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Alternate Tobacco Product and Drug Use among Adolescent who Use Electronic Cigarettes, Cigarettes Only, and Never-Smokers

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Abstract

Purpose—To determine whether use of alternative tobacco products (i.e., cigars, blunts, hookah, smokeless tobacco), alcohol and marijuana use differs between adolescents who currently use 1) e-cigarettes; 2) cigarettes only; and 3) never-smokers.

Methods—Analysis of a self-reported survey from 4 high schools in 2010–2011 (n=3,102) with a subsample (n=1,556) surveyed on alcohol and marijuana. Analyses were conducted with multinomial logistic regression models accounting for clustering by schools.

Results—The sample contained 2.4% (n=76) e-cigarette users, 12.4% (n=386) cigarette smokers, and 85.1% (n=3,197) never-smokers. E-cigarette users were more likely than cigarette-only smokers to report blunt (Adjusted odds ratio (AOR) 1.81 (95% Confidence Interval (CI) 1.21–2.71) and hookah use (AOR 3.12 (CI 1.90–5.13), but not cigar, smokeless tobacco, alcohol, or marijuana use.

Conclusions—E-cigarette users are more likely than cigarette smokers to use hookah and blunts.

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Keywords

Tobacco Products; Adolescent; Alcohol; Marijuana

Introduction

Electronic cigarettes (e-cigarettes) are battery-operated devices that deliver vapor through inhalation. There is concern that use of e-cigarettes among youth may be linked to the initiation or continuation of tobacco products. Existing research suggests that adolescent cigarette smokers are more likely than non-smokers to use e-cigarettes,[1] however the patterns of alternative tobacco product use (i.e., cigars, blunts [marijuana rolled in tobacco], hookah, smokeless tobacco [chew/dip]) are unknown.

There is a well-documented increased likelihood of alcohol and marijuana use in adolescent cigarette smokers.[2] This may be due to the desire to seek novel or intense experiences (i.e. “sensation-seeking”),[3] the “gateway hypothesis”, wherein individuals may start using one tobacco product and then proceed to use other substances,[4] or the social milieu of adolescence which supports the adoption of multiple risky behaviors.[5] Given these findings, adolescents who use e-cigarettes may arguably also be at increased risk for adopting alternative tobacco product, alcohol, or marijuana use; however it is unknown whether this risk is higher than that of cigarette smokers who do not use e-cigarettes.

The objective of this study is to determine whether alternative tobacco product, alcohol and marijuana use differs between adolescent 1) current e-cigarette users; 2) current cigarette smokers; and 3) never-smokers.

Methods

This is a data analysis of cross-sectional, self-report surveys assessing tobacco behaviors conducted in 4 suburban high schools in Connecticut and New York in October 2010 (NY) and January 2011 (CT). A subsample of schools (n=2) agreed to survey students about alcohol and drug use. Full methods have been published elsewhere.[6] This study was approved by the Yale School of Medicine and Roswell Park Cancer Institute Institutional Review Boards. We obtained passive parental permission through letters mailed home to parents, and students were informed that the survey was voluntary and anonymous.

Sample

The full sample consisted of 3,912, students (response rate = 80.1%). Students who did not use e-cigarettes and were former smokers were excluded (n=605). Of the remaining students (n=3307), 3102 (93.8%) were included in the analysis with complete demographic and tobacco use data. The subsample examining alcohol and marijuana use consisted of 1,957 students attending 2 high schools in Connecticut of which 293 were excluded due to former smoking status. Of the remaining 1,849 students, 1556 (84.1%) were included in the analysis with complete data. Students with missing data did not differ from the included sample or subsample in grade, sex, or race/ethnicity.

Measures

Current e-cigarette and alternative tobacco use was assessed with the question, “In the past 30 days have you used any of the following tobacco products?” Choices included: cigars, blunts [marijuana with tobacco], bidis/kreteks, hookahs, smokeless tobacco [chew/dip], and e-cigarettes [An electronic cigarette that is filled with liquid nicotine and emits “smoke” vapor]. Bidi/kretek use was not included in the analysis due to the low prevalence of use ($n=24$; 0.7%). Current cigarette, alcohol (drinking one or more drinks of an alcoholic beverage), binge drinking (drinking more than 5 drinks in a row on one occasion), and marijuana use were defined as reporting the behavior 1 day in the past month.

Data Analysis

Descriptive statistics were reported for : 1) current e-cigarette users, which included both current cigarette and non-cigarette users; 2) current cigarette users who did not report current e-cigarette use and 3) never-smokers. Bivariate comparisons were conducted with chi-square and Fisher’s exact test for categorical variables and the t-test for continuous variables. Separate multinomial logistic regression models were constructed for each alternative tobacco product, current alcohol use, current binge drinking and current marijuana use to compare the associations between e-cigarette users and never-smokers, cigarette smokers and never-smokers, and e-cigarette users vs. cigarette smokers. We reported unadjusted associations and models adjusted for demographic variables (grade, sex, and race/ethnicity). Proc surveylogistic procedures were conducted with SAS v.9.3 (Cary, NC) to account for clustering by school. Bonferroni correction for multiple comparisons was applied and $p<0.0008$ was considered statistically significant.

Results

The sample consisted of 2.5% ($n=76$) current e-cigarette users, 12.4% ($n=386$) current cigarette smokers and 85.1% ($n=2,640$) never-smokers (Table 1). Most current e-cigarette users reported occasional (44.7%) or daily smoking (30.3%), 15.7% had ever tried a cigarette, but were not current smokers, and 9.2% were never-smokers. Current e-cigarette users used a higher mean number of alternative tobacco products (i.e. cigars, blunts, hookah, smokeless tobacco) (1.75; Standard Deviation (SD)=1.32) than current cigarette smokers (1.15; SD=1.03) or never-smokers (0.06; SD=0.3) ($p<0.0001$). The prevalence of all types of alternative tobacco products was higher among current e-cigarette users and cigarette smokers than never-smokers ($p<0.001$). In addition, a larger proportion of current e-cigarette users reported hookah use (42.1% vs. 18.9%; $p<0.0001$) than current cigarette smokers. Among the subsample ($n=1,556$), the prevalence of current alcohol, binge drinking and marijuana use did not differ between current e-cigarette users and current cigarette smokers, although these groups had a higher prevalence than never-smokers ($p<0.0001$).

Adjusted models demonstrated alternative tobacco product, alcohol and marijuana use were more likely in current e-cigarette users and current cigarette smokers compared to never-smokers (Table 2). Current e-cigarette users were more likely than current cigarette smokers to report blunt (Adjusted odds ratio (AOR) 1.81 (95% Confidence Interval (CI) 1.21–2.71)

and hookah use (AOR 3.12 (CI 1.90–5.13) use, but not cigar, smokeless tobacco, alcohol, or marijuana use.

Discussion

A large proportion of current e-cigarette users concurrently used cigarettes. E-cigarette users were more likely than both current cigarette smokers and never-smokers to use certain alternative tobacco products (blunts, and hookah). Similar to findings from young adults,[7] current e-cigarette users did not have an elevated risk of also using alcohol or marijuana as compared to current cigarette smokers. Adolescents who use e-cigarettes may use hookah and blunts because they perceive that all of these products are less harmful than traditional tobacco products.[8–10] Future studies are needed to examine these and other possibilities.

Limitations of this study include self-reported data and limited generalizability due to predominantly White (80.9%) northeast suburban schools. As the study was cross-sectional, we cannot make causal inferences. The e-cigarette users mostly included adolescents who concurrently smoked cigarettes. The sample size of the e-cigarette users who did not use cigarettes was small, making it impossible to separate out the effects of only using e-cigarettes. We were only able to ascertain alcohol and marijuana use in a subsample of schools. Lastly, given the overall low prevalence of e-cigarette use (especially within the subsample), our estimates have wide confidence intervals and further larger studies are needed to provide more precise effect estimates. As this data is cross-sectional, future longitudinal studies are needed to understand the potential consequences of dual e-cigarette and alternative tobacco product use when trying to estimate the net population health impact of these novel products in youth.

In summary, similar to previous studies, a large proportion of adolescent e-cigarette users reported using cigarettes.[1] Current e-cigarette users were more likely than current cigarette smokers to use blunts and hookah. These findings suggest that e-cigarette use is likely to be a marker of polytobacco use in adolescents.

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Implications and Contribution

This study demonstrates that adolescents who currently use electronic cigarettes are more likely than adolescents who currently smoke cigarettes only and never-smokers to use blunts and hookah. However, adolescents who currently use electronic cigarettes do not have an elevated risk of also using alcohol or marijuana as compared to adolescents who only smoke cigarettes.

Table 1
Demographic Characteristics, Tobacco Use Patterns, and Other Drug Use Patterns of Three Different Tobacco Use Groups

	Current e-cigarette users			No current e-cigarette use			E-cigarette vs. cigarette smoker <i>p</i> value ^d	E-cigarette vs. Cigarette <i>p</i> value ^d
	Total (n=3,102)	Current e-cigarette users (n= 76)	Current cigarette smokers (n=386)	Never-Smokers (n=2,640)				
Demographics								
Grade (n,%)								
9	843 (27.2)	10 (13.2)	74 (19.2)	759 (28.8)			<0.0001	0.3
10	777 (25.0)	24 (31.6)	88 (22.8)	665 (25.2)				
11	778 (25.1)	18 (23.7)	104 (26.9)	656 (24.8)				
12	704 (22.7)	24 (31.6)	120 (31.1)	560 (21.2)				
Gender (n,%)								
Male	0 1467 (47.3)	47 (61.8)	195 (50.5)	1225 (46.4)			0.01	0.07
Female	1 1635 (52.7)	29 (38.2)	191 (49.5)	1415 (53.6)				
Race/Ethnicity (n,%)								
White, non-Hispanic	4 2509 (80.9)	55 (72.4)	281 (72.8)	2173 (82.3)				
Black, non-Hispanic	3 152 (4.9)	4 (5.3)	25 (6.5)	123 (4.7)				
Hispanic	2 188 (6.1)	10 (13.2)	39 (10.1)	139 (5.3)				
Other	1 253 (8.2)	7 (9.2)	41 (10.6)	205 (7.8)			<0.001	0.9
Tobacco Use Behaviors								
Status of Cigarette Use ^b (n,%)								
Never Smokers	2659 (85.7)	7 (9.2)	0 (0.0)	2640 (100.0)			<0.001	<0.0001
Ever Tried Cigarettes, but not current	12 (0.4)	12 (15.8)	0 (0.0)	0 (0.0)				
Current occasional Smoker	289 (9.3)	34 (44.7)	255 (66.1)	0 (0.0)				
Current Daily Smoker	154 (5.0)	23 (30.3)	131 (33.9)	0 (0.0)				
Age First Smoked Whole Cig. (mean, SD)								
	13.3 (2.4) ^c	12.8 (2.6)	13.4 (2.3)	NA			NA	0.07
Cigarette per day (n,%)								
less than 1	1 241 (7.8)	39 (51.3)	202 (52.3)	NA			NA	0.002

	Current e-cigarette users			No current e-cigarette use		E-cigarette vs. never-smoker <i>p</i> value ^d	E-cigarette vs. Cigarette <i>p</i> value ^d
	Total (n=3,102)	Current e-cigarette users (n= 76)	Current cigarette smokers (n=386)	Never-Smokers (n=2,640)			
1 to 5	122	18	104	NA			
6 to 1/2 pack	3	11	46	NA			
1 pack or more	4	6	30	NA			
Missing	6	2	4	NA			
Number of Alternative Tobacco Products Used, ^d (n, %)						<0.001	<0.0001
0	2647	14	114	2519	(95.4)		
1	279	25	157	97	(3.7)		
2	104	14	72	18	(0.7)		
3	47	12	31	4	(0.2)		
4	25	11	12	2	(0.1)		
Mean (SD)	0.23 (0.70)	1.75 (1.32)	1.15 (1.03)	0.06 (0.3)		<0.0001	0.0003
Type of Other Tobacco Product Used (n,%)		(0.0)	(0.0)				
Cigars	173	31	109	33	(1.3)	<0.0001	0.03
Blunts	331	51	207	73	(2.8)	<0.0001	0.04
Hookahs	131	32	73	26	(1.0)	<0.0001	<0.0001
Smokeless Tobacco	93	19	53	21	(0.8)	<0.0001	0.01
Other Substance Use Behaviors (n, %)	Total (n=1556)	Current e- cigarette users (n= 52)	Current cigarette smokers (n=145)	Never-smokers (n=1,359)			
Ever Alcohol Use	844	49	131	664	(48.9)	<0.0001	0.6
Current Alcohol Use	503	45	113	345	(25.4)	<0.0001	0.2
Current Binge Drinking	306	35	86	185	(13.6)	<0.0001	0.3
Ever Marijuana Use	355	41	120	194	(14.3)	<0.0001	0.5
Current Marijuana Use	229	37	99	93	(6.8)	<0.0001	0.7

^aCompared using chi-square test and Fisher's exact test for categorical variables and students t-tests for anova for continuous variables.

^bEver tried cigarettes was defined as having tried a cigarette, even 1 or 2 puffs, but not being a current smoker, occasional smoker smoked 1–29 days in past 30 days and regular smoker smoked every day in past 30 days.

^c Represents mean age for current e-cigarette users (n=76) and current cigarette smokers (n=386) only.

^d Alternative tobacco products included cigars, blunts, hookah or smokeless tobacco. This was coded as an ordinal variable, as well as a continuous variable to calculate the mean.
 bolded values indicate significance at $p < 0.0008$

Table 2

Odds Ratios for Alternative Tobacco Product and Drug Use among E-cigarette Users, Cigarette Smokers, and Never-Smokers

	Current E-Cigarette Users vs. Never-Smokers		Current Cigarette Smokers vs. Never-Smokers		E-cigarette users vs. Cigarette Smokers	
	Crude OR	Adjusted OR	Crude OR	Adjusted OR	Crude OR	Adjusted OR
Alternative Tobacco Product Use (n=3,659)						
Cigars	54.41 (11.51–257.17)	47.54 (7.28–310.36)	31.09 (15.84–61.01)	29.70 (15.48–56.96)	1.75 (0.36–8.51)	1.62 (0.26–10.21)
Blunts	71.74 (54.61–94.24)	67.22 (53.52–84.43)	40.67 (21.30–77.65)	38.20 (20.73–70.37)	1.76 (1.05–2.96)	1.81 (1.22–2.71)
Hookahs	73.12 (34.60–154.50)	63.79 (27.49–148.05)	23.45 (9.31–59.06)	20.76 (8.99–47.95)	3.12 (1.67–5.83)	3.12 (1.90–5.13)
Smokeless Tobacco	41.57 (16.05–107.65)	36.21 (12.60–104.05)	19.85 (5.22–75.42)	19.55 (5.43–70.43)	2.09 (0.93–4.70)	1.86 (0.62–5.57)
Other Drug Use (n=1,556)						
Current Alcohol	18.89 (11.60–30.75)	17.88 (10.25–31.18)	10.38 (7.37–14.62)	10.00 (5.42–18.45)	1.82 (0.79–4.18)	1.81 (0.87–3.74)
Current Binge Drinking	13.07 (6.61–25.81)	11.62 (4.85–27.80)	9.25 (7.39–11.59)	8.52 (8.49–8.55)	1.41 (0.90–2.23)	1.47 (0.66–3.27)
Current Marijuana	33.58 (14.87–75.84)	29.14 (12.12–70.05)	29.30 (9.60–89.41)	28.02 (9.83–79.83)	1.15 (0.85–1.55)	1.07 (1.01–1.13)

^a adjusted for grade, sex, and white/other race

bolded values indicate significance at p<0.008