seen or heard of each. Those who responded positively were asked whether they had ever used the product, even 1 or 2 times. This study included only respondents aged 12 to 24 years who answered negatively to all tobacco product use questions at wave 1 for cigarettes, e-cigarettes, cigars, and smokeless tobacco products (N = 10 989; 5410 male [weighted percentage, 48.3%]; 5579 female [weighted percentage, 51.7%]). At wave 2, respondents were shown pictures for the same tobacco products and similarly queried on use. One difference from wave 1 was that e-cigarette use was expanded

Key Points

Question Is receptivity to advertising of e-cigarettes, cigarettes, cigars, and smokeless tobacco products a risk factor for trying tobacco products in youth and young adults?

Findings In this population-based study including 10 989 participants, receptivity to tobacco advertising at wave 1 was significantly associated with committed never tobacco users aged 12 to 17 years progressing to susceptibility and tobacco product use at 1-year follow-up in wave 2. For never tobacco users aged 12 to 21 years at wave 1, receptivity to e-cigarette advertising was significantly associated with ever use of conventional cigarettes at wave 2.

Meaning Receptivity to tobacco product advertising is associated with progression to tobacco use among young never tobacco users, and receptivity to e-cigarette marketing is associated with later conventional cigarette smoking.

to include other electronic nicotine products, such as e-cigars, e-pipes, e-hookahs, personal vaporizers, vape pens, and hookah pens. We considered all of these as electronic nicotine delivery systems (ENDS) and e-cigarette variations.

Susceptibility to Use Tobacco Products

To determine susceptibility of future use,[17] we identified committed never users (ie, those considered at minimum risk of future use) and categorized all others as susceptible. For cigarettes and other tobacco products that a respondent had seen or heard of, never users aged 12 to 17 years were asked 3 questions at wave 1: "Have you ever been curious about using <product>?"; "Do you think you might try using <product> soon?"; and "If one of your best friends were to offer you <product>, would you use it?" Four-level responses ranged from not at all curious to very curious, or from definitely not to definitely yes. Respondents with the strongest negative response to all 3 questions and respondents who had never heard of the product were categorized as committed never users. All other respondents were categorized as susceptible to use the product, including those with missing responses. Susceptibility was not queried among participants aged 18 to 24 years at wave 1 but was among those aged 12 to 24 years at wave 2.

Receptivity to Tobacco Product Advertising

The PATH Study assessed receptivity at wave 1 based on favorite ads, recall, and liking ads.[24] Respondents were asked to select the brand of their favorite tobacco advertisement from a list. We allocated favorite brands to 1 of the 4 categories (cigarettes, e-cigarettes, cigars, or smokeless tobacco products). Unless snus was specifically mentioned, we assumed that nomination of Marlboro or Camel referred to cigarettes.

Each respondent was then shown 20 ads (5 from each study category) randomly sampled from a near-census collection (n = 959) of print, direct mail, and television ads used in the period immediately preceding the survey.[24] For each ad shown, respondents were asked if they had seen the ad in the past 12 months (aided recall) and whether they liked, disliked, or were neutral to the ad (eFigure in the Supplement). Receptivity to ads for each product type was categorized as (1) no receptivity (no recall or liking of any of the 5 ads and no favorite ad), (2) low receptivity (recall of at least 1 shown ad but no liking of any ad and no favorite), or (3) moderate/high receptivity (liking at least 1 of the ads or naming a favorite ad). Any receptivity was a combination of categories 2 and 3. Respondents could be receptive to ads for multiple products. We report data for combinations of ads for conventional cigarettes, e-cigarettes, and other products (eg, smokeless and cigars).

Other Variables

Assessments of age, sex, and race/ethnicity are provided in the PATH Study Data User Guide.[26,27] Missing self-report data were replaced by data from the household screener sex (n = 26), age (n = 2), race (n = 473), and ethnicity (n = 187). As these variables were important for weighting, any remaining missing data were statistically imputed (eg, race, n = 135).[27] To address our age 21-years hypothesis and to be comparable with previous work,[24] we categorized age at wave 1 as 12 to 14, 15 to 17, 18 to 21, and 22 to

24 years. To assess social and secondhand tobacco exposure, respondents were asked: "Does anyone who lives with you now use any of the following: <list of tobacco products>?" and "During the past 7 days, about how many hours were you around others who were smoking? Include time in your home, in a car, at school, or outdoors." We reported binary variables of exposure for household and social exposure (0 vs ≥1 hour).

Statistical Analysis

We computed variances using the recommended balanced repeated replication method with Fay adjustment = 0.3.[28] Weighted percentages and modified Wilson confidence limits (CLs) for proportions were also calculated.[29] For each product assessed, a logistic regression among wave 1 never users of the product aged 12 to 17 years tested the association of wave 1 susceptibility with wave 2 use of the product. For each of the 4 products with receptivity data, among committed never users aged 12 to 17 years, logistic regression models tested whether wave 1 receptivity (compared with no receptivity) was associated with either ever use or progression (combined susceptibility and ever use) at wave 2. As males are much more likely to use smokeless products than females,[30,31] we repeated the smokeless models for males only. Finally, for never tobacco smokers aged 12 to 21 years, a logistic regression tested whether wave 1 receptivity to e-cigarette advertising was associated with ever using a cigarette at wave 2. Logistic regressions included wave 1 covariates for sociodemographics and both household and social exposure to tobacco use. Odds ratios, 95% CLs, and P values were reported from the weighted, adjusted model. All analyses were conducted using SAS SURVEY procedures, version 9.4 (SAS Institute).

Results

Receptivity to Advertising for Different Tobacco Products by Age at Wave 1

The proportion of individuals with any level of receptivity to any tobacco ad increased significantly across successive age groups up to 21 years (nonoverlapping 95% CLs), from 44.0% for those aged 12 to 14 years to 68.7% for those aged 18 to 21 years, with receptivity among the 22- to 24-year group closer to that of the 15- to 17-year group (**Table 1**). For all age groups through 21 years, any receptivity was highest for e-cigarette ads, followed by cigarette, smokeless tobacco, and cigar ads. This pattern of a progressively greater proportion that was receptive to any product advertisement up to age 21 years was most marked for moderate/high receptivity: those aged 18 to 21 years were almost 3 times more likely to have moderate/high receptivity compared with those aged 12 to 14 years (27.5% vs 9.7%). Any vs no receptivity levels for covariates are presented in the eTable in the Supplement.

Receptivity to Combinations of Tobacco Product Advertising Among Never Tobacco Users Aged 12 to 24 Years

Of those with receptivity to a tobacco ad, 68.4% had low receptivity, although most were receptive to advertising for multiple products (**Table 2**). Receptivity to the most

Table 1. Receptivity to Ads for Different Tobacco Products by Age Among Never Tobacco Users: Population Assessment of Tobacco and Health Study Wave 1, 2013-2014[a]

Characteristic	Age, % (95% CL)			
	12-14 y	15-17 y	18-21 y	22-24 y
Sample size, No (%) [SE]	5567 (37.8) [0.4]	3924 (27.9) [0.3]	1008 (21.6) [0.5]	490 (12.7) [0.6]
Receptive to cigarette ads				
Low	19.0 (17.8-20.3)	18.3 (16.9-19.8)	29.5 (26.4-32.7)	22.7 (19.0-26.9)
Moderate/high	3.8 (3.1-4.5)	7.1 (6.3-8.0)	13.7 (11.4-16.3)	17.8 (14.2-22.1)
Any	22.8 (21.4-24.1)	25.4 (23.9-27.0)	43.1 (39.6-46.7)	40.5 (35.4-45.8)
Receptive to e-cigarette ads				
Low	25.8 (24.5-27.1)	27.7 (26.2-29.1)	34.8 (31.5-38.2)	27.7 (23.6-32.2)
Moderate/high	3.9 (3.4-4.5)	5.2 (4.4-6.2)	12.1 (9.8-14.9)	11.3 (8.8-14.4)
Any	29.7 (28.5-31.0)	32.9 (31.1-34.6)	47.0 (43.5-50.5)	39.0 (34.1-44.1)
Receptive to cigar ads				
Low	7.4 (6.7-8.2)	8.4 (7.5-9.3)	17.2 (14.7-20.0)	10.7 (8.1-14.1)
Moderate/high	1.6 (1.3-2.0)	3.2 (2.7-3.9)	8.2 (6.2-10.8)	9.7 (7.2-12.8)
Any	9.0 (8.3-9.8)	11.6 (10.6-12.7)	25.4 (22.3-28.8)	20.4 (16.9-24.4)
Receptive to smokeless ads				
Low	13.4 (12.5-14.4)	15.4 (14.1-16.7)	21.3 (18.2-24.7)	16.3 (12.7-20.6)
Moderate/high	2.8 (2.3-3.4)	4.7 (4.0-5.5)	11.8 (9.7-14.3)	13.1 (10.0-17.0)
Any	16.2 (15.1-17.4)	20.1 (18.7-21.5)	33.1 (29.7-36.7)	29.4 (24.8-34.4)
Receptive to any tobacco ads[b]				
Low	34.3 (32.8-35.7)	34.6 (32.9-36.3)	41.2 (37.8-44.7)	34.3 (30.1-38.7)
Moderate/high	9.7 (8.8-10.7)	14.8 (13.5-16.1)	27.5 (24.2-31.0)	29.1 (24.9-33.7)
Any	44.0 (42.6-45.4)	49.3 (47.6-51.1)	68.7 (64.9-72.2)	63.3 (57.7-68.6)

Abbreviation: CL, confidence limit.

[a] Percentages and 95% CLs are weighted estimates.

[b] Indicates receptivity to ads for cigarettes, e-cigarettes, cigars, or smokeless tobacco products.

Table 2. Receptivity to Combinations of Tobacco Product Ads Among Never Tobacco Users Aged 12 to 14 Years With Receptivity to Any Product in Population Assessment of Tobacco and Health Study Wave 1, 2013-2014 (n = 5409)

Tobacco Product Ad[a,b]	% (95% CL)[b]		
	Low Receptivity	Moderate/High Receptivity	Any Receptivity
Cigarettes (Without e-Cigarettes)			
Receptive only to cigarette ads	9.6 (8.7-10.5)	4.0 (3.3-4.8)	13.6 (12.5-14.7)
Receptive to cigarette ads and other products but not e-cigarette ads	6.1 (5.4-7.0)	3.5 (2.9-4.2)	9.6 (8.7-10.5)
Subtotal	15.7 (14.5-17.0)	7.5 (6.6-8.5)	23.2 (21.8-24.6)
e-Cigarettes (Without Cigarettes)			
Receptive only to e-cigarette ads	20.3 (19.0-21.8)	2.4 (2.0-3.0)	22.8 (21.4-24.2)
Receptivity to e-cigarette ads and other products but not cigarette ads	6.7 (6.0-7.5)	3.7 (3.1-4.5)	10.5 (9.5-11.6)
Subtotal	27.1 (25.6-28.6)	6.2 (5.4-7.1)	33.3 (31.7-34.9)
Cigarettes and e-Cigarettes			
Receptive to both cigarette and e-cigarette advertising, but not other product advertising	6.4 (5.6-7.3)	3.0 (2.4-3.8)	9.5 (8.4-10.6)
Receptive to both cigarette and e-cigarette with other product advertising	13.6 (12.4-14.9)	10.8 (9.7-12.1)	24.5 (23.1-25.9)
Subtotal	20.0 (18.6-21.5)	13.9 (12.7-15.2)	33.9 (32.3-35.6)
Other Products			
Receptive only to other tobacco product advertising but not cigarette or e-cigarette ads	5.6 (4.8-6.5)	4.0 (3.3-5.0)	9.7 (8.7-10.8)
Total	68.4 (66.6-70.2)	31.6 (29.8-33.4)	100

Abbreviation: CL, confidence limit.

[a] Other products are cigars and smokeless products.

[b] Percentages and 95% CLs are weighted estimates.

prevalent combinations of tobacco product advertising was (1) cigarettes alone (23.2%), (2) e-cigarettes alone (33.3%), (3) both cigarettes and e-cigarettes (33.9%), and (4) any other combinations (9.7%). Thus, of those who had any level of receptivity to any product ad, 67.2% were receptive to e-cigarette ads and 57.1% were receptive to cigarette ads.

Susceptibility at Wave 1 and Progression Toward Product Use at Wave 2

Among never tobacco users aged 12 to 17 years, we ran a series of multivariable logistic regressions on the association between susceptibility to use each product at wave 1 and ever use of that product at wave 2 (Figure). Susceptibility to use was significantly associated with wave 2 use for each of the products for which receptivity was measured: conventional cigarettes (AOR, 3.66; 95% CL, 2.79-4.81), e-cigarettes (AOR, 3.55; 95% CL, 3.08-4.09), cigars (AOR, 4.36; 95% CL, 3.26-5.81), and smokeless products (AOR, 5.01; 95% CL, 3.32-7.56). Among the age 12- to 24-year group (n = 1187), at wave 2, 66.2% of those who had tried ENDS products had used an e-cigarette; e-hookah (49.5%) was the only other product with substantial ever use (percentages are weighted). Confining our analysis of ENDS products to only those who used e-cigarettes at wave 2 did not change our findings.

Receptivity to Tobacco Advertising at Wave 1 and Progression Toward Use at Wave 2

Among committed never users of each product aged 12 to 17 years at wave 1, we used multivariable logistic models to test whether any receptivity to each product's advertising at wave 1 was associated with (1) ever use of the product at wave 2 or (2) progression toward use (ie, susceptibility plus ever use) at wave 2 (Table 3). Receptivity to advertising at wave 1 was associated with ever use of the product at wave 2 for conventional cigarettes, e-cigarettes, and cigars, but not smokeless tobacco, either overall or for males only. Receptivity was also associated with the larger proportion of committed never users who progressed toward use (including those who became susceptible at wave 2) for conventional cigarettes (25.5% vs 19.0%), e-cigarettes (35.5% vs 24.6%), and cigars (31.7% vs 17.8%), although not for smokeless tobacco (10.8% vs 9.2%). The e-cigarette results included all ENDS products, but findings were similar when restricted to e-cigarettes and for smokeless tobacco for males only.

Receptivity to e-Cigarette Advertising at Wave 1 and Ever Using a Conventional Cigarette at Wave 2

Among never tobacco users aged 12 to 21 years at wave 1, we conducted a multivariable logistic regression of those who had ever used a cigarette at wave 2. Table 4 presents the results for the main combinations of receptivity to tobacco product advertising outlined in Table 2. Compared with those who were not receptive to advertisements for any tobacco product, those who were receptive only to conventional cigarette advertising at wave 1 were significantly more likely to have ever used a conventional cigarette at wave 2, as were those who were receptive to advertising for both conventional cigarettes and e-cigarettes. Those who were receptive to e-cigarette advertising, but not receptive to conventional cigarette advertising, were also more likely to have ever used a conventional cigarette at wave 2 compared with those with no receptivity.

Discussion

Susceptibility to conventional cigarettes, e-cigarettes, cigars, and smokeless tobacco at wave 1 was associated with ever use

Figure. Susceptibility to Use of a Tobacco Product in Respondents Aged 12 to 17 Years at Wave 1 and Ever Use of the Product at Wave 2 in the Population Assessment of Tobacco and Health Study
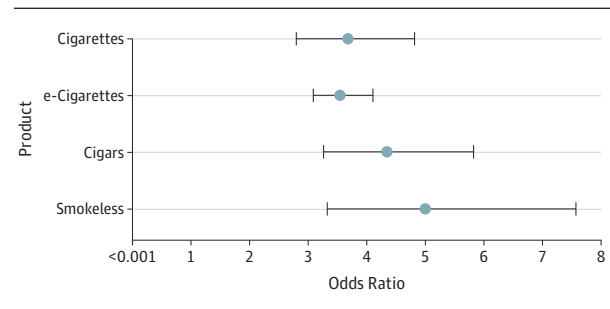
Adjusted odds ratios for ever use of product at wave 2. Adjusted for age, sex, race/ethnicity, and exposure to tobacco users. Vertical bar is a visual reference to the odds ratio = 1.0 line; when confidence limits (CLs) cross this line, they are not significantly different from the reference. Error bars indicate 95% CLs.

of that product by wave 2 and is thus an early measure of progression toward product use. Between wave 1 and 2 of the nationally representative PATH Study, there was considerable progression toward use of tobacco products among the aged 12- to 21-years group. Receptivity to advertising for each of the 4 tested products was associated with progression toward use of the advertised product. In 2013 to 2014, 44% of never tobacco users aged 12 to 14 years were receptive to advertising for at least 1 tobacco product. Among committed never e-cigarette users aged 12 to 17 years at wave 1, 36% of those who were receptive to e-cigarette advertising progressed toward e-cigarette use at wave 2 compared with 25% of those who were not receptive. Similarly, any receptivity was associated with progression toward use in the age 12- to 17-year group of conventional cigarettes (25.5% vs 19%), cigars (31.7% vs 17.8%), and smokeless tobacco for males (14.1% vs 10.4%). Receptivity was also associated with first use within the year for each product, except smokeless tobacco (which may be a small sample size issue). The crossover effect is important: receptivity to e-cigarette advertising without concurrent receptivity to cigarette advertising was associated with never tobacco users trying a conventional cigarette by wave 2.

Although the majority (66.2%) of ENDS users at wave 2 had used an e-cigarette, almost half reported use of e-hookah, suggesting that ENDS products might be perceived to be versions of the same product category. Accordingly, this study considers any ENDS use as e-cigarette use. We repeated our analyses using only those who progressed to e-cigarettes and, as this did not change our findings, kept the inclusive definition of e-cigarettes as any ENDS product at wave 2. Multiple longitudinal studies have shown a positive association between e-cigarette use by youth and later conventional cigarette smoking.[32-36] These findings suggest a hypothesis that initial exposure to nicotine can lead individuals to look for a more efficient product that provides satisfaction. Our study of never tobacco users suggests a role for an environmental influence in that the effectiveness of e-cigarette advertising contributes to the association between e-cigarette use and conventional cigarette smoking.

Table 3. Association of Receptivity Among Committed Never Tobacco Users Aged 12 to 17 Years at Wave 1 With Progression and Ever Use in Wave 2, 2014-2015, in Population Assessment of Tobacco and Health Study[a]

Wave 1 Variables		Sample	Progression Status at Wave 2, % (SE)[b]			AOR (95% CL)	
Product	Receptivity to Product at Wave 1	No. (%) [SE]	Susceptible at Wave 2	Ever Use at Wave 2	Any Progression[b]	Any Progression at Wave 2[b]	Ever Use at Wave 2
Cigarette model	None	5240 (79.6) [0.5]	17.4 (0.6)	1.6 (0.2)	19.0 (0.6)	1 [Reference]	1 [Reference]
	Any	1378 (20.4) [0.5]	22.6 (1.2)	2.9 (0.5)	25.5 (1.3)	1.43 (1.23-1.65)	1.54 (1.03-2.32)
e-Cigarette model	None	5085 (73.8) [0.6]	18.4 (0.6)	6.2 (0.4)	24.6 (0.7)	1 [Reference]	1 [Reference]
	Any	1866 (26.2) [0.6]	26.2 (1.2)	9.2 (0.7)	35.5 (1.2)	1.62 (1.41-1.85)	1.45 (1.19-1.75)
Cigar model	None	7551 (91.5) [0.3]	16.0 (0.5)	1.9 (0.2)	17.8 (0.6)	1 [Reference]	1 [Reference]
	Any	742 (8.5) [0.3]	27.6 (1.7)	4.1 (0.9)	31.7 (2.0)	2.01 (1.62-2.49)	2.07 (1.26-3.40)
Smokeless model	None	7253 (83.8) [0.5]	8.4 (0.4)	0.8 (0.1)	9.2 (0.4)	1 [Reference]	1 [Reference]
	Any	1409 (6.2) [0.5]	9.6 (0.8)	1.2 (0.3)	10.8 (1.0)	1.21 (0.96-1.52)	1.35 (0.68-2.70)
Smokeless model (males only)	None	3657 (85.1) [0.7]	9.2 (0.6)	1.2 (0.2)	10.4 (0.6)	1 [Reference]	1 [Reference]
	Any	647 (14.9) [0.7]	11.7 (1.3)	2.4 (0.7)	14.1 (1.5)	1.42 (1.07-1.89)	1.69 (0.81-3.55)

Abbreviations: AOR, adjusted odds ratio; CL, confidence limit.

[a] All models adjusted for sex (except the smokeless model for males), race/ethnicity, age, and exposure to use in household and social settings.

Percentages, ORs, and confidence limits are weighted estimates.

[b] Progression is a committed never user at wave 1 who is either susceptible to use or has ever used the product at wave 2.

Table 4. Association of Any Receptivity to e-Cigarette and Cigarette Ads at Wave 1 With Ever Smoking at Wave 2 Among Never Tobacco Users Aged 12 to 21 Years in the Population Assessment of Tobacco and Health Study[a]

	% (SE)		
Any Receptivity at Wave 1	Population	Wave 2 Ever Cigarette Users	AOR (95% CL)
No receptivity to any product	48.2 (0.7)	2.6 (0.3)	1 [Reference]
Receptive to cigarette ads, not e-cigarette ads	11.4 (0.4)	5.9 (0.9)	1.89 (1.30-2.75)
Receptive to e-cigarette ads, not cigarette ads	17.8 (0.5)	4.9 (0.8)	1.60 (1.08-2.38)
Receptive to both cigarette and e-cigarette ads	17.2 (0.5)	6.5 (0.8)	1.98 (1.34-2.92)
Other receptivity, not including cigarettes or e-cigarettes[b]	5.4 (0.3)	4.5 (1.1)	1.45 (0.84-2.51)

Abbreviations: AOR, adjusted odds ratio; CL, confidence limit.

[a] Adjusted for sex, race/ethnicity, age, exposure to use in household and social settings. Percentages, ORs, and 95% CLs are weighted estimates.

[b] Other products include smokeless tobacco and cigars.

First use of a tobacco product typically starts before age 21 years[1] and a number of jurisdictions have recently proscribed purchase of tobacco products before that age. The PATH Study measured receptivity to tobacco advertising among youth aged 12 to 24 years and we report that, across products, receptivity peaks by age 21 years. The approach to measuring receptivity was the most comprehensive of any study to date, with each respondent viewing 20 ads sampled for each respondent from a near-census of ads used in the previous year.

Strengths and Limitations

A limitation is that the PATH Study did not specifically include either online or social media marketing ad images; however, as tobacco ads are typically used on multiple media channels, our measure of receptivity likely included exposure to ads appearing on social media. More research is needed on this topic. A strength of the PATH Study is that data were collected from a nationally representative, household-based sample and that participants completed multiple surveys over time. At wave 2, the study retained over 83% of wave 1 participants. Susceptibility to use a product was not measured for those aged 18 to 24 years in wave 1, but relevant hypotheses may be addressed in future articles using waves 2 and 3 data. Furthermore, the wave 1 ever use rate for those aged 12 to 17 years was lower than for some other national surveys, which may be a survey mode effect.[37] Later waves did not include the ad receptivity measure, so we were unable to consider the effect of consistency in receptivity reporting across time.

Conclusions

Receptivity to tobacco product advertising is substantial among US youth who are below the minimum required age to purchase tobacco products. Among young committed never users, receptivity is significantly associated with progression toward use within a 1-year period. With 1 exception, likely related to study power, having any level of receptivity to a product's advertisements at wave 1 was associated with both progression toward use and ever use of the product at wave 2. Further research can examine why e-cigarette advertising was associated with trying a cigarette. Our study reinforces that tobacco product marketing continues to be an important contributor to tobacco use among young people.

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