

# Exposure to Advertisements and Electronic Cigarette Use Among US Middle and High School Students

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abstract

**BACKGROUND:** Electronic cigarette (e-cigarette) use among US students increased significantly during 2011 to 2014. We examined the association between e-cigarette advertisement exposure and current e-cigarette use among US middle school and high school students.

**METHODS:** Data came from the 2014 National Youth Tobacco Survey ( $n = 22\ 007$ ), a survey of students in grades 6 through 12. The association between current e-cigarette use and exposure to e-cigarette advertisements via 4 sources (Internet, newspapers/magazines, retail stores, and TV/movies) was assessed. Three advertising exposure categories were assessed: never/rarely, sometimes, and most of the time/always. Separate logistic regression models were used to measure the association, adjusting for gender, race/ethnicity, grade, and other tobacco use.

**RESULTS:** Compared with students who reported exposure to e-cigarette advertisements never/rarely, the odds of current e-cigarette use were significantly ( $P < .05$ ) greater among those reporting exposure sometimes and most of the time/always, respectively, as follows: Internet (adjusted odds ratio: middle school, 1.44 and 2.91; high school, 1.49, and 2.02); newspapers/magazines (middle school, 0.93 [not significant] and 1.87; high school, 1.26 and 1.71); retail stores (middle school, 1.78 and 2.34; high school, 1.37, and 1.91); and TV/movies (middle school, 1.25 [not significant] and 1.80; high school, 1.24 and 1.54).

**CONCLUSIONS:** E-cigarette advertisement exposure is associated with current e-cigarette use among students; greater exposure is associated with higher odds of use. Given that youth use of tobacco in any form is unsafe, comprehensive tobacco prevention and control strategies, including efforts to reduce youth exposure to advertising, are critical to prevent all forms of tobacco use among youth.

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**WHAT'S KNOWN ABOUT THIS SUBJECT:** Tobacco advertising prompts experimentation among youth and increases and maintains their tobacco product use. Many of the themes promoted in advertising for conventional tobacco products, including rebellion, freedom, rule-breaking, and independence, are also currently being used to advertise electronic cigarettes (e-cigarettes).

**WHAT THIS STUDY ADDS:** E-cigarette advertisement exposure on the Internet, in newspapers/magazines, in retail stores, and in TV/movies is associated with current e-cigarette use among US middle and high school students. Greater exposure is associated with higher odds of use.

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Electronic cigarettes (e-cigarettes) were first introduced in the United States in 2007, and considerable increases in the use of these products have occurred among US youth in recent years. During 2011 to 2014, past 30-day e-cigarette use increased from 0.6% to 3.9% among US middle school students and from 1.5% to 13.4% among high school students.<sup>1</sup> In 2014, an estimated 2.4 million US middle and high school students reported past 30-day e-cigarette use.<sup>1</sup> E-cigarettes typically contain tobacco-derived nicotine, which may promote addiction, lead to sustained tobacco use, and cause lasting harm to brain development among youth.<sup>2,3</sup>

By 2014, e-cigarettes had become a \$2.5 billion industry in the United States; sales are projected to reach \$10 billion by the year 2017.<sup>4</sup> One factor that may be contributing to this rapid growth is advertising.<sup>5</sup> Even though cigarette advertising on television has been prohibited since 1971, advertising for e-cigarettes currently remains unregulated at the federal level. As a result, e-cigarette advertising has proliferated in the print media, on television, and on the Internet; exposure to e-cigarette advertisement among youth aged 12 to 17 years increased by 256% from 2011 to 2013.<sup>6</sup> This increase in youth exposure to e-cigarette advertising closely mirrors increased dollar expenditures on advertising by e-cigarette manufacturers; between 2011 and 2014, the estimated e-cigarette advertising expenditures increased from \$6.4 million to \$115.3 million.<sup>7,8</sup> Although paid advertisements on TV comprise the majority of e-cigarette advertisement expenditures, other media requiring less marketing costs, such as the Internet, also have been used widely for e-cigarette advertisements.<sup>6,9</sup> Some e-cigarette advertisements also use similar themes and tactics found by the Surgeon General to promote conventional tobacco use among

youth, including rebellion, freedom, rule-breaking, and independence.<sup>2,9</sup>

Previous research indicates that conventional cigarette advertising is associated with increased product appeal, intent to smoke, initiation, and use among youth.<sup>2</sup> Studies on e-cigarette advertising have found positive reactions to e-cigarette advertisements among college students,<sup>10</sup> and more favorable attitudes and intentions to use e-cigarettes among adolescents exposed to e-cigarette advertising.<sup>5</sup> A study in US middle and high school students found exposure to tobacco advertisements in general and not specifically e-cigarettes to be associated with greater experimentation.<sup>11</sup> However, to date, no study has assessed the association between exposure to different sources of e-cigarette advertising and current e-cigarette use among US youth. To address this gap in the literature, we examined the association between e-cigarette advertisement exposure and current e-cigarette use among a nationally representative sample of US middle and high school students.

## METHODS

### Sample

Data came from the 2014 National Youth Tobacco Survey (NYTS), an annual, school-based, cross-sectional survey that collects information on key tobacco indicators from middle (grades 6 to 8) and high school (grades 9 to 12) students.<sup>12</sup> A total of 22 007 students completed the NYTS questionnaire in 2014, yielding an overall response rate of 73.3%. The sample included 10 419 middle school students, 11 399 high school students, 18 respondents who indicated “ungraded or other grade,” and 171 respondents who did not indicate a grade.

## Measures

### Current E-Cigarette Use

Survey respondents were asked whether they used e-cigarettes in the past 30 days using the following question, “During the past 30 days, on how many days did you use electronic cigarettes or e-cigarettes such as Blu, 21st Century Smoke, or NJOY?” Respondents who answered  $\geq 1$  days in the past 30 days were categorized as current e-cigarette users; those who answered 0 days in the past 30 days were categorized as not current e-cigarette users.

### Exposure to E-Cigarette Advertisements

Self-reported exposure to e-cigarette advertisements on the Internet, in newspapers/magazines, in retail stores, and in TV/movies was assessed separately using the following questions: “When you are using the Internet, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”; “When you read newspapers or magazines, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”; “When you go to a store, supermarket, or gas station, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”; and “When you watch TV or go to the movies, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

For each question, categorical response options were: “never,” “rarely,” “sometimes,” “most of the time,” and “always.” Respondents were also allowed to indicate if they did not access the specified sources (eg, “I do not use the Internet”). For each source assessed, exposure status was classified into three categories as follows: “never/rarely,” “sometimes,” and “most of the time/always.”<sup>13</sup> Respondents who indicated that they did not access the specified source or had missing data for the specified source were excluded from the analyses (Internet,  $n = 1457$ , 6.6%; newspapers/

magazines,  $n = 6315$ , 28.7%; retail stores,  $n = 1478$ , 6.7%; television/movies,  $n = 1468$ , 6.7%).

### Demographics

Assessed demographic characteristics included: gender (female or male); race/ethnicity (non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other [including non-Hispanic Asians, American Indians, Alaska Natives, Native Hawaiians, or Pacific Islanders]); and grade (sixth, seventh, and eighth for middle school; ninth, 10th, 11th, and 12th for high school).

### Other Tobacco Product Use

Survey respondents were also asked about current (past 30-day) use of other tobacco products, including cigarettes, cigars/cigarillos/little cigars, pipes, bidis, hookah, chewing tobacco, snuff, dip, dissolvable tobacco, and snus. These products were categorized as either combustible (cigars/cigarillos/little cigars, pipes, bidis, or hookahs) or noncombustible (chewing tobacco, snuff, dip, dissolvable tobacco, or snus). Current use of other tobacco product use was used to categorize respondents into four mutually exclusive categories: no tobacco use, combustible tobacco only use, noncombustible tobacco only use, and both combustible and noncombustible tobacco use.

### Analysis

Data were analyzed by using SAS-callable SUDAAN version 11 to provide weighted results that accounted for the complex sample design. Descriptive analyses were used to calculate point estimates and 95% confidence intervals (CIs). Exposure to e-cigarette advertisements was assessed overall and by current e-cigarette use for 4 sources: Internet, newspapers/magazines, retail stores, and television/movies. Separate logistic regression models were fitted for each source of e-cigarette

advertisement, by school level. Unadjusted and adjusted odds ratios were calculated for each model; the adjusted models controlled for gender, race/ethnicity, grade, and use of other tobacco product types.

Additionally, to assess the influence of frequency of e-cigarette use in the past 30 days on exposure to e-cigarette advertising, sensitivity analyses were conducted comparing exposure among those reporting any e-cigarette use (even once) in the past 30 days to those reporting greater frequencies of use, including “1 or 2 days” or “3 or more days,” in the past 30 days. The findings from this analysis revealed that the adjusted odds ratios (AORs) for the association between e-cigarette advertising exposure and e-cigarette use did not differ significantly between those reporting any e-cigarette use (even once) in the past 30 days to those reporting greater frequencies of use, thus supporting the validity of the broader past 30-day measure.

## RESULTS

### Advertisement Exposure by E-Cigarette Use Among Middle School Students

Among middle school students, the proportion of current e-cigarette users and current e-cigarette nonusers who reported being exposed to e-cigarette advertisements on the Internet was as follows: rarely/never, 41.3% and 63.9%; sometimes, 27.3% and 25.2%; and most of the time/always, 31.4% and 10.8%, respectively (Table 1). Similar patterns of exposure among current e-cigarette users and current e-cigarette nonusers were seen for other sources of e-cigarette advertising.

### Advertisement Exposure by E-Cigarette Use Among High School Students

Among high school students, the proportion of current e-cigarette users and current e-cigarette nonusers who

reported being exposed to e-cigarette advertisements on the Internet was as follows: rarely/never, 43.2% and 57.7%; sometimes, 38.1% and 31.5%; and most of the time/always, 18.7% and 10.8%, respectively (Table 1). Similar patterns of exposure among current e-cigarette users and current e-cigarette nonusers were seen for other sources of e-cigarette advertising.

### Association Between E-Cigarette Advertisement Exposure and E-Cigarette Use Among Middle School Students

After controlling for covariates, compared with middle school students who reported exposure to e-cigarette advertising on the Internet never/rarely, the odds of current e-cigarette use were higher for those who reported exposure to e-cigarette advertising sometimes (AOR 1.44, 95% CI 1.03–2.00) and most of the time/always (AOR 2.91, 95% CI 1.89–4.47) (Table 2). For newspapers/magazines, odds of current e-cigarette use was higher among those exposed most of the time/always (AOR 1.87, 95% CI 1.21–2.87). For retail stores, odds were higher among those exposed sometimes (AOR 1.78, 95% CI 1.30–2.45) and most of the time/always (AOR 2.34, 95% CI 1.70–3.23). For television/movies, odds were higher among those exposed most of the time/always (AOR 1.80, 95% CI 1.30–2.49) compared with never/rarely.

### Association Between E-Cigarette Advertisement Exposure and E-Cigarette Use Among High School Students

After adjustment, compared with high school students who reported exposure to e-cigarette advertising on the Internet never/rarely, odds of current e-cigarette use were higher for those exposed sometimes (AOR 1.49, 95% CI 1.22–1.84), and most of the time/always (AOR 2.02, 95% CI 1.66–2.46) (Table 2). For newspapers/magazines, odds of

**TABLE 1 E-Cigarette Advertisement Exposure Among Middle and High School Students, by Current (past 30 d) E-Cigarette Use: National Youth Tobacco Survey, 2014**

E-Cigarette Advertisement Exposure Source	<i>n</i>	Overall Weighted % (95% CI)	Current E-Cigarette User, % (95% CI) <sup>a</sup>	Current E-Cigarette Nonuser, % (95% CI) <sup>b</sup>
<b>Middle school students<sup>c</sup></b>				
Internet <sup>d</sup>	9009			
Never/rarely		63.1 (61.4–64.8)	41.3 (35.4–47.5)	63.9 (62.2–65.6)
Sometimes		25.2 (23.8–26.8)	27.3 (22.9–32.2)	25.2 (23.7–26.8)
Most of the time/always		11.7 (10.3–13.1)	31.4 (26.8–36.4)	10.8 (9.5–12.4)
Newspapers/magazines <sup>e</sup>	6418			
Never/rarely		63.8 (62.1–65.5)	50.5 (45.1–55.8)	64.4 (62.6–66.1)
Sometimes		24.7 (23.0–26.4)	23.1 (17.3–30.1)	24.7 (23.0–26.5)
Most of the time/always		11.5 (10.3–12.9)	26.4 (21.5–32.0)	10.9 (9.7–12.3)
Retail stores <sup>f</sup>	8988			
Never/rarely		45.5 (43.7–47.4)	26.9 (22.8–31.4)	46.4 (44.5–48.3)
Sometimes		27.4 (26.0–28.8)	29.1 (25.1–33.4)	27.3 (25.9–28.8)
Most of the time/always		27.1 (25.8–28.4)	44.0 (39.2–48.9)	26.2 (25.0–27.5)
TV/movies <sup>g</sup>	9027			
Never/rarely		65.1 (63.3–66.9)	51.8 (46.7–56.9)	65.7 (63.8–67.5)
Sometimes		22.6 (21.3–23.9)	25.6 (21.2–30.4)	22.5 (21.2–23.9)
Most of the time/always		12.3 (10.4–14.4)	22.6 (19.2–26.5)	11.8 (9.9–14.1)
<b>High school students<sup>h</sup></b>				
Internet <sup>d</sup>	10 303			
Never/rarely		55.8 (54.1–57.3)	43.2 (39.8–46.7)	57.7 (56.1–59.3)
Sometimes		32.4 (31.1–33.6)	38.1 (34.2–42.1)	31.5 (30.3–32.7)
Most of the time/always		11.9 (10.7–13.3)	18.7 (16.5–21.2)	10.8 (9.5–12.2)
Newspapers/magazines <sup>e</sup>	8312			
Never/rarely		55.9 (54.4–57.4)	46.8 (42.7–50.9)	57.3 (55.7–58.9)
Sometimes		32.1 (30.7–33.5)	34.5 (30.6–38.6)	31.8 (30.5–33.1)
Most of the time/always		12.0 (10.9–13.2)	18.7 (15.9–21.9)	10.9 (9.7–12.1)
Retail stores <sup>f</sup>	10 310			
Never/rarely		41.9 (40.3–43.5)	27.8 (24.1–31.8)	44.1 (42.5–45.7)
Sometimes		29.6 (28.6–30.5)	31.0 (27.7–34.5)	29.3 (28.3–30.4)
Most of the time/always		28.6 (27.1–30.1)	41.3 (38.0–44.6)	26.6 (25.1–28.1)
TV/movies <sup>g</sup>	10 265			
Never/rarely		60.2 (58.5–61.9)	52.0 (48.9–55.1)	61.6 (59.7–63.4)
Sometimes		26.9 (26.0–27.9)	30.1 (27.3–33.2)	26.4 (25.4–27.4)
Most of the time/always		12.9 (11.6–14.2)	17.9 (15.9–20.0)	12.1 (10.8–13.4)

<sup>a</sup> Individual who responded that they used e-cigarettes on  $\geq 1$  d to the questions “During the past 30 days, on how many days did you use electronic cigarettes or e-cigarettes such as Blu, 21st Century Smoke, or NJOY?”

<sup>b</sup> Individual who responded that they used e-cigarettes on 0 d to the questions “During the past 30 days, on how many days did you use electronic cigarettes or e-cigarettes such as Blu, 21st Century Smoke, or NJOY?”

<sup>c</sup> Individuals who responded sixth, seventh, or eighth to the question “What grade are you in?”

<sup>d</sup> Individuals who responded “never,” “rarely,” “sometimes,” “most of the time,” or “always” to the question “When you are using the Internet, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

<sup>e</sup> Individuals who responded “never,” “rarely,” “sometimes,” “most of the time,” or “always” to the question “When you read newspapers or magazines, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

<sup>f</sup> Individuals who responded “never,” “rarely,” “sometimes,” “most of the time,” or “always” to the question “When you go to a convenience store, supermarket, or gas station, how often do you see ads or promotions for electronic cigarettes?”

<sup>g</sup> Individuals who responded “never,” “rarely,” “sometimes,” “most of the time,” or “always” to the question “When you watch TV or go to the movies, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

<sup>h</sup> Individuals who responded ninth, 10th, 11th, or 12th to the question “What grade are you in?”

current e-cigarette use were higher among those exposed sometimes (AOR 1.26, 95% CI 1.01–1.55), and most of the time/always (AOR 1.71, 95% CI 1.25–2.33). For retail stores, odds were higher among those exposed sometimes (AOR 1.37, 95% CI 1.08–1.73), and most of the time/always (AOR 1.91; 95% CI 1.56–2.35). For TV/movies, odds

were higher among those exposed sometimes (AOR 1.24, 95% CI 1.04–1.50), and most of the time/always (AOR 1.54, 95% CI 1.28–1.86) compared with never/rarely.

## DISCUSSION

The findings from this study indicate that exposure to e-cigarette

advertisements on the Internet, in newspapers/magazines, in retail stores, and in TV/movies was associated with current e-cigarette use among US middle and high school students. Among middle school students, greater exposure to e-cigarette advertisements on the Internet and in retail stores were associated with higher odds of use.

**TABLE 2** Adjusted Odds of Current E-Cigarette Use, by Exposure to E-Cigarette Advertisements, Among U.S. Middle and High School Students; National Youth Tobacco Survey, 2014

Source of E-Cigarette Advertisement Exposure and Exposure Category	<i>n</i>	Unadjusted OR (95% CI)	Adjusted OR (95% CI) <sup>a</sup>
<b>Middle school students<sup>b</sup></b>			
Internet <sup>c</sup>			
Never/rarely	9009	1.00	1.00
Sometimes		1.68 (1.23–2.29) <sup>d</sup>	1.44 (1.03–2.00) <sup>d</sup>
Most of the time/always		4.48 (3.30–6.08) <sup>d</sup>	2.91 (1.89–4.47) <sup>d</sup>
Newspapers/magazines <sup>e</sup>			
Never/rarely	6418	1.00	1.00
Sometimes		1.19 (0.82–1.73)	0.93 (0.63–1.37)
Most of the time/always		3.08 (2.34–4.07) <sup>d</sup>	1.87 (1.21–2.87) <sup>d</sup>
Retail stores <sup>f</sup>			
Never/rarely	8988	1.00	1.00
Sometimes		1.83 (1.42–2.36) <sup>d</sup>	1.78 (1.30–2.45) <sup>d</sup>
Most of the time/always		2.89 (2.27–3.67) <sup>d</sup>	2.34 (1.70–3.25) <sup>d</sup>
TV/movies <sup>g</sup>			
Never/rarely	9027	1.00	1.00
Sometimes		1.44 (1.10–1.88) <sup>d</sup>	1.25 (0.87–1.80)
Most of the time/always		2.43 (1.80–3.27) <sup>d</sup>	1.80 (1.30–2.49) <sup>d</sup>
<b>High school students<sup>h</sup></b>			
Internet <sup>c</sup>			
Never/rarely	10303	1.00	1.00
Sometimes		1.61 (1.35–1.93) <sup>d</sup>	1.49 (1.22–1.84) <sup>d</sup>
Most of the time/always		2.32 (1.93–2.79) <sup>d</sup>	2.02 (1.66–2.46) <sup>d</sup>
Newspapers/magazines <sup>e</sup>			
Never/rarely	8312	1.00	1.00
Sometimes		1.33 (1.10–1.60) <sup>d</sup>	1.26 (1.01–1.55) <sup>d</sup>
Most of the time/always		2.11 (1.63–2.74) <sup>d</sup>	1.71 (1.25–2.33) <sup>d</sup>
Retail stores <sup>f</sup>			
Never/rarely	10310	1.00	1.00
Sometimes		1.68 (1.32–2.13) <sup>d</sup>	1.37 (1.08–1.73) <sup>d</sup>
Most of the time/always		2.46 (2.01–3.03) <sup>d</sup>	1.91 (1.56–2.35) <sup>d</sup>
TV/movies <sup>g</sup>			
Never/rarely	10265	1.00	1.00
Sometimes		1.35 (1.16–1.59) <sup>d</sup>	1.24 (1.04–1.50) <sup>d</sup>
Most of the time/always		1.75 (1.49–2.06) <sup>d</sup>	1.54 (1.28–1.86) <sup>d</sup>

<sup>a</sup> Adjusted for gender, race/ethnicity, grade and other tobacco use (cigarettes, cigars, hookah, smokeless, snus, pipes, bidis, dissolvables).

<sup>b</sup> Individuals who responded sixth, seventh, or eighth to the question “What grade are you in?”

<sup>c</sup> Individuals who responded ‘never’, ‘rarely’, ‘sometimes’, ‘most of the time’, or ‘always’ to the question “When you are using the Internet, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

<sup>d</sup> *P* < .05

<sup>e</sup> Individuals who responded ‘never’, ‘rarely’, ‘sometimes’, ‘most of the time’, or ‘always’ to the question “When you read newspapers or magazines, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

<sup>f</sup> Individuals who responded ‘never’, ‘rarely’, ‘sometimes’, ‘most of the time’, or ‘always’ to the question “When you go to a convenience store, supermarket, or gas station, how often do you see ads or promotions for electronic cigarettes?”

<sup>g</sup> Individuals who responded ‘never’, ‘rarely’, ‘sometimes’, ‘most of the time’, or ‘always’ to the question “When you watch TV or go to the movies, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?”

<sup>h</sup> Individuals who responded ninth, 10th, 11th, or 12th to the question “What grade are you in?”

Among high school students, greater exposure to e-cigarette advertising from all 4 sources was associated with higher odds of use. These findings suggest that comprehensive tobacco prevention and control strategies, including efforts to reduce youth exposure to advertising, are critical to prevent all forms of tobacco use among US youth, including e-cigarettes.

Findings from the current study are consistent with previous research demonstrating increased curiosity and intention to use e-cigarettes in youth exposed to e-cigarette advertisements.<sup>14,15</sup> For example, in a randomized controlled trial, adolescents who viewed e-cigarette TV advertisements were 54% more likely to say they would try an e-cigarette soon, and 43% more likely

to say they would try an e-cigarette within the next year, compared with adolescents who were not exposed to the e-cigarette TV advertisements.<sup>5</sup> They also were more likely to agree that e-cigarettes can be used in places where smoking is not allowed.<sup>5</sup> Moreover, active use of e-cigarettes in advertisements may serve as cues to smoke for both current and former smokers by stimulating an urge to smoke and thoughts about smoking cigarettes.<sup>16,17</sup> E-cigarette marketing has included unproven claims of safety and use for smoking cessation, and statements that they are exempt from clean air policies that restrict smoking.<sup>18</sup> These messages could promote situational substitution of e-cigarettes when smokers cannot smoke cigarettes, rather than complete substitution of e-cigarettes for conventional cigarettes; as well as undermine clean indoor air standards, smoke-free policy enforcement, and tobacco-free social norms.

Almost all tobacco use begins before the age of 18, during which time there is great vulnerability to social influences.<sup>2</sup> It is well established that tobacco advertising can entice tobacco experimentation, as well as increase and maintain tobacco product use among youth and young adults.<sup>2</sup> Tobacco companies have marketed tobacco using youth-oriented advertising. US District Court Judge Gladys Kessler found “beyond any reasonable doubt” [that tobacco companies] “have marketed to young people 21 and under while consistently, publicly, and falsely denying they do so.”<sup>2,19,20</sup> Some e-cigarette companies are using techniques similar to those used by cigarette companies that have been shown in the 2012 Surgeon General’s Report to increase use of cigarettes by youth, including candy-flavored products; youth-resonant themes such as rebellion, glamour, and sex; celebrity endorsements; and sports and music sponsorships.<sup>2,9,21</sup> This situation is compounded by the fact

that an emerging body of research has linked e-cigarette use with subsequent initiation of conventional cigarettes among youth and young adults. For example, a longitudinal study of 14-year-old adolescents found that e-cigarette users who did not use combustible tobacco at baseline were more likely to initiate combustible tobacco use at 1-year follow-up.<sup>22</sup> Similar results were observed in another longitudinal cohort study in US adolescents and young adults, in which the use of e-cigarettes at baseline was associated with progression to traditional cigarette smoking.<sup>23</sup> This evidence suggests the importance of public health strategies to address tobacco advertising exposure among youth.

In 2009, the Family Smoking Prevention and Tobacco Control Act gave the Food and Drug Administration (FDA) the authority to regulate the manufacture, marketing, and distribution of tobacco products. In April 2014, FDA issued a proposed rule to deem all products made or derived from tobacco subject to FDA jurisdiction, including e-cigarettes, cigars, pipe tobacco, dissolvables, gels, and waterpipe tobacco.<sup>24</sup> The agency is reviewing public comments on the proposed rule.<sup>24</sup> As required by the Tobacco Control Act, FDA will need to use a public health standard to evaluate regulatory strategies at both the individual and population levels, including impacts on initiation, cessation, and reinitiation by former tobacco users.<sup>25</sup> The Tobacco Control

Act also preserves the authority of states, localities, and tribes to adopt measures “relating to the sale, distribution, possession, exposure to, access to, advertising and promotion of, or use of tobacco products by individuals of any age.”<sup>25</sup> State and local strategies that could reduce youth marketing exposure include content-neutral restrictions on advertising; limits on internet sales of all tobacco products, including e-cigarettes; and tobacco retail outlet restrictions, including limits on outlet density and location and/or requirements that tobacco sales take place in adult-only facilities.<sup>26,27</sup>

Findings from this study are subject to at least 3 limitations. First, data were collected only from youth who attended either public or private schools and might not be generalizable to youth of similar age who are being home-schooled, those who have dropped out of school, or those in detention centers. However, data from the Current Population Survey indicate that 98.2% of US youths aged 10 to 13 years and 96.1% of those aged 14 to 17 years were enrolled in a traditional school in 2013.<sup>28</sup> Second, data were self-reported and are subject to potential misreporting. Finally, data were cross-sectional, and thus, causal relationships between e-cigarette advertising and use cannot be made. Current e-cigarette users might notice e-cigarette advertisements more than nonusers. Future studies with longitudinal follow-up are

important to address this limitation by confirming if exposure to e-cigarette advertising leads to e-cigarette use among youth.

## CONCLUSIONS

The findings from this nationally representative study of US middle and high school students found that e-cigarette advertisement exposure was associated with e-cigarette use, and greater exposure was associated with higher odds of use. Given that youth use of tobacco in any form is unsafe, comprehensive tobacco prevention and control strategies, including efforts to reduce youth exposure to advertising, are critical to prevent use of all tobacco products among youth.

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## ABBREVIATIONS

AOR: adjusted odds ratio  
CI: confidence interval  
FDA: Food and Drug Administration  
NYTS: National Youth Tobacco Survey

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