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Association between observing peers vaping on campus and E-cigarette use and susceptibility in middle and high school students

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Abstract

Background: This study examines the association between exposure to e-cigarette use on school campus and e-cigarette use behaviors among adolescents in the United States.

Methods: Data were obtained from the 2019 National Youth Tobacco Survey. First, two multivariate logistic regression models examined the association between in-school exposure to e-cigarette use and ever and past 30-day (i.e., current) e-cigarette use. Next, a multivariate logistic regression model to examine the relationship between in-school exposure to e-cigarette use and susceptibility to use was conducted among a subsample (n = 11,958) of never e-cigarette users. Covariates included grade, race/ethnicity, marketing exposure, and ever use of other tobacco products.

Results: Approximately 64.3 % of adolescents reported seeing someone use an e-cigarette on school campus; the most common locations being in the bathroom/locker room (34.4 %) and parking lot (34.0 %). In-school exposure to e-cigarette use was associated with greater odds of ever (Adj OR: 2.06; 95 % CI: 1.82–2.33) and current (Adj OR: 1.70; 95 % CI: 1.46–1.98) e-cigarette use among adolescents as well as greater odds of susceptibility to use (Adj OR: 2.00; 95 % CI: 1.82–2.20) among never e-cigarette users.

Conclusions: Observing e-cigarette use on school campus was associated with greater odds of e-cigarette use and susceptibility. It is plausible that observing e-cigarette use on campus reinforces the social acceptability of adolescent e-cigarette use. Findings inform on the prevalence of e-cigarettes use on-campus as well as how this phenomenon may influence e-cigarette use/

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Contributors

All authors assisted with development of the project and editing of the manuscript. Dr. Mantey and Dr. Onyinye designed the study and drafted the manuscript. Dr. Mantey also ran the statistical analyses. Ms. Ruiz and Ms. Vaugh assisted with the drafting and editing of the manuscript. Dr. Springer developed the hypotheses and assisted with the drafting and editing of the manuscript. Dr. Kelder and Dr. Springer supervised the project and assisted with drafting and editing the manuscript.

Declaration of competing interest

The authors report no declarations of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.drugalcdep.2020.108476.

susceptibility among youth. The observed relationship highlights the role of schools in the efforts to reduce adolescent e-cigarette use.

Keywords

Youth; E-cigarettes; Schools; Social influences

1. Introduction

In 2019, approximately 10.5 % of middle and 27.5 % of high school students reported using e-cigarettes in the past 30-days, (Wang et al., 2019) making e-cigarettes the most commonly used tobacco product among adolescents in the United States (Wang et al., 2019). E-cigarette use during adolescence is linked to nicotine dependence (Case et al., 2018) and subsequent combustible tobacco initiation (Odani et al., 2020). While it has been proposed that e-cigarettes may aid in cigarette smoking cessation for adults (Grabovac et al., 2020), even young adults (Mantey et al., 2017), the evidence remains mixed (Chen et al., 2020) and the precautionary principle supports interventions to mitigate future potential risk for adolescents. Therefore, exploratory research must identify risk factors for e-cigarette use during adolescence to reduce the risk for both nicotine dependence and combustible tobacco use among adolescents.

Emerging research (Jackson et al., 2020) suggests e-cigarette use on school campus may be a growing problem. A recent study of Connecticut high school students found 45 % of adolescent past 30-day e-cigarette users reported using on school campus (Jackson et al., 2020). Widespread use of e-cigarettes on school campus suggests a substantial degree of environmental exposure to peer e-cigarette use among students. Similarly, evidence has found that school-level factors (e.g., social norms; harm perceptions; e-cigarette use prevalence) can influence individual-level e-cigarette use (Lippert et al., 2019). However, to our knowledge, research has yet to explore the scope (i.e. prevalence; locations) of exposure to e-cigarette use on campus as well as how that exposure may be associated with susceptibly and subsequent use among a nationally representative sample.

Per the Social Cognitive Theory, environmental determinants play a crucial role in influencing (i.e. promoting or discouraging) adolescent health behaviors (Kelder et al., 2015). Exposure to normative influences (e.g. marketing) has been linked to increased risk of susceptibility and e-cigarette use (Mantey et al., 2016). Adolescents are highly vulnerable to behavior modeling, so exposure to e-cigarette users (i.e. observational learning) on school campus may reflect an environmental factor that elevates the risk for e-cigarette use (Lippert et al., 2019). This elevates the need for research that examines the association between exposure to e-cigarette use on school campus and e-cigarette use/susceptibility among adolescents.

This study examines the association between observing e-cigarette use on school campus and e-cigarette use behaviors among a nationally representative sample of middle and high school students. We examine the relationship between self-reported observed e-cigarette use on school campus and ever e-cigarette use, past 30-day e-cigarette use, and susceptibility to e-cigarette use among never e-cigarette users. We hypothesize that observing e-cigarette use

on school campus will be associated with all three study outcomes. Findings from this study may inform school campus policies aimed at addressing adolescent e-cigarette use.

2. Methods

2.1. Study sample & population

This study analyzed data from the 2019 National Youth Tobacco Survey (NYTS), which produces a representative sample of 6th −12th grade students in the United States. Sampling procedures of the NYTS are probabilistic and conducted without replacement at all stages. The first stage of sample was to select primary sampling units within each stratum, then schools within each selected primary sampling unit, followed by classes within each selected school. Participation was voluntary and confidential for both students and schools.

This study examined cases with no missing data (n = 17,977); thus n = 1,041 were excluded. Additionally, a subsample of never e-cigarette users (n = 11,958) was used to examine aims related to susceptibility to e-cigarette use.

2.2. Measures

2.2.1. E-cigarette use behaviors—Ever and current e-cigarette use were the outcome variables for the full sample. To assess ever use, participants were asked: “Have you ever used an e-cigarette, eve once or twice?” To assess current use, participants were asked “During the past 30 days, on how many days did you use e-cigarettes?” For the purposes of this study, any use (>/ = 1 day) in the past 30-days was considered to be current e-cigarette use.

Susceptibility use was examined as an outcome variable for this study among never e-cigarette users. Susceptibility was assessed using three questions: (1) “Do you think you will try an electronic cigarette or e-cigarette soon?”, “Have you ever been curious about using an electronic cigarette or e-cigarette?” and “If one of your best friends were to offer you an electronic cigarette or e-cigarette, would you use it?” (Barrington-Trimis et al., 2018). Never e-cigarette users were considered susceptible if they responded with anything other than “definitely not” to one or more of the questions.

2.2.2. On campus exposure—The primary independent variable of this study was exposure to e-cigarette use on school campus. Participants were asked “Have you ever seen anyone using an e-cigarette, such as JUUL, Vuse, MarkTen, or blu in any locations in or around your school?” Participants who responded “no” were considered to not be exposed to e-cigarette use on campus (referent group). Participants who did report exposure to e-cigarette use on school campus were asked to report where this exposure occurred and were allowed to select one or more locations. Possible locations included: “a school bathroom or locker room”; “a classroom”; “some other area of the school (hallway, cafeteria); “outside of the school, such as in the parking lot, sidewalk, or other school groups”; and “somewhere else not listed.” Exposure to e-cigarette use on school campus was coded as a binary variable.

2.2.3. Covariates—This study controlled for the following socio-demographic covariates: race/ethnicity; sex; and grade level. For the purposes of this study, race/ethnicity was categorized as: non-Hispanic, white (referent); non-Hispanic, black; Hispanic/Latino; and "other" (i.e., non-Hispanic, Asian; multiracial; and any other race). For sex, males served as the referent group and females as the comparison group. Grade level was categorized as middle school (6th – 8th grade) and high school (9th – 12th grade). Middle school served as the referent group.

This study also controlled for cumulative exposure to tobacco marketing which encompassed both traditional tobacco products (e.g. combustible cigarettes; cigars; smokeless tobacco). Four channels (internet, print media, retail setting, and entertainment) of tobacco marketing exposure were assessed. Possible responses for each of these eight questions (i.e. four for traditional tobacco and four for e-cigarettes) were "never," "rarely," "sometimes," "most of the time," or "always." Exposure to each channel was dichotomized with participants reporting "never" or "rarely" considered not exposed to that particular channel (and those reporting "sometimes," "most of the time," or "always" considered to be exposed to that particular channel (coded as 1). A cumulative tobacco product marketing exposure variable was generated to match number of channels participant was exposed to, with possible responses ranging from 0 to 8.

This study also controlled for lifetime (i.e. ever) tobacco use. Specifically, participants that self-reported past 30-day use of combustible cigarettes, cigar products (i.e., cigars, cigarillos, or little cigars), hookah, smokeless tobacco, pipe tobacco, snus, bidis, dissolvable tobacco, or roll your own tobacco. Participants that reported ever using any of these products were coded as 1.

2.3. Statistical analyses

Data were weighted to be representative of U.S. middle and high school students. We conducted a total of three multivariate logistic regression models. First, we estimated the statistical association between self-reported exposure to e-cigarette use on school campus and (1) ever e-cigarette use; and (2) current e-cigarette use, among the full sample. Next, we estimated the statistical association between self-reported exposure to e-cigarette use on school campus and susceptibility to use e-cigarettes, among a subsample of never e-cigarette users. All models controlled for race/ethnicity, sex, grade level, marketing exposure, and other tobacco use. Analyses were conducted using STATA 14.2 (College Station, TX).

3. Results

Overall, approximately 64.3 % of adolescents reported exposure to e-cigarette use on school campus. Further, approximately 34.9 % of the study sample reported ever using an e-cigarette while 19.8 % reported current e-cigarette use. Among never users, 44.4 % were considered susceptible to e-cigarette use. The most common location for exposure to e-cigarette use on school campus was the bathroom/locker room (34.4 %) and by the parking lot/sidewalk (34.0 %). Further descriptive statistics for the study sample and the specific location(s) of exposure to e-cigarette use on school campus are available in Table 1 and supplementary documents.

As seen in Table 2, exposure to e-cigarette use on school campus was associated with 2.06 (95 % CI: 1.82–2.33) greater odds of ever e-cigarette use, controlling for covariates. Similarly, exposure to e-cigarette use on school campus was associated with 1.70 (1.46–1.98) greater odds of current e-cigarette use, controlling for covariates. Furthermore, among never e-cigarette users, exposure to e-cigarette use on school campus was associated with 2.00 (95 % CI: 1.82–2.20) greater odds of susceptibility to e-cigarette use, controlling for covariates.

4. Discussion

The study found that exposure to e-cigarette use on school campus was associated with elevated risk for ever and current e-cigarette users among adolescents as well as susceptibility to e-cigarette use among e-cigarette never users. To our knowledge, this is the first study to investigate the association between observing e-cigarette use on school campus and e-cigarette use behaviors among a nationally representative sample of middle and high school students. These findings are paramount given the current adolescent e-cigarette use epidemic with emphasis on curtailing this crisis.

This study is far-reaching, particularly for school health. This study found that approximately 2 out of 3 middle and high school students reported seeing someone use an e-cigarette on school campus, with the bathroom and parking lot being the most common locations. This significant figure underscores the need for better enforcement of school-based policies restricting the use of tobacco products, including e-cigarettes, on campus grounds, particularly in the more common areas. Efforts to reduce e-cigarette use on school campus should include updating teachers and school staff members' knowledge on e-cigarettes and e-cigarettes use behaviors that includes the ability to recognize the signs of e-cigarette use (Schillo et al., 2020). However, given the high rate of e-cigarette use among adolescents, efforts to reduce use on school campus must be a multi strategy approach with a holistic focus on reducing adolescent e-cigarette use. Thus, it is recommended that schools implement evidence-based e-cigarette prevention programs to reduce the prevalence of adolescent e-cigarette users (Kelder et al., 2020).

This research also has implications for public health practice and intervention. Theory-driven tobacco and e-cigarette prevention programs that are designed to combat multi-level determinants of behavior among youth are currently available (Kelder et al., 2020; Thomas et al., 2013, 2015). This study found that exposure to e-cigarette use on campus more than doubled the odds of ever e-cigarette use and susceptibility to use. It is plausible that observing peers use e-cigarettes on campus may impact the perception of e-cigarette use among adolescents, resulting in normalization of the behavior and elevating perceived prevalence of e-cigarette use among peers (Kelder et al., 2015). Study findings suggest the need to address e-cigarette use on school campus as a potential environmental determinant of e-cigarette use among middle and high school students.

This study has limitations. First, data are self-reported thus responses are subject to recall and response bias. Adolescents, particularly those who use and/or those with friends who use e-cigarettes on school campus may underreport exposure to e-cigarette use on campus.

Second, data are cross-sectional and thus causal inferences cannot be drawn. Third, exposure to e-cigarette use on campus was measured via a single, binary variable, therefore cannot provide answers related to dose-response. And fourth, this study could not account for peer-level e-cigarette use; social network analysis is likely needed to further investigate the relationship observed in this study.

Despite these limitations, findings prove insights into the relationship between observing e-cigarette use on school campus and risk of e-cigarette susceptibility/use among middle and high school students. Findings not only highlight the role of schools in the efforts to reduce adolescent e-cigarette use, but demonstrates the relevance of evidence-based e-cigarette prevention (e.g. CATCH My Breath) (Kelder et al., 2020) and cessation programs (e.g. Not-On-Tobacco) (Franks et al., 2007) in complementing school strategies to reduce adolescents e-cigarette use.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Descriptive of Full Sample, by Exposure to E-Cigarette on Campus, and by E-Cigarette Use Behavior (NYTS, 2019).

	Full Sample	Any Exposure to Vaping on Campus[a]	Ever E-Cigarette Users	Current E-Cigarette Users[b]	Susceptible to E-Cigarette Use[c]
Percent of Sample	100 %	64.3 % (62.3–66.3)	34.9 % (32.8–37.1)	19.8 % (18.4–21.4)	44.4 % (42.9–45.8)
Sex					
Male	48.4 % (46.7–50.2)	66.1 % (63.8–68.3)	34.4 % (32.1–36.9)	20.0 % (18.3–21.8)	46.2 % (44.2–48.2)
Female	51.6 % (49.8–53.3)	62.7 % (60.4–65.0)	35.4 % (32.6–38.4)	19.7 % (18.0–21.4)	42.6 % (41.0–44.3)
Grade level[d]					
Middle School	43.4 % (39.2–47.8)	52.2 % (49.4–55.0)	19.7 % (18.1–21.4)	10.4 % (9.1–11.7)	46.5 % (44.6–48.3)
High School	56.5 % (52.2–60.8)	73.7 % (71.2–76.0)	46.7 % (43.9–49.5)	27.1 % (25.0–29.4)	41.9 % (39.8–44.1)
Race/Ethnicity					
Non-Hispanic, White	52.4 % (48.1–56.8)	68.0 % (65.8–70.1)	38.0 % (35.4–40.8)	23.0 % (21.0–25.1)	44.1 % (42.3–46.0)
Hispanic/Latino	24.7 % (21.7–27.9)	62.6 % (59.9–65.3)	35.0 % (32.1–38.0)	18.3 % (16.5–20.3)	48.0 % (45.9–50.0)
Non-Hispanic, Black	12.5 % (10.0–15.4)	54.3 % (49.6–59.0)	26.2 % (23.2–29.4)	13.3 % (11.1–15.9)	36.4 % (33.3–39.7)
Non-Hispanic, Other[e]	10.4 % (9.0–12.1)	62.1 % (58.4–65.7)	29.6 % (26.7–32.7)	15.2 % (13.0–17.8)	47.5 % (44.5–50.5)
Ever Used Other Tobacco[f]					
No	74.4 % (71.8–76.9)	61.3 % (59.1–63.4)	20.1 % (18.6–21.7)	8.9 % (8.1–9.8)	43.3 % (41.7–44.8)
Yes	25.6 % (23.1–28.2)	73.3 % (70.7–75.8)	78.0 % (75.3–80.5)	51.7 % (47.8–55.8)	56.0 % (51.5–60.3)
Marketing Exposure[g]					
Mean (SD)	1.45 (1.3)	1.64 (1.3)	1.67(1.3)	1.66 (1.3)	1.47 (1.3)

All cells contain estimate percentage and 95 % Confidence Interval.

[a]Self-reported seeing use of e-cigarettes on school campus from one or more of the following: (1) Bathroom/Locker Room; (2) Classroom; (3) Inside, other (Hallway/Cafeteria); (4) Outside, other (Parking lot, Sidewalk); and (5)Somewhere Else on Campus.

[b]Self-reported use of an e-cigarette in the past 30-days.

[c]Susceptibility to E-cigarette Use is (yes¼1, no¼0) where a response of “Definitely yes,” “Probably yes,” or “Probably not” to any of the following 3 questions is considered susceptible (1): “Have you ever been curious about using an electronic cigarette or e-cigarette such as Blu, 21 st Century Smoke or NJOY?” / “Do you think that you will try an electronic cigarette or e-cigarette soon?” / “If one of your best friends were to offer you an electronic cigarette or e-cigarette, would you use it?” Only those that responded “Definitely not” to all three questions were considered not susceptible (0).

[d]Middle School reflects 6th–8th grades; High School reflects 9th–12th grades.

[e]For this study, “other” reflects non-Hispanic, Asian; multiracial; and any other race.

[f] Self-reported use, even once, of any of the following products: combustible cigarettes; cigars; smokeless; hookah; snus; dissolvable; pipe tobacco; and bidis.

[g] Sum of number of e-cigarette advertising sources exposed (including internet, print, retail, and TV/movies) ranging from 0 to 4; exposed is answering "sometimes," "most of the time," or "always.".

Table 2

Association of Observing Vaping on Campus and E-cigarette Use and Susceptibility in Middle and High School Students (NYTS 2019).

	Ever User (n = 17,977) Adj OR 95 % Confidence Intervals	Current User[a] (n = 17,977) Adj OR 95 % Confidence Intervals	Susceptible to E-Cigarette Use[b] (n = 11,958) Adj OR 95 % Confidence Intervals
On-School Exposure[c]			
No	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Yes	**2.07*** (1.83–2.35)**	**1.70*** (1.46–1.98)**	**2.00*** (1.82–2.20)**
Sex			
Male	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Female	0.93 (0.83–1.04)	**0.82* (0.70–0.97)**	**0.89* (0.81–0.98)**
Grade level[d]			
Middle School	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
High School	**2.53*** (2.24–2.85)**	**2.04*** (1.71–2.45)**	**0.67*** (0.59–0.75)**
Race/Ethnicity			
Non-Hispanic, White	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Hispanic/Latino	0.91 (0.80–1.03)	**0.74*** (.63–0.87)**	**1.24*** (1.12–1.36)**
Non-Hispanic, Black	**0.47*** (0.38–0.58)**	**0.44*** (0.35–0.54)**	**0.76*** (0.66–0.88)**
on-Hispanic, Other[e]	**0.69*** (0.57–0.83)**	**0.62*** (0.50–0.76)**	**1.22** (1.06–1.41)**
Ever Used Other Tobacco[f]			
No	1.00 (Referent)	1.00 (Referent)	1.00 (Referent)
Yes	**13.10*** (11.42–15.03)**	**9.92*** (8.50–11.58)**	**1.84*** (1.53–2.22)**
Marketing Exposure[g]			
Mean	**1.13*** (1.09–1.16)**	**1.06* (1.01–1.11)**	**1.12** (1.08–1.17)**

[a] Self-reported use of an e-cigarette in the past 30-days.

[b] Susceptibility to E-cigarette Use is (yes¼1, no¼0) where a response of “Definitely yes,” “Probably yes,” or “Probably not” to any of the following 3 questions is considered susceptible (1): “Have you ever been curious about using an electronic cigarette or e-cigarette such as Blu, 21 st Century Smoke or NJOY?” / “Do you think that you will try an electronic cigarette or e-cigarette soon?” / “If one of your best friends were to offer you an electronic cigarette or e-cigarette, would you use it?” Only those that responded “Definitely not” to all three questions were considered not susceptible (0).

[c] Self-reported seeing use of e-cigarettes on school campus from any of the following: (1) Bathroom/Locker Room; (2) Classroom; (3) Inside, other (Hallway/Cafeteria); (4) Outside, other (Parking lot, Sidewalk); and (5)Somewhere Else on Campus.

[d] Middle School reflects 6th–8th grades; High School reflects 9th–12th grades.

[e] For this study, “other” reflects non-Hispanic, Asian; multiracial; and any other race.

[f] Self-reported use, even once, of any of the following products: combustible cigarettes; cigars; smokeless; hookah; snus; dissolvable; pipe tobacco; and bidis.

[g] Sum of number of e-cigarette advertising sources exposed (including internet, print, retail, and TV/movies) ranging from 0 to 4; exposed is answering “sometimes,” “most of the time,” or “always.”.