

# Receptivity to Tobacco Advertising and Susceptibility to Tobacco Products

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abstract

**BACKGROUND AND OBJECTIVES:** Non-cigarette tobacco marketing is less regulated and may promote cigarette smoking among adolescents. We quantified receptivity to advertising for multiple tobacco products and hypothesized associations with susceptibility to cigarette smoking.

**METHODS:** Wave 1 of the nationally representative PATH (Population Assessment of Tobacco and Health) study interviewed 10 751 adolescents who had never used tobacco. A stratified random selection of 5 advertisements for each of cigarettes, e-cigarettes, smokeless products, and cigars were shown from 959 recent tobacco advertisements. Aided recall was classified as low receptivity, and image-liking or favorite ad as higher receptivity. The main dependent variable was susceptibility to cigarette smoking.

**RESULTS:** Among US youth, 41% of 12 to 13 year olds and half of older adolescents were receptive to at least 1 tobacco advertisement. Across each age group, receptivity to advertising was highest for e-cigarettes (28%–33%) followed by cigarettes (22%–25%), smokeless tobacco (15%–21%), and cigars (8%–13%). E-cigarette ads shown on television had the highest recall. Among cigarette-susceptible adolescents, receptivity to e-cigarette advertising (39.7%; 95% confidence interval [CI]: 37.9%–41.6%) was higher than for cigarette advertising (31.7%; 95% CI: 29.9%–33.6%). Receptivity to advertising for each tobacco product was associated with increased susceptibility to cigarette smoking, with no significant difference across products (similar odds for both cigarette and e-cigarette advertising; adjusted odds ratio = 1.22; 95% CI: 1.09–1.37).

**CONCLUSIONS:** A large proportion of US adolescent never tobacco users are receptive to tobacco advertising, with television advertising for e-cigarettes having the highest recall. Receptivity to advertising for each non-cigarette tobacco product was associated with susceptibility to smoke cigarettes.



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**WHAT'S KNOWN ON THIS SUBJECT:** The consensus that cigarette marketing is 1 cause of adolescent smoking is the basis for marketing constraints imposed on these products in the United States and elsewhere. Little is known about the influence of marketing for non-cigarette tobacco products.

**WHAT THIS STUDY ADDS:** Advertising for non-cigarette tobacco products is reaching non-tobacco-using US adolescents, especially through television. High percentages of non-tobacco-using adolescents recognize tobacco ad images, including e-cigarette ads. Receptivity to these ads is associated with susceptibility to future cigarette smoking.

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Cigarette advertising has been causally linked with adolescent smoking initiation,<sup>1</sup> prompting marketing restrictions to reduce smoking among minors.<sup>2</sup> However, these restrictions are not uniformly applied across tobacco products. For example, e-cigarettes, introduced in the past decade, are currently allowed to be advertised on television.<sup>3</sup> E-cigarette marketing budgets increased rapidly,<sup>4</sup> with a growing presence on television reaching youth and young adult markets.<sup>5</sup> The Centers for Disease Control and Prevention reports<sup>6</sup> that high school students in the United States are increasingly using e-cigarettes (2015 = 16.0%), whereas the decline in cigarette smoking may have stalled (2015 = 9.3%). The 2015 high school use of cigars was 8.6%, use of hookahs was 7.2%, and smokeless tobacco use was 6.0%. In a randomized trial, exposure to select television advertisements (ads) for e-cigarettes increased the susceptibility to use e-cigarettes.<sup>7</sup> In 2014, Blu was the dominant e-cigarette brand that used television advertising.<sup>5,8</sup> Its ads often modeled vaping, which has many behavioral similarities to cigarette smoking. These similarities have led to suggestions that these ads might promote cigarette smoking as well.<sup>9,10</sup>

The effect of advertising on adolescent smoking has been investigated by using the communication-persuasion matrix,<sup>11–13</sup> which states that an individual's receptivity to an ad can be ordered hierarchically by items that query exposure, cognitive recall, and affective response (eg, liking, having a favorite ad).<sup>14</sup> At the height of popular cigarette marketing campaigns in the 1990s (Joe Camel, Marlboro Miles), more than half of California adolescents indicated a favorite cigarette advertisement<sup>15</sup> and this higher level of receptivity was associated with later cigarette

smoking.<sup>16,17</sup> Lower levels of receptivity to advertising, such as recall of ads without affective response, have been associated with later initiation of alcohol use.<sup>18</sup> Furthermore, researchers who have combined recall and liking measures into an "any receptivity" construct have identified associations with first use of both cigarettes<sup>19,20</sup> and alcohol.<sup>21</sup> Visual prompting (aided recall) is necessary to obtain valid measures.<sup>22</sup> We know of no study that has sampled a substantial proportion of all available tobacco advertising and reported population estimates for aided recall of either individual ads or ads for a product category.

Susceptibility to smoking is a validated measure that predicts the risk of smoking initiation as many as 3 to 4 years before first experimentation.<sup>23–25</sup> A series of questions identifies "committed never users" as those who have never been curious about use, have strong intentions not to use, and who would resist an offer to use from a best friend. All other never users are considered susceptible. Susceptibility and subsequent experimentation vary across sociodemographic variables, receptivity to tobacco marketing,<sup>16,17</sup> exposure to other tobacco users,<sup>26</sup> use of another psychoactive substance,<sup>27</sup> use of another tobacco product,<sup>28</sup> and psychosocial variables such as externalizing problem behaviors (eg, rule-breaking, aggression),<sup>29</sup> internalizing problem behaviors (eg, depression, anxiety),<sup>30</sup> and sensation-seeking.<sup>31</sup>

This study explores levels of receptivity to the marketing of e-cigarettes, cigarettes, cigars, and smokeless tobacco products among never-using 12 to 17 year olds, with the use of data from the national Population Assessment of Tobacco and Health (PATH) Study. The study design allowed us to assess adolescent receptivity

to advertising for multiple tobacco products and to summarize this in a measure of receptivity to any tobacco advertising. We investigated whether this general receptivity to tobacco advertising was associated with susceptibility to use any tobacco product. Finally, we investigated the associations of advertising receptivity to each product with susceptibility to cigarette smoking.

## METHODS

### Adolescent Sample

Data are from wave 1 of the PATH study, which is a nationally representative sample of the civilian, noninstitutionalized US population, aged  $\geq 12$  years between September 2013 and December 2014.<sup>32,33</sup> With oversight from the National Institute of Drug Abuse and the Food and Drug Administration, Westat collected data with the use of audio-computer-assisted self-interviews. Westat's Institutional Review Board approved the study design/protocol, and the Office of Management and Budget approved the data collection. Households were identified by using an address-based, area-probability sampling method, and a screener survey enumerated household members (response rate = 54%). Generally, all youth aged 12 to 17 years (maximum 2 per household) were selected for interview, and parental consent and youth assent were obtained. Interviews were completed for 78.4% of selected youth. The data were weighted to adjust for the complex sample design and nonresponse to allow population estimates. If the respondent did not answer regarding their age, sex, race, or Hispanic ethnicity, these were obtained from the household screener ( $n = 704$  or 6.6%) or, if not available, by using statistical imputation methods ( $n = 143$  or 1.3%).<sup>34</sup> In this article, our analyses were restricted to the 10 751 of the youth sample ( $N = 13 651$ ) who

reported that they had never used any tobacco product.

### **Dependent Variable: Susceptibility To Use Tobacco Products and Cigarettes**

Following previous research,<sup>23,24</sup> never users who had heard of the product were classified as either susceptible to use or committed never users on the basis of their responses to 3 questions assessing their curiosity about the product, intention to try it in the near future, and likely response if a best friend were to offer them the product (see Supplemental Information). Only those with the strongest rejection to all 3 questions were categorized as committed never users to each of the following 8 products (cigarettes, e-cigarettes, pipes, cigars, hookahs, smokeless tobacco, dissolvable tobacco, and bidis/kreteks). The strongest rejection to all questions for all products classified an individual as a committed never tobacco user; all others were considered to be susceptible to use  $\geq 1$  products. For this analysis, those who had never heard of a product were considered to be committed never users.

### **Key Independent Variable: Receptivity to Tobacco Product Advertising**

#### *Favorite Ad*

Respondents were asked “What is the brand of your favorite tobacco advertisement?” A list of brands was provided, with an option to nominate another brand. We assumed that identifying Marlboro or Camel as favorite referred to cigarettes, unless snus was specifically mentioned.

#### *Aided Recall and Liking of Contemporary Ads*

Respondents were shown, 1 at a time, a stratified random set of 20 tobacco advertisements (5 for each of the following 4 products: cigarettes, e-cigarettes, cigars, and smokeless products) from 959 recently used

print, direct mail, Internet, and television ads. We purchased all available ads (i.e. a near census) from 2 commercial ad-monitoring firms (Competitrack and Mintel). The initial ad pool (period 1 [P1]) was refreshed once in January 2014 (period 2 [P2]). Within each of the 4 product sets, randomization was within substrata levels. The 5 cigarette ads always contained a randomized print ad for Marlboro (P1:  $n = 43$  ads; P2:  $n = 27$  ads), Camel (P1:  $n = 36$ ; P2:  $n = 36$ ), and Newport (P1:  $n = 88$ ; P2:  $n = 52$ ), which made up 76% of available print ads for cigarettes. The final 2 cigarette ads were randomly selected from other brand ads (P1:  $n = 59$ ; P2:  $n = 26$ ). The 5 smokeless tobacco print ads included 2 randomly selected ads for snus products (P1:  $n = 56$ ; P2:  $n = 21$ ), 2 for oral dip products (P1:  $n = 99$ ; P2:  $n = 62$ ), and 1 for chew products (P1:  $n = 2$ ; P2:  $n = 3$ ). The cigar set included 1 randomly chosen from the large cigars set (P1:  $n = 200$ ; P2:  $n = 134$ ) and 4 randomly chosen from the little cigars and cigarillos set (P1:  $n = 45$ ; P2:  $n = 6$ ). The e-cigarette set included 2 ads that were “still shots” of television ads (P1:  $n = 11$ ; P2:  $n = 24$ ). The remaining 3 e-cigarette ads were chosen randomly from print ads (P1:  $n = 59$ ; P2:  $n = 68$ ). The frequency with which each brand was presented to respondents was a function of how many ads there were for a given product in the ad pool and the total number of ads in each pool.

For each ad presented, respondents were asked if they had seen the ad in the past 12 months and whether they liked the ad. We categorized receptivity for each product category as follows: (1) no receptivity (no recall or liking of any of the 5 ads and no indication of a favorite ad that was for the category’s product), (2) low receptivity (recall of at least 1 ad but no indication of liking any ad in the category or having a favorite ad that was for the category’s product), (3) moderate receptivity (liking at

least 1 of the ads or naming a favorite ad that was for the category’s product), and (4) high receptivity (liking at least 1 of the ads and a having favorite ad that was for the category’s product).

### **Recall of Advertisements by Brand**

The above sampling scheme allowed some respondents to see  $>1$  ad for a brand within a category, particularly for the little cigars and cigarillos set in P2. When  $>1$  ad was shown for a brand, aided recall was assessed only on the first ad that was displayed. We computed the estimated recall rate as the weighted proportion of respondents who recalled seeing an ad for the brand out of the total number of respondents who were shown an ad for the brand. Before ranking brands on the frequency of recall, we removed brands with advertisements that were shown to  $<500$  participants. Thus, for the rank order of aided recall, we considered a total of 55 tobacco brands (9 cigarette brands, 9 e-cigarette brands with television ads, 14 e-cigarette brands with print ads, 9 smokeless brands, and 14 cigar brands).

### **Other Covariates of Tobacco Use in Adolescence**

#### *Exposure to Tobacco Use*

All 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 report 2 binary variables: 1 for household exposure (no users of tobacco in the household versus any) and 1 for general exposure (no exposure to smoking by others in the past 7 days versus any).

#### *Use of Other Drugs or Alcohol*

Ever use was ascertained for alcohol, marijuana, as well as for misuse of prescription drugs (ie, Ritalin/

Adderall, painkillers, sedatives, tranquilizers), cocaine or crack, methamphetamine or speed, heroin, inhalants, solvents, and hallucinogens by a series of questions: "Have you ever used [substance]?" (See Supplemental Information for the full list of questions). Adolescents who reported ever use of any of these were classified as "any use"; all others were classified as "no use."

### *Psychosocial Predictors of Tobacco Use*

We adjusted for mental health and substance use problems by using scales from the Global Appraisal of Individual Needs–Short Screener.<sup>35</sup> The internalizing subscale ( $\alpha = .81$ ) included 4 items of depressive and anxiety symptoms. The externalizing subscale ( $\alpha = .70$ ) included experience with 5 conduct and behavioral items. The substance use problems subscale ( $\alpha = .67$ ) asked 7 questions about problems associated with alcohol or drug use. Adolescents were scored on how many items they had experienced in the past month or past 2 to 12 months (see Supplemental Information for questions). In addition, sensation seeking ( $\alpha = .74$ ) was assessed by 3 items modified from the Brief Sensation Seeking Scale.<sup>36</sup> On all scales, respondents were scored as having no symptoms (0), low to moderate symptom levels (1–2), or high symptom levels ( $\geq 3$ ).

### **Statistical Analyses**

Analyses were performed by using SAS Software, version 9.3 (SAS Institute, Cary, NC).<sup>37</sup> We used the survey weights supplied with the data, and computed variances and *P* values by using the recommended Balanced Repeated Replication method with Fay = 0.3.<sup>27,33,38</sup> Weighted percentages were calculated with SAS version 9.3 PROC SURVEYFREQ. Modified Wilson confidence limits for proportions were calculated on the weighted estimates by using PROC SURVEYFREQ. Separate

logistic regression models tested the association of receptivity to any tobacco advertising with susceptibility to any tobacco product, as well as with susceptibility to cigarette smoking. These models controlled for the above-mentioned covariates.  $\chi^2$  Tests were also conducted to test for significant differences between percentage recall of pairs of selected ad brands or modes. Odds ratios, confidence limits, and *P* values are reported from the weighted, adjusted model (calculated via PROC SURVEYLOGISTIC).

## **RESULTS**

### **Demographic Characteristics**

This sample of adolescent never tobacco users was balanced on sex and had a high proportion of younger adolescents (12–13 years: 39.5%; 14–15 years: 34.1%; 16–17 years: 26.4%) (Table 1). Just over half were non-Hispanic white (53.6%), 22.4% were Hispanic, 14.4% were non-Hispanic African American, 5.2% were Asian, and 4.5% were other races/ethnicities. Most adolescents (82.0%) had parents who completed high school, and 60.7% had parents with at least some college education. Never tobacco users who were not receptive to any tobacco advertising (54%) had the lowest susceptibility to any tobacco use (34.3%; 95% confidence interval [CI]: 32.9%–35.6%). Among never users with low receptivity (34%), 50.4% (95% CI: 48.5%–52.2%) were susceptible. Among the 10% of never users who had a moderate receptivity, 65.4% (95% CI: 62.2%–68.4%) were susceptible. Among the <2% of never users with high receptivity to tobacco advertising, 87.7% (95% CI: 81.2%–92.2%) were susceptible to any tobacco product.

### **Receptivity to Tobacco Advertising**

Overall, 41.0% of 12 to 13 year olds and approximately half of both 14 to

15 year olds and 16 to 17 year olds were classified as being receptive to any tobacco advertising (Table 2). Approximately one-third of each age group had a low level of receptivity. There were significantly fewer 12 to 13 year olds with moderate or high receptivity (8.8%) compared with 16- to 17-year-old adolescents (15.0%) ( $P < .001$ ).

E-cigarette ads generated the highest proportion of adolescents who were receptive. For 12 to 13 year olds, 27.8% were receptive to ads for e-cigarettes, 21.5% to ads for cigarettes, 14.8% to ads for smokeless tobacco, and 7.9% to ads for cigars. For 16 to 17 year olds (14–15 year olds had similar numbers), 32.7% were receptive to ads for e-cigarettes, 25.0% to ads for cigarettes, 20.5% to ads for smokeless tobacco, and 12.6% to ads for cigars.

In multivariable logistic regression (Table 1) controlling for potential confounding variables, even low receptivity to any tobacco ads was significantly associated with increased concurrent susceptibility to use any tobacco product (adjusted odds ratio [aOR]: 1.38; 95% CI: 1.25–1.53). Moderate and high receptivity levels had higher and significant odds ratios (moderate: aOR = 2.39,  $P < .001$ ; high: aOR = 6.73,  $P < .001$ ).

### **Aided Recall for Tobacco Advertising by Brand**

Four of the top 10 recalled ads were television ads for e-cigarettes and half of the top 20 recalled ads were for e-cigarette brands (Table 3). The television ads for Blu e-cigarettes were recalled the most (31.0%; 95% CI: 29.5%–32.5%) followed by Blu print ads (22.3%; 95% CI: 21.1%–23.6%). Recall of Blu television ads was significantly higher than that for Blu print ads ( $P < .001$  for each age group and overall). Recall of Blu print ads was significantly higher than that for either Grizzly (the third most recalled brand ads) or Camel

**TABLE 1** Logistic Regression Predicting Susceptibility to Any Tobacco Product Among Never-Using Adolescents

Variable	Population			Susceptible			aOR	95% CI	P
	n	%	95% CI	%	95% CI				
Age, y									
12–13	4312	39.5	38.6–40.5	34.9	33.5–36.4	Ref	—	—	—
14–15	3689	34.1	33.2–35.0	47.7	45.9–49.5	1.38	1.25–1.53	<.001	<.001
16–17	2750	26.4	25.6–27.2	52.1	50.1–54.1	1.44	1.28–1.61	<.001	<.001
Sex									
Male	5422	50.4	49.5–51.4	43.5	42.1–44.9	1.12	1.02–1.24	.02	—
Female	5329	49.6	48.6–50.5	44.1	42.7–45.7	Ref	—	—	—
Race/ethnicity									
NH white	5107	53.6	52.6–54.5	41.5	39.9–43.2	Ref	—	—	—
NH African American	1538	14.4	13.8–15.1	48.3	45.4–51.2	1.46	1.25–1.70	<.001	<.001
Hispanic	3132	22.4	21.6–23.2	46.7	44.9–48.5	1.63	1.47–1.81	<.001	<.001
Asian	318	5.2	4.8–5.6	36.8	31.5–42.4	1.14	0.87–1.49	.34	.34
Other	656	4.5	4.1–4.9	50.1	45.8–54.5	1.32	1.07–1.63	.009	.009
School performance									
Mostly A's	3003	30.0	29.0–31.0	37.2	35.5–39.0	0.72	0.63–0.82	<.001	<.001
A's and B's	3796	34.8	33.9–35.7	44.2	42.4–46.3	0.89	0.78–1.01	.08	.08
Other	3952	35.2	34.1–36.3	49.0	47.3–50.7	Ref	—	—	—
Parental education <sup>a</sup>									
Less than HS graduate	2184	17.2	16.1–18.5	43.5	41.5–45.6	Ref	—	—	—
HS graduate	2408	21.3	20.2–22.5	42.2	40.2–44.2	0.92	0.81–1.05	.21	.21
Some college	2876	26.9	25.6–28.3	44.4	42.4–46.5	1.00	0.89–1.13	.97	.97
College graduate	3205	33.8	31.6–36.0	44.5	42.5–46.4	1.25	1.09–1.43	.001	.001
No data	78	0.8	0.06–1.0	45.2	34.0–56.9	1.08	0.67–1.74	.77	.77
Tobacco user in HH									
No	7427	70.3	68.6–72.0	41.0	39.6–42.4	—	—	—	—
Yes	3324	29.7	28.0–31.4	50.5	48.6–52.5	1.19	1.06–1.34	.003	.003
Exposure to smoking									
Some exposure	3834	35.0	33.8–36.3	53.5	51.8–55.1	1.39	1.26–1.54	<.001	<.001
No exposure	6917	65.0	63.7–66.2	38.6	37.3–39.9	Ref	—	—	—
Ad receptivity									
None	5762	54.1	53.0–55.3	34.3	32.9–35.6	Ref	—	—	—
Low	3741	34.1	33.0–35.3	50.4	48.5–52.2	1.38	1.24–1.53	<.001	<.001
Moderate	1070	10.1	9.5–10.7	65.4	62.2–68.4	2.39	2.02–2.84	<.001	<.001
High	178	1.7	1.4–2.0	87.7	81.2–92.2	6.73	3.90–11.61	<.001	<.001
Internalizing problems									
None	3627	33.5	32.4–34.5	28.9	27.3–30.5	Ref	—	—	—
Low–moderate	3606	33.8	32.7–34.9	43.4	41.8–45.1	1.34	1.19–1.51	<.001	<.001
High	3518	32.8	31.6–34.0	59.4	57.3–61.5	1.62	1.42–1.84	<.001	<.001
Externalizing problems									
None	3767	35.0	33.8–36.1	26.2	24.6–27.8	Ref	—	—	—
Low–moderate	4198	38.9	37.9–39.9	46.9	45.2–48.6	1.55	1.39–1.73	<.001	<.001
High	2786	26.1	25.1–27.1	62.8	60.6–65.0	2.07	1.81–2.37	<.001	<.001
Sensation seeking									
None	6536	61.0	60.0–62.0	34.3	33.1–35.5	Ref	—	—	—
Low–moderate	3678	34.0	33.1–34.9	56.3	54.4–58.1	1.58	1.43–1.76	<.001	<.001
High	537	5.0	4.6–5.4	75.2	70.5–79.3	2.52	1.92–3.29	<.001	<.001
Substance use problems									
None	10251	95.5	95.1–95.9	42.3	41.3–43.4	Ref	—	—	—
Low–moderate	426	3.9	3.5–4.3	74.5	69.7–78.8	0.99	0.74–1.32	.95	.95
High	74	0.6	0.5–0.8	82.8	72.7–89.8	1.41	0.74–2.69	.30	.30
Used other substances									
No	7269	66.8	65.5–68.1	32.0	30.9–33.1	Ref	—	—	—
Yes	3482	33.2	31.9–34.5	67.6	66.0–69.2	2.99	2.69–3.33	<.001	<.001

Percentages, confidence limits, odds ratios, and *P* values are all weighted estimates. Other categories presented in the table may include respondents who did not provide data for the question. HH, household; HS, high school; NH, non-Hispanic; Ref, reference.

<sup>a</sup> There were 78 records that did not include information on parental educational level.

**TABLE 2** Receptivity to Tobacco Advertising by Product Type Among Never Tobacco Users

Product Type and Age, y	Receptivity							
	Low		Moderate		High		Any <sup>a</sup>	
	%	95% CI	%	95% CI	%	95% CI	%	95% CI
Any product								
12–13	32.2	30.8–33.8	7.6	6.7–8.5	1.2	0.9–1.6	41.0	39.5–42.6
14–15	36.0	34.2–37.8	11.2	10.0–12.4	1.6	1.2–2.1	48.7	46.8–50.6
16–17	34.5	32.6–36.5	12.5	11.1–13.9	2.5	1.9–3.3	49.5	47.4–51.6
E-cigarettes								
12–13	24.2	22.9–25.6	3.3	2.7–3.9	0.3	0.2–0.6	27.8	26.5–29.2
14–15	28.0	26.4–29.7	4.2	3.5–5.1	0.5	0.3–0.8	32.8	31.0–34.5
16–17	27.2	25.5–28.9	4.9	4.1–6.0	0.6	0.3–1.0	32.7	30.6–34.8
Cigarettes								
12–13	18.2	17.0–19.5	3.1	2.5–3.7	0.2	0.1–0.4	21.5	20.2–22.8
14–15	19.5	18.1–21.0	5.2	4.3–6.2	0.3	0.2–0.5	25.0	23.36–26.8
16–17	17.7	16.0–19.4	6.4	5.6–7.4	0.9	0.6–1.4	25.0	23.3–26.8
Smokeless tobacco								
12–13	12.2	11.2–13.3	2.4	2.0–3.0	0.1	0.1–0.3	14.8	13.5–16.1
14–15	16.1	14.7–17.6	3.5	2.9–4.2	0.2	0.1–0.4	19.8	18.2–21.5
16–17	15.6	14.1–17.2	4.8	4.0–5.7	0.1	0.1–0.4	20.5	18.9–22.2
Cigars <sup>b</sup>								
12–13	6.6	5.8–7.4	1.4	1.0–1.8	0.0	0.0–0.2	7.9	7.1–8.9
14–15	8.8	7.9–9.7	1.9	1.4–2.6	0.1	0.0–0.4	10.8	9.8–11.9
16–17	8.8	7.7–10.0	3.7	3.0–4.5	0.1	0.0–0.2	12.6	11.3–14.0

Percentages and confidence limits are weighted estimates.  $N = 10751$ .

<sup>a</sup> Any receptivity is the sum of low, moderate, and high receptivity levels. No receptivity is not shown but is equal to 100 – any. For all products, the age differences are significant ( $P < .001$ ), as determined by  $\chi^2$  tests.

<sup>b</sup> Cigars include traditional cigars, cigarillos, and filtered cigars.

**TABLE 3** Ads for Tobacco Brands With the Highest Aided Recall by Age Group Among US Never Tobacco Users

Order <sup>a</sup>	Brand	Product	Youth Shown Ads, $n$	Percentage With Aided Recall of Ads by Age							
				12–13 y		14–15 y		16–17 y		Total	
				%	95% CI	%	95% CI	%	95% CI	%	95% CI
1	Blu cig (TV)	E-cigarette	5668	27.2	25.2–29.2	35.0	32.6–37.6	31.8	28.8–34.9	31.0	29.5–32.5
2	Blu cig (print)	E-cigarette	6125	20.2	18.5–22.0	23.4	21.4–25.6	24.2	21.9–26.5	22.3	21.1–23.6
3	Grizzly	Oral dip	10545	8.9	7.9–10.0	11.5	10.2–12.8	11.5	10.2–12.9	10.5	9.7–11.2
4	Camel	Cigarette	10751	10.4	9.5–11.4	10.5	9.5–11.5	9.3	8.1–10.6	10.1	9.5–10.8
5	Vapor Shark (TV)	E-cigarette	1335	11.6	8.6–15.3	8.6	6.0–12.2	10.0	7.3–13.7	10.1	8.3–12.3
6	NJOY (TV)	E-cigarette	1848	9.1	7.0–11.6	9.9	7.6–12.8	8.7	6.3–11.9	9.2	7.7–11.1
7	NJOY (print)	E-cigarette	6100	8.5	7.4–9.7	9.3	8.0–10.7	8.6	7.2–10.3	8.8	8.0–9.6
8	Marlboro	Cigarette	10751	8.6	7.8–9.5	9.0	8.0–10.0	7.6	6.5–8.9	8.4	7.9–9.0
9	Newport	Cigarette	10751	6.7	5.8–7.7	8.3	7.4–9.5	8.7	7.6–9.9	7.8	7.1–8.5
10	VUSE (TV)	E-cigarette	1485	7.1	5.0–9.8	6.8	4.9–9.3	6.7	4.5–9.7	6.9	5.6–8.4
11	V4L Vapor4Life (print)	E-cigarette	1000	4.5	2.9–7.1	4.9	3.1–7.6	10.0	6.6–15.0	6.1	4.7–7.9
12	NEO (print)	E-cigarette	528	5.1	2.7–9.4	6.5	3.4–11.9	6.7	3.1–14.0	6.0	4.1–8.8
13	VUSE (print)	E-cigarette	755	6.3	4.0–9.7	6.4	4.0–10.0	5.0	2.7–9.0	6.0	4.3–8.2
14	Zig Zag	Cigarillo/little cigar	841	4.9	3.0–7.8	5.4	3.3–8.9	7.4	4.5–12.0	5.8	4.4–7.6
15	Camel	Snus	7832	4.7	4.0–5.6	6.5	5.5–7.8	5.4	4.2–7.0	5.5	4.9–6.2
16	Gold	Cigarillo/little cigar	853	3.9	2.3–6.7	4.9	2.7–8.8	6.4	3.7–10.7	4.9	3.7–6.6
17	Marlboro	Snus	683	4.4	2.3–8.2	5.9	3.3–10.1	4.5	2.4–8.3	4.9	3.4–7.0
18	Skoal	Oral dip	1211	3.5	2.0–6.0	5.9	4.0–8.5	5.1	2.7–9.3	4.7	3.5–6.3
19	L&M	Cigarette	5022	4.6	3.7–5.6	4.9	3.8–6.2	4.2	3.1–5.6	4.6	3.9–5.3
20	Apollo (print)	E-cigarette	739	4.2	2.4–7.3	4.9	2.6–9.0	4.3	2.2–8.2	4.4	3.2–6.2

Percentages and confidence limits are weighted estimates. In cases in which a respondent saw > 1 ad for a brand, only the response to the first presentation of the ad was tallied. Modified Wilson confidence limits are reported. TV, television.

<sup>a</sup> Rank order is from the Total column for ages 12–17 y.

**TABLE 4** Variables Associated With Susceptibility to Cigarette Smoking Among Adolescent Never Tobacco Users

Receptivity to	Population			Susceptible to Cigarette Smoking			aOR	95% CI	P
	n	%	95% CI	% Susceptible	95% CI				
<b>Cigarette ads</b>									
No receptivity	8158	76.4	75.38–77.36	26.9	25.88–28.00	Ref	—	—	
Low receptivity	2054	18.5	17.64–19.42	37.3	35.12–39.58	1.08	0.96–1.22	.20	
Moderate–high receptivity	539	5.1	4.60–5.67	51.6	46.71–56.41	1.57	1.25–1.98	<.001	
<b>Smokeless ads</b>									
No receptivity	8822	82.0	81.04–82.92	27.8	26.81–28.80	Ref	—	—	
Low receptivity	1560	14.4	13.61–15.30	38.1	35.38–40.85	1.03	0.88–1.22	.70	
Moderate–high receptivity	369	3.6	3.20–3.96	51.2	45.97–56.34	1.58	1.23–2.03	<.001	
<b>Cigar<sup>a</sup> ads</b>									
No receptivity	9617	89.9	89.28–90.42	28.5	27.51–29.44	Ref	—	—	
Low receptivity	890	7.9	7.37–8.45	41.9	38.32–45.49	1.13	0.94–1.36	.20	
Moderate–high receptivity	244	2.2	1.95–2.58	54.6	47.65–61.41	1.15	0.81–1.63	.42	
<b>E-cigarette ads</b>									
No receptivity	7384	69.2	68.13–70.27	26.2	25.14–27.32	Ref	—	—	
Low receptivity	2890	26.3	25.28–27.35	36.3	34.49–38.11	1.11	0.99–1.25	.06	
Moderate–high receptivity	477	4.5	4.07–4.94	54.0	48.79–59.17	1.53	1.21–1.94	<.001	

Percentages, odds ratios, confidence limits, and *P* values are all from weighted estimates. The logistic regression model controlled for the variables listed in Table 1: age, sex, race-ethnicity, parental education, school performance, and tobacco use in the household as well as exposure to smoking, the psychosocial risk factor summary measure (none versus any externalizing, internalizing, sensation seeking, or substance use problems), and use of other substances. An indicator for receptivity to each of the product categories was included in the model; thus, a respondent might be receptive to multiple products. Ref, reference.

<sup>a</sup> Cigars include traditional cigars, cigarillos, and filtered cigars.

(the fourth most recalled brand ads) ( $P < .001$  for each age group and overall). Recall of television and print ads for NJOY were ranked as the sixth and seventh most recalled ads. For the majority of these most recalled ads, recall by 12 to 13 year olds was similar to recall for older age groups.

### Association of Advertising Receptivity With Susceptibility to Cigarette Smoking

In our multivariable logistic regression controlling for potential covariates, moderate to high receptivity to cigarettes (aOR: 1.57; 95% CI: 1.25–1.98), e-cigarettes (aOR: 1.53; 95% CI: 1.21–1.94), and smokeless tobacco (aOR: 1.58; CI: 1.23–2.03) was significantly associated with concurrent susceptibility to smoke cigarettes (Table 4), which was not the case for moderate to high receptivity to cigar advertising. A low level of receptivity to any of the 4 forms of tobacco advertising was not associated with concurrent

susceptibility to smoke cigarettes.

### DISCUSSION

With the use of stratified random sampling, we selected 20 ads to present to each respondent, from a near census of recent cigarette, e-cigarette, smokeless tobacco, and cigar ads to assess population levels of receptivity to tobacco advertising among US adolescents who had never used tobacco. Receptivity was highest for e-cigarettes, followed by cigarettes, smokeless tobacco, and cigars. Aided recall of a tobacco ad (without liking or a favorite) was categorized as a low level of receptivity to tobacco advertising and was present in 34% of adolescents. Those with a low receptivity to a product's advertising were significantly more likely to be concurrently susceptible to use a tobacco product than those who were not receptive. The 12% of adolescents with a moderate to high receptivity to advertising for each of cigarettes, e-cigarettes, and smokeless products were

significantly more likely to be concurrently susceptible to smoke cigarettes. We hypothesize that low levels of receptivity may be associated with committed never smokers becoming susceptible over the following year and propose to test this hypothesis with wave 2 data from the PATH study. Evidence in this article is consistent with the idea that tobacco industry advertising builds a general interest in tobacco use (cigarette smoking, in particular), in addition to any effect in encouraging the use of a particular product brand. In addition, because youth receptivity to tobacco product marketing may be driven by product, brand, and ad-level factors, research identifying the most critical factors will be important to inform regulatory policy.

Despite marketing restrictions on cigarettes and other products, tobacco advertising continues to reach one-third to one-half of adolescents, depending on age. E-cigarette advertising generated the highest reach. This dominance of e-cigarettes is in stark contrast

to the advertising expenditures for each product over the study period: >\$9 billion/year for cigarettes,<sup>39</sup> \$415 million/year for smokeless products,<sup>40</sup> and only \$60 million/year for e-cigarettes<sup>4</sup> (although this latter amount appears to be growing substantially each year). One explanation for receptivity being highest for the product with the lowest marketing budget<sup>4</sup> is that the product with minimal marketing restrictions may have a significant advantage. Products with less-restricted marketing can use marketing synergies across multiple media channels, which are likely more cost-effective than campaigns for products with significant marketing restrictions.<sup>41</sup> It has been noted that television is still among the most effective advertising platforms in the United States.<sup>42</sup> In this study, 4 of the top 10 ads recalled were e-cigarette television ads, which made up only a portion of the e-cigarette marketing expenditures, a budget that was 2 orders of magnitude below the cigarette marketing budget.<sup>4,39</sup> Our results suggest that, even though cigarettes are not allowed to be

advertised on television, interest in them may be increased through observing ads for other tobacco products. This topic, along with how receptivity may affect harm perceptions, will be explored in separate longitudinal analyses of PATH study data.

Two major study strengths are its large nationally representative sample of adolescents and the use of a stratified random sample from a near census of recent tobacco advertising images to gauge reach and receptivity. A limitation is that our findings are cross-sectional and the directionality of associations cannot be determined. However, susceptibility has been a consistent precursor of risk of smoking initiation<sup>2</sup> and, in the PATH study wave 1, susceptibility to use tobacco among 12 to 17 year olds appears to be equivalent to the prevalence of experimentation for those aged a few years older.<sup>43</sup> Moreover, this sample will be followed longitudinally, allowing us to confirm whether both low and moderate/high receptivity to tobacco advertising predicts later tobacco use behavior among these never smokers.

## CONCLUSIONS

In this survey, 41% of US 12 to 13 year olds, as well as half of older adolescents who had never used tobacco, were receptive to tobacco advertising and this receptivity was associated with increased susceptibility to cigarette smoking, regardless of the type of tobacco product advertised. Indeed, there was no difference in the association between receptivity for advertising for the different tobacco products and susceptibility to cigarette smoking. E-cigarette advertising was the most recalled by US adolescents, particularly ads that were shown on television. This high level of recall was achieved despite e-cigarette advertising expenditures being a fraction of those for cigarette marketing.

## ABBREVIATIONS

CI: confidence interval  
aOR: adjusted odds ratio  
P1: period 1  
P2: period 2  
PATH: Population Assessment of Tobacco and Health

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the manuscript; Ms White carried out the initial analyses and reviewed and revised the manuscript; Dr Messer designed the analyses and reviewed and revised the manuscript; Drs Carusi and Hyland lead the PATH project, including the design of survey instruments, and reviewed and revised the manuscript; and Drs Borek, Portnoy, Kaufman, Stanton, Bansal-Travers, Strong, Pearson, Coleman, Trinidad, and Moran and Ms Green, Ms Noble, and Mr Leas reviewed and approved the initial proposed analyses and reviewed and revised the manuscript; and all authors approved the final manuscript as submitted.

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