



Original article

Electronic Nicotine Delivery Systems and Acceptability of Adult Cigarette Smoking Among Florida Youth: Renormalization of Smoking?

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 A B S T R A C T

Purpose: There is a dearth of research into whether electronic nicotine delivery systems (ENDS) promote acceptance of cigarette smoking. Therefore, we aimed to assess the association between ENDS exposure, acceptance of cigarette smoking, and susceptibility to cigarette smoking.

Methods: Data from the 2014 Florida Youth Tobacco Survey with a state representative sample of middle and high school students ($n = 68,928$) were analyzed. Own ENDS use, exposure to ENDS advertising, living with ENDS users, acceptance of adult cigarette smoking, demographics, and known predictors of cigarette smoking were assessed. Susceptibility to cigarette smoking was assessed among never smokers. Weighted multiple logistic regression models and mediation analyses were conducted, stratified by middle/high school and never/ever smoking. Analyses were conducted in 2016.

Results: Own ENDS use, exposure to ENDS advertising, and living with ENDS users were associated with acceptance of adult cigarette smoking even among never smokers, after accounting for covariates ($p < .05$). In a mediation analysis, own ENDS use, exposure to ENDS advertising, and living with ENDS users were indirectly associated with susceptibility to cigarette smoking among never smokers through acceptance of adult cigarette smoking ($p < .05$).

Conclusions: Youth ENDS exposure may contribute to normalizing adult cigarette smoking and may in turn heighten susceptibility to cigarette smoking. If confirmed by longitudinal studies, these findings suggest that ENDS policy interventions may help prevent youth cigarette smoking.

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 IMPLICATIONS AND CONTRIBUTION

Positive associations were found between electronic nicotine delivery systems (ENDS) exposure (i.e., ENDS use, exposure to ENDS advertising, and living with ENDS users), acceptance of cigarette smoking, and openness to try cigarette smoking among Florida youth. Findings will inform the discussion of the impact of ENDS on adolescent health.

Conflicts of Interest: The authors have no conflicts of interest to disclose.

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Reduction in the prevalence of youth smoking is a public health success. The prevalence of youth smoking has decreased since 1998 [1], to 9.3% in 2015 [2]. However, other tobacco product use, such as electronic nicotine delivery systems (ENDS), is on the rise. Particularly, youth experimentation of ENDS has risen dramatically, from 4.7% of high school students in 2011 to 27.3% in 2014 [3]. The past 30-day ENDS use among high school

students also rose from 1.5% in 2011 to 16.0% in 2015 [2]. Although, some evidence suggests that the use of ENDS may be a useful approach to reducing harm associated with cigarette smoking among current adult smokers [4,5], there remain several concerns about ENDS [6]. One of these concerns is the potential to renormalize smoking, which is to make smoking “acceptable” to the public again [6]. Previous research has shown that denormalization of cigarette smoking is a successful strategy to reduce cigarette smoking. For example, Hammond et al. [7], in an international longitudinal study, found that smokers who perceived societal disapproval of smoking were more likely to intend to quit smoking and subsequently quit smoking. Thus, renormalization of cigarette smoking could lead to a resurgence of cigarette smoking. However, to date, no studies have examined how ENDS is associated with acceptance of cigarette smoking.

ENDS may make cigarette smoking more acceptable in three ways. First, experimentation with ENDS may lead youth to think that cigarette smoking is acceptable, given that the act of using ENDS is similar to the act of cigarette smoking. This hypothesis is supported by at least four longitudinal studies demonstrating that ENDS use by nonsmoking youth was associated with future cigarette smoking [8–11]. However, none of these studies tested whether cigarette smoking initiation was partly due to higher levels of acceptance of cigarette smoking after ENDS use. Second, exposure to ENDS marketing may also promote acceptance of cigarette smoking. ENDS (especially those that are cigalike) are marketed widely, including through television commercials featuring celebrities [12,13]. Youth exposure to ENDS advertising is also increasing. For example, youth exposure to televised ENDS advertisements increased 256% between 2011 and 2013 [13]. Several studies have shown that exposure to ENDS marketing is associated with ENDS use, much like cigarette advertising has been reported to be associated with cigarette use [14]. For example, a dose-response relationship has been found between higher exposure to protobacco advertisements for snus and ENDS, and having tried those products, among U.S. adolescents [15]. In a cross-sectional sample of youth in Scotland, having seen ENDS advertising in shops and supermarkets was associated with having tried an ENDS [16]. More importantly, the study found that having seen ENDS advertising at these points of sale was associated with intending to try ENDS in the next 6 months, after accounting for ever ENDS use [16]. However, no studies to date have examined the association between exposure to ENDS marketing and acceptance of cigarette smoking. Third, family and peer ENDS use may promote acceptance of cigarette smoking, similar to how parental and sibling cigarette smokings are predictors of adolescent cigarette smoking [17]. Given the similarities between the acts of smoking and ENDS use, it is possible that youth who live with ENDS users are more likely than youth who do not live with ENDS users to find cigarette smoking acceptable. This hypothesis was supported by a study conducted in Southern California which showed that family and peer ENDS use was associated with susceptibility to smoking [18].

To inform the public health discussion related to ENDS, we analyzed data from the 2014 Florida Youth Tobacco Survey (FYTS). The FYTS is unique in that it assesses the degree to which youth perceived adult cigarette smoking to be acceptable, which is not assessed in the National Youth Tobacco Survey or in other national youth risk behavior surveillance systems. We aimed to assess whether own ENDS use, exposure to ENDS advertising, and living with ENDS users are associated with acceptability of

adult cigarette smoking. We also aimed to assess whether these associations differ between middle and high school youth and by smoking status (never and ever smokers). Finally, we aimed to investigate whether the associations between own ENDS use, exposure to ENDS advertising, living with ENDS users, and susceptibility to cigarette smoking among never smokers were mediated by acceptability of adult cigarette smoking using structural equation models [19]. These models would shed light on the potential behavioral mechanisms through which ENDS may lead to youth cigarette smoking.

Methods

Study population

We used data from the 2014 FYTS. The FYTS is an anonymous, school-based, self-administered, paper-and-pencil survey conducted annually in classrooms by the Florida Department of Health, and the details of the study design and survey instruments are described elsewhere [20]. In brief, the sample includes middle school ($n = 36,726$) and high school students ($n = 32,672$) from 765 schools across the state of Florida, using a two-stage cluster probability design. In the first stage, a random sample of public middle and high schools was selected across the state. In the second stage, a random sample of classrooms was selected within each selected school. All students in the selected classrooms were invited to participate in the survey in spring 2014. Data were collected from 66 counties in Florida, with two counties excluded owing to unrepresentative sampling or refusal to participate. Parental consent was required by all counties, with two counties using active consent and the rest using passive consent procedures. The response rate among sampled middle schools was 81%, and the response rate among sampled high schools was 78%. In the current analysis, participants missing information on grade level were excluded ($n = 470$). The National Institutes of Health Office of Human Subjects Research determined that the analyses were exempted from the institutional review board's review.

Measures

All participants were asked if they had ever used ENDS (“Have you ever tried, even once using an electronic cigarette?”) and if they had used ENDS in the past 30 days (“During the past 30 days, have you used an electronic cigarette?”). The survey did not inquire about the use of ENDS other than electronic cigarettes (e.g., tank-type e-vapor) and did not ask if the respondents used ENDS that deliver nicotine. Participants reported whether they had heard or seen advertising for ENDS (“During the past 30 days, have you heard or seen advertising for electronic cigarettes in any of the following places: commercials on the radio/on TV, on the Internet, on billboards or outdoor signs, and in magazines or newspapers?”). Participants also reported whether they lived with ENDS users (“Does anyone who lives in your home use any of the following products now: electronic cigarettes?”).

Acceptance of cigarette smoking was assessed among all participants by two items. Peer acceptance of adult smoking was assessed by asking, “Do you think your friends view cigarette smoking among adults as acceptable?” and community acceptance of adult smoking was assessed by asking, “Do you think people in your neighborhood or community view cigarette smoking among adults as acceptable?” Four options were provided in both items

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