Use of emerging tobacco products among adolescents who do not smoke conventional cigarettes

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Although youth cigarette smoking has steadily declined across the US, use of emerging tobacco products, most notably e-cigarettes and hookah, has increased.[1] In 2015, 25.3% of US high school youth currently used at least one tobacco product.[1] E-cigarettes were the most commonly used product (16.0%), surpassing all other products including cigarettes (9.3%), cigars (8.6%), hookah (7.2%), and smokeless tobacco (6.0%). From 2011-2015, youth use of e-cigarettes and hookah substantially increased, while use of cigarettes, cigars, and smokeless tobacco declined. Increased use of emerging products has essentially canceled out decreases in cigarette use, resulting in no change in overall tobacco use among youth.[1]

In Rhode Island (RI), current cigarette use among high school students declined from 8.0% in 2013 to 4.8% in 2015 – one of the lowest youth smoking rates in the country. E-cigarette data were collected for the first time on the 2015 RI Youth Risk Behavior Survey (YRBS). Despite the fact that most RI high school students do not smoke conventional cigarettes, 25.1% of all youth reported current use of tobacco (cigarettes, cigars, smokeless, or e-cigarettes) in 2015. E-cigarettes were the most commonly used product (19.3%), followed by hookah (11.8%), cigars (8.4%), smokeless tobacco (5.3%), and cigarettes (4.8%).

Youth use of any tobacco or nicotine product is unsafe. Exposure to nicotine during adolescence can harm brain development and lead to more severe levels of nicotine addiction.[2] Research suggests that e-cigarette use among youth who do not smoke conventional cigarettes may act as a gateway to initiation of combustible tobacco products.[3] Because RI's youth cigarette smoking rate is so low, yet one in four adolescents report using tobacco, it is important to understand what other tobacco products are used by adolescents who are not current cigarette smokers. This study aimed to 1) describe current use of four tobacco products among RI high school youth who do not smoke conventional cigarettes (hereby referred to as "nonsmokers") and 2) identify factors associated with e-cigarette use among nonsmokers.

METHODS

We used data from the 2015 High School RI YRBS. The YRBS is developed by the Centers for Disease Control and Prevention (CDC), and is conducted biennially in US public high schools and middle schools. The YRBS uses a two-stage, cluster sample design to generate a representative sample of students in grades 9–12. Further description of YRBS methodology is described elsewhere.[4]

In 2015, 3,462 public high school students completed self-administered paper surveys. The analytic sample was limited to adolescents who were not current cigarette smokers (n=3,109) defined as reporting zero days to the question: "during the past 30 days, how many days did you smoke cigarettes?" Current use (past 30 days) of four emerging tobacco products was calculated for nonsmoking youth: 1) electronic vapor products (e-cigarettes, e-cigars, e-pipes, vape pens, e-hookah, and hookah pens); 2) cigars (little cigars and cigarillos); 3) smokeless tobacco (chewing tobacco, snuff, and dip); and 4) hookah (defined as a large water pipe to smoke tobacco/shisha). Prevalence of each product was cross-tabulated by age, grade, sex, race/ethnicity, sexual orientation, and disability status.

Multivariate logistic regression was used to identify factors associated with e-cigarette use among nonsmokers. The outcome variable was current e-cigarette use defined as past 30-day use of an electronic vapor product. Covariates were demographic characteristics (age, grade, gender, sexual orientation), disability status (physical or emotional/learning), current alcohol use (any use past 30 days), current marijuana use (any use past 30 days), and other tobacco products (smokeless tobacco, hookah, or cigars). Adjusted odds ratios with 95% confidence intervals were calculated. Statistical significance for regression coefficients was tested using the Wald chi-square statistic (p<.05).

RESULTS

About one in five (20.7%) nonsmoking RI youth reported current use of at least one other tobacco product. E-cigarettes (15.3%) were the most commonly reported product used among nonsmoking youth. Hookah use (9.2%) was the second most commonly used product, followed by cigars (4.4%) and smokeless tobacco (2.3%). Of youth using only one product (12.6%), the most commonly used product was e-cigarettes (60.2%), followed by hookah (26.8%). Among adolescents using ≥2 products (8.2%), e-cigarettes (95.3%) were most common, followed by hookah (72.4%). Product type prevalence by participant characteristics is presented in Table 1. Emerging product use was generally more frequent among youth who are male, non-Hispanic White, older, sexual minorities, or youth with a disability.

Table 1. Characteristics of adolescents who do not smoke conventional cigarettes by current use of emerging tobacco products

Characteristics	E-cigarettes % (95% CI)	Smokeless tobacco products % (95% CI)	Hookah % (95% CI)	Cigars, cigarillos, little cigars % (95% CI)
Overall	15.3 (12.0 – 18.5)	2.3 (1.2 – 3.4)	9.2 (7.0 – 11.5)	4.4 (3.2 – 5.6)
Age				
< 15 years	10.7 (7.0 - 14.3)	1.7 (0.6 - 2.6)	6.0 (4.8 – 7.2)	2.4 (1.8 – 3.0)
16 to 18 years	17.7 (13.9 - 21.6)	2.7 (1.4 – 4.0)	11.0 (7.9 – 14.1)	5.5 (3.9 – 7.2)
Sex				
Female	14.0 (10.9 – 17.2)	--	10.6 (7.2 – 14.1)	1.7 (0.9 – 2.5)
Male	16.5 (11.9 – 21.0)	3.8 (2.1 – 5.5)	7.8 (6.0 – 9.7)	7.1 (5.1 – 9.2)
Sexual orientation				
Gay/Lesbian/Bisexual	19.9 (13.5 – 26.3)	--	13.2 (5.9 – 20.5)	--
Heterosexual	15.0 (11.1 – 18.9)	2.4 (1.2 – 3.5)	8.7 (6.4 – 10.9)	4.5 (3.1 – 5.9)
Race/ethnicity				
Hispanic	12.9 (8.9 – 16.9)	--	12.4 (8.2 – 16.7)	3.3 (1.2 – 5.3)
Non-Hispanic Black	10.1 (8.4 – 11.9)	--	--	--
Non-Hispanic White	17.3 (12.5 – 22.1)	2.6 (1.4 – 3.8)	8.7 (6.2 – 11.3)	5.2 (3.6 – 6.8)
Non-Hispanic other race groups	11.6 (7.2 – 16.1)	--	8.2 (3.7 – 12.7)	--
Grade				
9th	11.1 (7.3 – 15.1)	--	6.4 (3.5 – 9.3)	2.0 (0.8 – 3.2)
10th	16.6 (11.7 – 21.5)	2.6 (0.8 – 4.3)	9.6 (5.9 – 13.2)	4.5 (2.7 – 6.4)
11th	12.5 (10.1 – 14.8)	--	9.5 (4.8 – 14.1)	3.7 (1.3 – 6.1)
12th	21.8 (14.7 – 28.9)	--	11.7 (8.8 – 14.5)	7.7 (5.3 – 10.1)
Disability				
No	13.5 (10.3 – 16.7)	2.0 (1.2 – 2.9)	8.4 (6.4 – 10.3)	4.6 (3.2 – 6.2)
Yes	22.9 (16.6 – 29.1)	--	12.8 (7.4 – 18.2)	3.4 (1.7 – 5.1)

-- Unweighted number < = 20
CI = confidence intervals

use of conventional cigarettes. Recent shifts in youth tobacco use suggest that tobacco control programs should increase surveillance of emerging tobacco products, especially e-cigarettes, to better understand tobacco behaviors among youth who are not conventional smokers. We found that one-fifth of nonsmoking youth reported using at least one other tobacco product. Overall tobacco use among nonsmoking youth was found to be driven mostly by e-cigarettes, followed by hookah use.

Studies have found that nonsmoking youth who used e-cigarettes were more likely to report initiation of combustible products,[3] and were more likely to report intentions to smoke in the near future.[5,6] Adolescents may believe e-cigarettes are less harmful, less addictive than conventional cigarettes, and helpful for quitting.[7] In this study, e-cigarette use was more likely among boys, non-Hispanic White youth, and youth with a disability. E-cigarette use was also associated with other risk behaviors including alcohol and marijuana use. Multiple risk behaviors can be partially explained by adolescent propensity for risk taking and other developmental factors. Findings underscore the importance of substance use interventions that simultaneously target multiple risk behaviors that cluster together.

Regression results (Table 2) showed the odds of e-cigarette use were significantly associated with being male (aOR=1.47, 95% CI=1.02-2.11, p=.04), having a disability (aOR=1.90, 95% CI=1.28-2.82, p=<.01), current alcohol use (aOR=2.05, 95% CI=1.14-3.68, p=.02), and current marijuana use (aOR=3.23, 95% CI=1.78-5.86, p=<.001). Concurrent use of hookah was strongly associated with e-cigarette use (aOR=10.94, 95% CI=7.3-15.90, p=<.0001) and use of cigars was also significantly associated with e-cigarette use (aOR=4.15, 95% CI=2.07-8.29, p=<.0001). Hispanic, non-Hispanic Black, and non-Hispanic other race groups were significantly less likely to use e-cigarettes compared to non-Hispanic White peers. Age, grade, and sexual orientation were not significant multivariate predictors (p>.05)

DISCUSSION

Preventing youth initiation of tobacco use is a primary goal of CDC and state-based tobacco control programs. In RI, youth use of emerging tobacco products exceeds their Regression results showed that hookah use was the strongest predictor of e-cigarette use, followed by cigars. Concurrent use of hookah or cigars raises concerns about the prevalence of multiple product use among youth. Youth that use more than one tobacco product increase their exposure to nicotine and are at higher risk for nicotine addiction. Some nonsmoking youth in RI reported use of two or more tobacco products. Of nonsmoking youth who used an emerging tobacco product, approximately 39% used ≥2 more products. Polytobacco use among youth highlights the variety of tobacco products available to youth, as well as the effect of tobacco industry marketing on youth. Emerging products are commonly available in candy and fruit flavors that appeal to youth. These products are often priced cheaply and marketed to youth in retail environments.

Table 2. Predictors of current e-cigarette use among adolescents who do not smoke conventional cigarettes

Characteristics	Adjusted Odds Ratio	95% CI	P- value
Age			
16 to 18 years	1.07	0.73 – 1.57	0.72
Sex			
Male	1.47	1.02 – 2.11	0.04
Sexual orientation			
Gay/Lesbian/Bisexual	1.48	0.76 – 2.88	0.25
Race/ethnicity			
Hispanic	0.56	0.33 – 0.94	0.03
Non-Hispanic Black	0.35	0.19 – 0.63	<.001
Non-Hispanic other race groups	0.46	0.24 – 0.91	0.02
Disability			
Yes	1.90	1.28 – 2.82	<.01
Current tobacco use			
Use smokeless tobacco products	1.79	0.41 – 7.82	0.43
Use hookah to smoke tobacco	10.94	7.53 – 15.90	<.0001
Smoke cigars, cigarillos, little cigars	4.15	2.07 – 8.29	<.0001
Current alcohol use			
Yes	2.05	1.14 – 3.68	0.02
Current marijuana use			
Yes	3.23	1.78 – 5.86	<.001

Reference groups: Age: 12 to 15 years; Sex: female; Sexual orientation: heterosexual; Race/ethnicity: non-Hispanic white; disability: no; Current tobacco use: none; Current alcohol use: no; Current marijuana use: no; CI = confidence intervals

Findings are subject to at least three limitations. Causality cannot be determined from cross-sectional data. Missing responses may have resulted in underestimation of use of emerging tobacco products. Finally, the YRBS is limited to public school students and may not be generalizable to high school students that attend private schools.

Youth use of emerging products is on the rise. Strengthening policies that reduce youth access to all tobacco products, not just cigarettes, is an effective strategy to prevent youth tobacco use.[8] Best practice and emerging policy initiatives include raising the cost of all tobacco products, raising the minimum age of sale to 21, and creating tobacco-free environments for schools and campuses (inclusive of e-cigarettes). RI already has strong tobacco control policies. RI has the second highest state cigarette tax ($3.75/pack), a comprehensive indoor smoking ban prohibiting combustible products including hookah, and a state law prohibiting e-cigarette sales to individuals under 18. Despite major tobacco control successes, new initiatives are needed to respond to youth uptake of emerging products. Future directions for RI include increased surveillance of emerging products, counter-marketing about the dangers of emerging products, and local point of sale strategies that require local tobacco retailer licenses and ban sales of flavored and discounted tobacco products.

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