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Exposure to Advertisements and Susceptibility to Electronic Cigarette Use Among Youth

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A B S T R A C T

Purpose: Despite the rapid increase in e-cigarette use among youth, little is known about the social and behavioral factors that have contributed to this rise. We investigated whether young e-cigarette users are susceptible to e-cigarette advertisements.
Methods: Estimates of e-cigarette use and exposure to e-cigarette advertisements from the 2014 National Young Tobacco Survey were investigated. Factors associated with the prevalence and levels of e-cigarette use were analyzed using multinomial logistic regression.
Results: Of all respondents (n = 21,491), 19.8% had tried e-cigarettes and 9.4% were current e-cigarette users. Exposure to e-cigarette ads was prevalent among youth, with 38.6%/29.6%/53.2%/35.4% having medium to high exposure to e-cigarette ads from the Internet/newspapers/stores/TV, respectively. Current use of e-cigarettes among youth was associated with frequent exposure (high vs. low) to e-cigarette advertising from the Internet (odd ratio [OR] = 3.1, $p < .0001$), newspapers/magazines (OR = 2.5, $p < .0001$), stores (OR = 2.8, $p < .0001$), and TV/movies (OR = 2.1, $p < .0001$). In the multivariate analysis that joint analyzed four advertisement channels and covariates, greater exposure to e-cigarette ads on the Internet (adjusted OR = 1.9, $p < .0001$) and in retail stores (adjusted OR = 1.9, $p < .0001$) remained to be significantly associated with increased odds of using e-cigarettes. Vaping by other household members significantly increased the risk of adolescent e-cigarette use (OR = 8.7, $p < .0001$).
Conclusions: Exposure to e-cigarette ads significantly increased susceptibility to e-cigarette use among adolescents. E-cigarette advertising regulations and educational campaigns are critically needed.

IMPLICATIONS AND CONTRIBUTION

E-cigarette ads are strongly associated with increased e-cigarette use among youth. This study identified high prevalence and poly exposure of e-cigarette ads from multiple channels. E-cigarette use by other household members or current cigarette smoking also increased the risk of vaping among youth.

Since electronic cigarettes (e-cigarettes) entered the U.S. market in 2007, use of e-cigarettes has been rising exponentially. According to the 2015 National Youth Tobacco Survey (NYTS), e-cigarette use among middle and high school students in the

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United States quadrupled in 2 years, rising from approximately 780,000 in 2013 to over 3 million students in 2015 [1]. Among teens, use of e-cigarettes has outpaced the use of traditional cigarettes. The 2015 Monitoring the Future survey shows that about 16% of 12th graders reported using an e-cigarette over the past month in 2015 compared with 11% who reported they had smoked a traditional cigarette [2].

E-cigarette makers have significantly increased their advertising expenditures, spending an estimated $115 million in 2014 to promote e-cigarettes, up from $6.4 million in 2011 [3,4]. As a result, more than 18 million middle and high school students now see e-cigarette advertising in stores, online, in newspapers and magazines, or on television and in movies [5]. Exposure to e-cigarette TV ads, in particular, increased by 256% among youth (aged 12–17 years) and by 321% among young adults (aged 18–24 years) from 2011 to 2013 [6]. Past studies of the effects of tobacco advertising on youth smoking have shown that youth are vulnerable to tobacco companies' advertising promotions and more receptive to emerging tobacco products [7–9]. For example, through a meta-analysis, Robertson et al. [10] found that youth have 1.6 times higher odds of having tried smoking and 1.3 times higher odds of being susceptible to future smoking when frequently exposed to point-of-sale tobacco promotion. Similar results have been found for teens exposed to e-cigarette advertising. Through a randomized trial, Farrelly et al. [11] found that adolescents who viewed four e-cigarette TV ads had a greater likelihood of future e-cigarette use compared with a control group who did not receive interventions.

An understanding of the factors that influence youth to initiate and maintain their e-cigarette use is critically needed to respond to the surge in electronic cigarette popularity among adolescents. Such knowledge could inform policymakers, school administrators, and health care practitioners to formulate future regulations on e-cigarette promotions and advertisements, establish policies that regulate e-cigarettes, and conduct educational campaigns to prevent youth from vaping. To date, studies of e-cigarette advertising have primarily focused on exposure to TV ads [6,12] and have largely been based on randomized trials or online/regional surveys [11,13]. A timely and insightful research from Mantey et al. [14] found significant associations between e-cigarette marketing and e-cigarette use among youth. In this study, exposure to varying types of e-cigarette marketing were measured by a binary variable (yes vs. no) while the e-cigarette use was defined as (current use, ever use, and susceptibility to use). Our work adds to literature by using the multiple-level measures (high, median, and low) to differentiate the intensity of e-cigarette use as well as level of exposure to e-cigarette advertisements. Multiple-level measures might be more psychometrically robust than status measures (yes vs. no) to assess the effects of exposure to e-cigarette ads on e-cigarette use [15]. Furthermore, current e-cigarette use, as often defined as using at least one e-cigarette within the past 30 days, limits the ability to distinguish experimenters from regular users [15]. We, therefore, aimed to examine the associations between the level of exposure to e-cigarette ads from different channels (Internet, newspaper/magazine, store, and TV/movies) and e-cigarette use (never, former, and current) among a nationally representative sample of middle and high school students. Among current e-cigarette users, we further evaluated the impacts of e-cigarette advertisement exposure to the intensity of e-cigarette use (high, medium, and low).

Methods

Data

Data on e-cigarette use were obtained from the 2014 NYTS, an ongoing survey that supports estimation of the tobacco-related knowledge, attitudes, and behaviors of students in middle school (grades 6–8) and high school (grades 9–12) from all 50 states and the District of Columbia. In the 2014 NYTS survey, 207 schools participated and 22,007 students completed the questionnaires, yielding an overall response rate of 73.3% [16].

The 2014 NYTS used a stratified, three-stage cluster sampling procedure to generate a nationally representative sample of U.S. middle and high school students. Sampling procedures for 2014 NYTS were probabilistic and conducted without replacement at three stages: (1) primary sampling units, such as a county, a group of small counties, or part of a very large county; (2) secondary sampling units including schools within each selected primary sampling unit; and (3) students within each selected school. National weights were applied to each student record to adjust for nonresponse and for different probabilities of selection.

Since NYTS are public data with deidentified information, this study has been reviewed and approved as a study involving nonhuman subjects by the institutional review board from Children's Mercy Hospital.

Measures

E-cigarette use. Two items from 2014 NYTS were used to define e-cigarette use: (1) "Have you ever tried an electronic cigarette or e-cigarette, such as Blu, 21st Century Smoke, or NJOY?"; and (2) "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?" We classified the survey respondents as never e-cigarette users (students who had never tried e-cigarettes), former e-cigarette users (students who had tried e-cigarettes in the past but had not used them within the last 30 days), and current e-cigarette users (students who had used e-cigarettes on at least 1 day during the last 30 days). We further categorized current e-cigarette users into low- ($\leq$5 days), medium- (6–19 days), and high-level users ($>$20 days) based on how many days they had used e-cigarettes within the past 30 days. We excluded 516 students from the analysis whose answers were missing or inconsistent, resulting in 21,491 respondents in the final study.

Exposure to advertisements. Exposure to e-cigarette ads through the Internet, newspapers/magazines, stores, or TV/movies was measured by the following four items from the 2014 NYTS: (1) "When you are using the Internet, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?" (2) "When you read newspapers or magazines, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?" (3) "When you go to convenience store, supermarket, or gas station, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?" and (4) "When you watch TV or go to the movies, how often do you see ads or promotions for electronic cigarettes or e-cigarettes?" All respondents were classified by degree of exposure to each type of ad: N/A (I don't use the Internet or I don't read newspapers or magazines or I never go to a convenience store, supermarket, or gas station, or I don't watch TV or go to the movies), low (never/rarely), medium (sometimes), and high (most of the time/always).