Flavored E-cigarette Use and Cigarette Smoking Susceptibility among Youth

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Abstract

Objectives—Research indicates youth e-cigarette use may lead to the use of conventional cigarettes, but the specific effects of flavored e-cigarettes—which greatly appeal to youth—are unknown. Therefore, this study examines how flavored e-cigarette use predicts cigarette smoking susceptibility among youth non-smokers.

Methods—We used 2014 National Youth Tobacco Survey to explore the relationship between current e-cigarette use (non-use, flavored and plain e-cigarette use) and smoking susceptibility among 18,392 youth non-smokers (ages 11–18 years).

Results—Overall, 2.2% and 2.1% of non-smoking youth currently used plain and flavored e-cigarettes. Compared to 30.0% of non-users, 61.1% and 74.1% of plain and flavored e-cigarette users reported smoking susceptibility. Flavored e-cigarette users were more likely to be susceptible than plain e-cigarette users (AOR=1.7, p< .001) and non-users (AOR=3.8, p< .0001). The

magnitude of the relationship between flavored e-cigarette use and smoking susceptibility was significantly higher for females (AOR=6.5, p< .01) than males (AOR=2.5, p< .01).

Conclusions—Flavored more so than plain e-cigarette use is strongly associated with smoking susceptibility among non-smoking youth. Flavored e-cigarettes are recruiting females and those with low smoking-risk profile to experiment conventional cigarettes. Legislative efforts to ban e-cigarettes with child-friendly flavors should be enhanced.

Keywords

E-cigarettes; Flavors; Youth; Smoking Susceptibility

INTRODUCTION

Electronic cigarettes (e-cigarettes), also called electronic nicotine delivery systems, are battery-operated devices that vaporize liquid containing varying amounts of nicotine, flavorings, and other chemicals. E-cigarettes are gaining popularity among U.S. youth (aged <18 years). Since 2014, e-cigarettes have become the popular tobacco products among middle and high school students.[1] In 2015, 5.4% and 16.0% of middle and high school students, respectively, have used e-cigarettes in the past 30-days.[1] E-cigarettes' attractiveness to teenagers is attributed to its wide selection of child-friendly flavors.[2–4] E-cigarettes come in both plain (traditional tobacco flavor) and flavored (e.g., candy, fruit, and other child-friendly sweet flavors) varieties. In 2013–2014, two-thirds of youth e-cigarette users used flavored e-cigarettes, making flavored e-cigarettes the most commonly used flavored tobacco product,[5] and 81% of the youth users reported the availability of appealing flavors as the primary reason for using e-cigarettes.[6]

Tobacco industry's marketing efforts on promoting flavored e-cigarettes have successfully recruited the young generation in experimenting and regularly using e-cigarette products. In 2014, there were almost 8,000 flavors available for e-cigarettes, with 241 new flavors introduced each month.[7] From 2012 to 2015, the number of candy-flavored e-cigarettes appearing on social media grew by six times.[8] Although in May 2016, the Food and Drug Administration (FDA) has extended its regulatory authority to e-cigarette products, the deeming rule did not ban the production, sales, and marketing of flavored e-cigarette products. This lack of regulation will allow the e-cigarette industry to continue to expand the production and marketing of flavored e-cigarettes in the U.S. Consequently, an increasing number of adolescents might experiment e-cigarettes and become regular users of the product in the upcoming years.

The growing popularity of e-cigarettes has raised public health concerns about its potential to serve as an attitudinal and cognitive gateway to conventional cigarette use among youth. Conventional cigarette smoking remains the leading preventable cause of death in the U.S.[9] For the last decade, mortality associated with cigarette smoking remains around 400,000 and millions more live with smoking-related diseases.[9] Adolescence is a critical period for prevention, since about 87% of established adult smokers initiated cigarette smoking between the ages of 11 and 18.[9] Thus, relevant cross-sectional and longitudinal studies were performed to investigate e-cigarette's potential effect on youth's smoking intention and

behavior. These studies consistently identified a strong positive association of e-cigarette use with cigarette smoking intention and behavior among non-smoking youth.[10–13]

Although evidence has shown that e-cigarette use has the potential to lead the non-smoking youth to experiment and regularly use conventional cigarettes,[11–13] there is a limited research on the differential impact of plain versus flavored e-cigarette use on youth's perceptions and behaviors of cigarette smoking. However, a growing body of literature has indicated that youth's harm perceptions, sensational experience, and satisfactory of using plain versus flavored e-cigarettes differ to a great extent.[4,14–16] Thus, it remains justifiable to know if non-smoking youth using plain versus flavored e-cigarettes are at a higher risk of using cigarettes. The sweet flavors of e-cigarettes may mimic flavors that youth are more familiar with, and these enjoyable experiences may make the idea of smoking more appealing. On the other hand, using flavored e-cigarettes may deter youth from using cigarettes since regular cigarettes can't satisfy their needs and curiosity towards experimenting new flavors. It is also possible that youth's positive attitudes surrounding flavored e-cigarettes, such as the belief they are less harmful than plain e-cigarettes,[4,14,15] may reinforce negative attitudes towards cigarette smoking, and thus, decrease their smoking intention. It's also unclear if gender, race/ethnicity, age, and the exposure to smoking risk factors may influence plain versus flavored e-cigarette use differently in having smoking intention. All things considered, an initial step needs to be taken to explore how plain versus flavored e-cigarettes are related to non-smoking youth's possibility of future smoking.

OBJECTIVES

This study aims to determine the association between e-cigarette use (categorized by non-use, plain e-cigarette use, and flavored e-cigarette use) and smoking susceptibility, in a nationally representative sample of non-smoking middle and high school students. We hypothesize that flavored e-cigarette use, compared to plain and non-e-cigarette use, will be positively associated with smoking susceptibility among non-smoking youth in the U.S. We further hypothesize that the relationship between flavored e-cigarette use and smoking susceptibility will be different among subgroups of non-smoking youth who have various demographic characteristics and smoking risk. This study is the first to examine the relationship of flavored e-cigarette use and susceptibility to cigarette smoking among non-smoking youth in a nationally representative sample.

METHODS

National Youth Tobacco Survey

Our data came from the 2014 NYTS, a nationally representative, self-administered survey of U.S. middle and high school students in both public and private schools. The overall response rate for the 2014 NYTS was 73.3%. The survey used a three-stage clustered probability sampling design without replacement to select Primary Sampling Units (PSUs), schools within each PSU, and students within each school. Non-Hispanic Black and Hispanic students were oversampled. Permission to participate was obtained from legal guardians.[17] Notably, 2014 was the first year that the NYTS included questions about

flavored nicotine and tobacco products, including e-cigarettes. Therefore, our analysis was limited to this year.

Study Population

From 22,007 complete surveys, this study considers data from 18,392 youth respondents. Current smokers of cigarettes, cigars, and hookahs (N=3,496) were excluded, as the objective was to examine the association between e-cigarette use and susceptibility to future smoking. Additionally, participants who did not answer all three of the questions about smoking susceptibility were excluded (N=119).

Measures

Current E-cigarette Use—Two survey questions asked about current use of plain and flavored e-cigarettes: 1) "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?" (numeric response) and 2) "Which of the following tobacco products that you used in the past 30 days were flavored to taste like menthol (mint), alcohol (wine, cognac), candy, fruit, chocolate, or other sweets?" (response choices: cigars, chewing tobacco, electronic cigarettes or e-cigarettes, and other forms of tobacco products). Participants were put in one of three categories: 1) non-e-cigarette users—or "non-users" (responded '0' to the first question); 2) plain e-cigarette users (responded '≥1 days' to the first question and did not respond 'e-cigarettes' to the second question); and 3) flavored e-cigarette users (responded '≥1 days' to the first question and 'e-cigarettes' to the second question).

Susceptibility to Cigarette Smoking—Smoking susceptibility, which is defined as the absence of a determined decision not to smoke,[18] is a validated measure repeatedly used to predict future experimentation and established cigarette smoking among youth.[18–20] Respondents were classified as "not susceptible" to cigarette smoking if they answered "Definitely Not" to all of the three following questions: "Do you think that you will try a cigarette soon?" "Do you think you will smoke a cigarette in the next year?" and "If one of your best friends were to offer you a cigarette, would you smoke it?"[18] Respondents who selected "Definitely yes," "Probably yes," and "Probably not" to any of the three questions were classified as susceptible.

Demographic Characteristics—The study included the following demographic characteristics: sex (Male and Female), school level (Middle and High School), and race/ethnicity (Non-Hispanic White, Non-Hispanic Black, Hispanic, and Non-Hispanic Other).

Risk Factors for Cigarette Smoking—Pro-tobacco advertisement exposures were measured by asking participants about how often they see ads or promotions for cigarettes or other tobacco products when they used the following media sources: Internet, magazine/newspaper, retail, and TV/movies, was described at the beginning of the questions. Respondents who answered "I do not use/read/go/watch," "Never," or "Rarely" were considered not exposed to that particular source and those who chose other options were considered being exposed. The total number of distinct sources was summed to create a cumulative exposure measure (none, 1–2, 3–4). Tobacco marketing receptivity was

measured by the question: "How likely is it that you would ever use or wear something—such as a t-shirt, hat, or sunglasses —that has a tobacco brand name, logo, or picture on it?" (High= "Very likely" vs. Low= "Somewhat likely." "Somewhat unlikely," and "Very unlikely") Nicotine dependence was assessed through the questions: "How true is this statement for you? I feel restless and irritable when I don't use tobacco for a while" and "How soon after you wake up do you want to use a tobacco product?" Respondents who answered "Sometimes true," "Often true," or "Always true" to the first question and reported they wanted to use tobacco within 30 minutes of the wake-up time were considered to have nicotine dependence. Respondents who answered "I do not use tobacco" or "Not at all true" for the first question and reported that they did not or rarely wanted to use tobacco, or wanted to use tobacco after 30 minutes of the wake-up time were considered being without nicotine dependence. Household members using tobacco was measured by the answer "Does anyone lives with you now…." The respondents choosing "No one who lives with me now uses any form of tobacco" were considered to be living without tobacco users. The respondents who chose other options were considered to live with a tobacco user. Cigarette harm perception was measured using the question "How much do you think people harm themselves when they smoke cigarettes some days but not every day?" (High= "A lot of harm" vs. Low= "Some harm," "Little harm," and "No harm"). Perceived easiness of purchasing tobacco in stores was based on the question "How easy do you think it is for kids your age to buy tobacco products in a store?" (High= "Some what easy" and "Easy" vs. Low= "Not easy at all"). Smoker prototypes were measured by questions: "Do you think smoking cigarettes makes young people look cool or fit in?" and "Do you think young people who smoke cigarettes will have more friends?" Those who answered "Definitely yes" to both questions were considered as to have favorable smoker prototypes; all others were considered having less favorable smoker prototypes. Cigarette smoking experimentation was measured by the question: "Have you ever tried cigarette smoking, even one or two puffs?" (Yes/No) Experimentation to cigar products and experimentation other tobacco products were measured in the same way.

Analysis

Survey data were adjusted for nonresponse and weighted to be representative of the U.S. middle and high school student population. The prevalence estimates and 95% confidence intervals (CIs) of self-reported smoking susceptibility were calculated, stratified by demographic and risk factor variables including sex, school level, race/ethnicity, and smoking risk factors including pro-tobacco advertisements exposure, tobacco marketing receptivity, nicotine dependence, household member uses cigarettes, cigarette harm perceptions, perceived easiness of getting tobacco, smoker prototypes, cigarette experimentation, cigar experimentation, and other tobacco experimentation. Using chi-square tests, we assessed differences in demographic characteristics and smoking risk factors by smoking susceptibility (susceptible vs. not susceptible) and status of e-cigarette use (non-use, plain e-cigarette use, and flavored e-cigarette use). Logistic regression was used to estimate unadjusted and adjusted odds ratios (ORs and AORs) of cigarette smoking susceptibility by e-cigarette use status, demographic characteristics and risk factors for cigarette smoking. To explore the moderating variables that influence the direction and strength of association between e-cigarette use and smoking susceptibility, we used

multivariate logistic regression to identify two-way interactions between e-cigarette use and each covariate, controlling for other covariates. Once significant interactions were identified, stratified analysis was used to estimate the direction and strength of the moderating effect. All analyses were completed using Stata 12.0.[21] The statistical significance level was set at $p < .05$.

RESULTS

Plain versus. Flavored E-cigarette Use

Overall, 2.2% (CI= 1.7–2.5) and 2.1% (CI= 1.7–2.9) of non-smoking youth used plain e-cigarettes and flavored e-cigarettes, respectively (Table 1). Males were more likely to use plain (59.1%) and flavored (54.1%) e-cigarettes than females ($p < .001$). High school students were more likely to use plain (70.9%) and flavored (79.1%) e-cigarettes than middle school students ($p < .0001$). Non-Hispanic (NH) Whites, Hispanics, and NH others, were more likely to use flavored e-cigarettes (59.6%, 22.7%, and 11.0%, respectively), and Hispanics were more likely to use plain e-cigarettes (28.1%) than youth of other racial/ ethnic background ($p < .05$). Youth with smoking risk factors except for pro-tobacco advertisements exposure, were more likely to use plain and flavored e-cigarettes than those who were without the risk factors. For example, plain and flavored e-cigarette use was 37.9% and 41.3% among those who lived with a tobacco-using household member compared with 26.0% among those who did not ($p < .001$). Differences of demographic characteristics and smoking risk factors were not salient between plain versus flavored e-cigarette users.

E-cigarette Use and Smoking Susceptibility

Compared to 30.0% of non-users, 61.1% of plain and 74.1% of flavored e-cigarette users reported smoking susceptibility ($p < .0001$, Table 2). The bivariate analyses showed that, except for sex, smoking susceptibility was significantly associated with demographic characteristics and smoking risk factors. Unadjusted logistic regression revealed that users of plain (OR=3.6, CI=2.7–4.8, $p < .001$) and flavored (OR=6.6, CI=3.8–9.1, $p < .001$) e-cigarettes had higher odds of being susceptible to cigarette smoking than non-users. The unadjusted odds ratio of being susceptible to cigarette smoking was the largest for flavored e-cigarette use (OR=6.6, CI=3.8–9.1, $p < .0001$), followed by cigarette experimentation (OR=4.7, CI=4.0–5.5, $p < .001$) and plain e-cigarette use (OR=3.6, CI=2.7–4.8, $p < .001$).

In the adjusted analysis (Table 2), flavored e-cigarette users had higher odds of being susceptible to cigarette smoking than plain e-cigarette users (AOR=1.7, CI=1.3–2.4, $p < .001$) and non-users (AOR=3.8, CI=2.8–5.3, $p < .0001$). Being NH Black (AOR=0.9, CI=0.8–1.0, $p < .05$) had lower odds while being Hispanic (AOR=1.3, CI=1.2–1.5, $p < .001$) had higher odds of being susceptible to smoking than being NH White. High school students (AOR=0.8, CI=0.7–0.9, $p < .001$) had lower odds of smoking susceptibility than middle school students. Being male and NH Other were not significantly associated with smoking susceptibility. Except for being exposed to 1–2 distinct sources of tobacco advertisements, youth with any of other types of smoking risk factors had greater odds of being susceptible to smoking than those without smoking risk factors. The association between smoking

susceptibility and flavored e-cigarette use (AOR=3.8, CI=2.8–5.3, $p < .0001$) was again the largest across all the demographic characteristics and smoking risk factors.

Interaction Effects

E-cigarette use interacted significantly with five covariates (Table 3), including sex ($p < .01$), nicotine dependence ($p < .01$), tobacco marketing receptivity ($p < .01$), and cigarette experimentation ($p < .01$). In the stratified analyses, the association between smoking susceptibility and flavored e-cigarette use was significantly higher for females (AOR=6.5, CI=4.2–9.9, $p < .01$) than males (AOR=2.5, CI=1.5–4.1, $p < .01$). Among those who were not dependent on nicotine, both plain (AOR=1.8, CI=1.3–2.5, $p < .01$) and flavored (AOR=4.0, CI=2.9–5.5, $p < .01$) e-cigarette users had greater odds of being susceptible to smoking than non-users. However, no significant association was found for those with nicotine dependency. The association between smoking susceptibility and flavored e-cigarette use was significantly higher for those who were not receptive to tobacco marketing (AOR=5.0, CI=3.5–7.0, $p < .01$) than those who were receptive (AOR=2.5, CI=1.2–3.1, $p < .05$). However, this association was not found for plain e-cigarette use. Flavored e-cigarette users had greater odds of being susceptible regardless if they had tried cigarettes before (AOR=2.4, CI=1.5–4.0 $p < .01$; AOR=5.0, CI=3.5–7.3, $p < .01$, respectively), while plain e-cigarette users had greater odds of being susceptible only if they had tried cigarettes (AOR=1.9, CI=1.2–3.1, $p < .05$).

DISCUSSIONS

Use of flavored e-cigarettes compared to plain e-cigarettes among youth appeared to be a greater risk for smoking susceptibility—the absence of a determined decision not to smoke.[18] In a nationally representative sample of non-smoking middle and high school students, the use of flavored e-cigarettes put youth at twice the risk than those who used plain e-cigarettes compared to those who did not use e-cigarettes. Indeed, using flavored e-cigarettes was the strongest factor among other known characteristics and smoking risk factors associated with smoking susceptibility investigated in this study.

Several factors that increase smoking susceptibility may be playing a role in the current patterns, but have not been systematically investigated in flavored versus plain e-cigarette users. One factor—sensation seeking—has been identified as greatly increasing youth's willingness to use e-cigarettes[10] and cigarette use behavior.[13,22] Since high sensation seekers gravitate towards searching for unique and emotionally intense stimuli,[23] it is possible that the youth who experiment with multiple flavors are higher sensation seekers. One experimental study found that adolescent high sensation seekers had increased smoking intention when seeing flavored cigarette descriptors than the plain ones while this trend was not found for low sensation seekers.[23] Unfortunately, the current study did not collect data on the measure of sensation seeking. We recommend future studies account for youth's individual predispositions or acquired personality traits when examining the relationship between the perceptions and use of two or more than two tobacco products.

The access to peer networks and social media that promote cigarette smoking might also explain the association between flavored e-cigarette use and smoking susceptibility. The

Social Learning Theory[24] emphasizes the important role of peers as modeling for youth to learn and acquire substance use behavior.[25] It was found that perceived peer use of cigarettes was strongly associated with youth's subsequent smoking behavior.[26] It's possible that flavored e-cigarette users expose to a higher number of peer cigarette users through social networks where they experiment and share flavors, as compared to the plain e-cigarettes users who have less communal experience of using e-cigarettes. Although we controlled for the number of distinct channels of media exposure in our model, the frequencies and intensities of pro-cigarette-marketing exposure was not taken into account. It's possible that flavored e-cigarette users were exposed to pro-cigarette-use social media more often and to a greater extent than those who used plain e-cigarettes considering the escalated marketing efforts promoting flavored e-cigarettes observed in recent years.[7,8]

In our subpopulation analyses, we found that, although females and males did not differ in smoking susceptibility, female flavored e-cigarette users' smoking susceptibility was significantly higher than their male counterparts. Research has documented that tobacco industry added flavors to cigarette products to attract female users since females reported increased satisfactory experiences after using the flavored cigarettes.[27] In regards to e-cigarettes, previous studies indicated that females were more likely to use[28] and prefer[29] flavored e-cigarettes than males. Additionally, females who used e-cigarettes of their preferred flavors had higher nicotine concentration and more product satisfaction than those who used non-preferred flavors; yet this association was not found in males.[30] Thus, it's possible that the pleasurable flavor experience from using e-cigarettes helps persuade women, more than men, to try smoking cigarettes. It's also plausible that social experiences of using flavored e-cigarettes have a bigger impact on women's decision to initiate cigarette smoking. Studies found sociability was associated with cigarette initiation among teenage girls, instead of boys.[31,32] Future studies need to account for the distinct patterns of psychological and physiological reactions between the two genders when examining the consequences of e-cigarette use. Public health efforts need to address the high smoking susceptibility among female flavored e-cigarette users by developing gender-specific health campaign messages highlighting the harm of flavoring chemicals in e-cigarette products to reduce flavors' attractiveness to female teenagers.

We also found that e-cigarette use, especially flavored e-cigarette use, is only associated with smoking susceptibility among youth without nicotine dependence. However, almost all the current sample was not nicotine dependent (99%), making the results from the small group of nicotine dependent youth difficult to interpret. Since our sample only included those who were not currently using combustible tobacco products, the respondents who were non-nicotine dependent were more likely to be novice tobacco users with low smoking-risk profile compared to those who were nicotine dependent or were excluded from the sample. Similarly, we also found that the youth who were not receptive to tobacco marketing and those who had never experimented cigarettes before were more likely to be influenced by flavored e-cigarette use, than those who had the corresponding smoking risk factors. These findings suggest that flavored e-cigarettes are successfully recruiting youth with low smoking-risk profile to become consumers of conventional cigarettes. This is of particular concern as flavored e-cigarettes are continuing to rapidly gain market share in the U.S. over time.[33]

Limitations

This study has some limitations. Given the cross-sectional design, no temporal or causal inferences can be drawn. Though youth who were psychosocially susceptible to cigarette smoking may have turned to using flavored e-cigarettes, an equally plausible explanation is that the respondents used flavored e-cigarettes first and later became willing to smoke cigarettes through various mechanisms. Both scenarios are worrisome since both cigarette smoking and flavored e-cigarette use exert harm and safety hazards to the users and the public.[9,34–36] Emerging research regarding e-cigarettes has found that chemical flavorants, when inhaling, are known to cause respiratory diseases,[37] and certain flavorants are cytotoxic.[35,38] Nevertheless, longitudinal studies are needed to explore the temporal sequence in order to further inform smoking prevention efforts.

It is also important to note that due to the structure and content of the question defining plain versus flavored e-cigarette use, the results generated from this study should be interpreted with caution for the following reasons. Firstly, potential misreporting might have occurred since a single question was used to collect information about flavors used in all types of tobacco products, and e-cigarette was only one option in the response. Secondly, using the question, it is not possible to determine if flavored e-cigarette users were also using plain e-cigarettes. Thus, avoiding plain e-cigarettes may not be the variable that predicts smoking susceptibility: rather the use of flavor either with or without using plain e-cigarettes indicated the smoking susceptibility. Additionally, one caveat to interpret the study results is that menthol was included in the flavors. Previous studies showed that the use[39,40] and consequences[41] of menthol flavored e-cigarettes were similar to plain e-cigarettes instead of e-cigarettes with other candy and fruit flavors. Thus, the mixing of menthol flavors in the child-friendly flavors might have contaminated statistical inferences and reduced differences in the smoking susceptibility between plain and flavored e-cigarette use to some extent. Future studies need to include questions specifically examining flavors used in e-cigarettes and allow participants to choose more than one flavor. The development of a systematic and consistent scheme of categorizing e-cigarette flavors is also recommended to facilitate cross-referencing and result comparison among studies. Overall, despite some limitations, this study confirms the importance of flavored e-cigarette use as a strong predictor of smoking susceptibility among youth non-smokers.

Implications For Tobacco Regulation

This study finding calls for enhanced legislative efforts to ban and limit the availability of flavored e-cigarettes, including flavored e-liquid and e-juice. The Family Smoking Prevention and Tobacco Control Act of 2009 banned flavored cigarettes (except menthol) [42] to reduce the attractiveness of conventional cigarettes to minors. Thus, prohibiting flavors in e-cigarettes may be an effective way to dissuade young people from trying these products, and subsequently prevent smoking initiation. Researchers could explore the relationship between flavored e-cigarette use and cigarette smoking-related consequences more in depth in future studies, as well as examine the underlying mechanisms that build the relationship to strengthen the evidence base for future policy recommendations and campaign message development.

Acknowledgments

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Table 1.

Sample Characteristics and E-cigarette Use Among Nonsmoking Youth (N=18,392) –2014 National Youth Tobacco Survey (NYTS).

Respondent Characteristics	Total %[1]	Non-E-cigarette Users (n=17,581; 95.7%[1])		Plain E-cigarette Users (n=402; 2.2%[1])		Flavored E-cigarette Users (n=409; 2.1%[1])		p[2]
		%[1]	(95% CI)	%[1]	(95% CI)	%[1]	(95% CI)	
Sex								<.001
Male	49.2	48.9	(46.9, 50.8)	59.1	(51.7, 66.1)	54.1	(48.5, 59.5)	
Female	50.8	51.1	(49.2, 53.1)	40.9	(33.9, 48.3)	45.9	(40.5, 51.5)	
School Level[3]								<.0001
Middle	47.4	48.5	(42.2, 54.8)	29.1	(21.8, 37.8)	20.9	(14.4, 29.4)	
High	52.6	51.5	(45.2, 57.8)	70.9	(62.2, 78.2)	79.1	(70.6, 85.7)	
Race/Ethnicity[4]								<.05
NH White	53.9	53.9	(50.0, 57.8)	48.9	(42.0, 55.9)	59.6	(51.0, 67.6)	
NH Black	14.7	14.9	(12.3, 17.9)	13.8	(9.5, 19.7)	6.7	(4.6, 9.9)	
Hispanic	21.0	20.8	(18.4, 23.4)	28.1	(23.3, 33.5)	22.7	(16.2, 30.8)	
NH Other	10.4	10.4	(9.0, 12.2)	9.2	(6.1, 13.5)	11.0	(7.8, 15.3)	
Pro-tobacco Ads Exposure								.3697
None	8.4	8.5	(7.8, 9.2)	8.4	(5.5, 12.4)	5.2	(3.2, 8.4)	
1–2	46.9	46.9	(45.7, 48.1)	44.2	(36.6, 52.1)	48.7	(43.1, 54.3)	
3–4	44.7	44.6	(43.3, 46.0)	47.5	(40.0, 55.1)	46.0	(40.7, 51.5)	
Tobacco Marketing Receptivity								<.0001
Low	78.6	79.4	(78.2, 80.5)	59.5	(53.8, 64.9)	61.7	(54.2, 68.8)	
High	21.4	20.6	(19.5, 21.8)	40.5	(35.1, 46.2)	38.3	(31.2, 45.9)	
Nicotine Dependence								<.0001
No	98.6	98.9	(98.5, 99.2)	91.3	(88.2, 93.6)	94.5	(91.6, 96.4)	
Yes	1.4	1.1	(0.8, 1.5)	8.7	(6.4, 11.8)	5.5	(3.6, 8.4)	
Household Member Using Cigarettes								<.0001
No	73.4	74.0	(72.4, 75.5)	62.1	(55.6, 68.2)	58.7	(51.5, 65.5)	
Yes	26.6	26.0	(24.5, 27.6)	37.9	(31.8, 44.4)	41.3	(34.5, 48.5)	
Cigarettes Harm Perception								<.0001
Low	54.9	44.6	(43.6, 45.6)	56.2	(48.7, 63.5)	56.2	(50.8, 61.5)	

Respondent Characteristics		Total %[1]	Non-E-cigarette Users (n=17,581; 95.7%)[1]		Plain E-cigarette Users (n=402; 2.2%)[1]		Flavored E-cigarette Users (n=409; 2.1%)[1]		p[2]
			%[1]	(95% CI)	%[1]	(95% CI)	%[1]	(95% CI)	
	High	45.1	55.4	(54.4, 56.4)	43.8	(36.5, 51.4)	43.8	(38.6, 49.2)	
Perceived Easiness of Purchasing Tobacco in Stores									< .0001
	Low	32.7	37.8	(35.5, 40.2)	20.9	(16.4, 26.3)	26.5	(21.9, 31.7)	
	High	68.3	62.2	(59.8, 64.5)	79.1	(73.7, 83.6)	73.5	(68.3, 78.1)	
Smoker Prototypes									< .0001
	Less Favorable	47.5	48.1	(46.7, 49.4)	36.3	(30.2, 43.0)	32.3	(27.9, 39.1)	
	Favorable	52.5	51.9	(50.6, 53.3)	63.7	(57.0, 69.8)	66.7	(60.9, 71.1)	
Cigarette Experimentation									< .0001
	No	86.5	88.2	(87.0, 89.2)	52.7	(45.9, 59.4)	48.4	(40.3, 56.7)	
	Yes	13.5	11.8	(10.8, 13.0)	47.3	(40.6, 54.1)	51.6	(43.3, 59.8)	
Cigar Experimentation									< .0001
	No	91.0	92.0	(91.0, 92.9)	70.9	(64.8, 76.3)	64.0	(55.2, 72.0)	
	Yes	9.0	8.0	(7.1, 9.0)	29.1	(23.7, 35.2)	36.0	(28.0, 44.8)	
Other Tobacco Experimentation									< .0001
	No	90.5	91.7	(90.7, 92.6)	60.2	(53.4, 66.7)	66.9	(59.1, 73.8)	
	Yes	9.5	8.3	(73.7, 93.3)	39.8	(33.3, 46.6)	33.1	(26.2, 40.9)	

[1] Weighed percentage.

[2] p-value corresponds to differences between non-e-cigarettes users, plain e-cigarette users, and flavored e-cigarette users.

[3] Students in 6th, 7th, or 8th grades were considered to be in middle school and 9th, 10th, 11th, or 12th grades in high school.

[4] The "Non-Hispanic (NH) Other" category included NH Asian, Native American or Alaska Native, Hawaiian or Pacific Islander, or multiple races.

Table 2.

Sample Characteristics and Smoking Susceptibility Among Nonsmoking Youth (N=18,392) – 2014 National Youth Tobacco Survey (NYTS).

		Smoking Susceptibility (Yes or No)								
		Prevalence			Unadjusted OR			Adjusted OR		
		%[1]	95% CI	p	OR	95% CI	p	AOR	95% CI	p
Respondent Characteristics										
E-cigarette Use				<.0001						
	None	30.3	(29.2, 31.5)		(ref)	---	---	(ref)	---	---
	Plain E-cigs	61.1	(54.0, 67.8)		3.6	(2.7, 4.8)	<.001	1.7	(1.3, 2.4)	<.01
	Flavored E-cigs	74.1	(67.2, 80.0)		6.6	(3.8, 9.1)	<.001	3.8	(2.8, 5.3)	<.001
Sex				.21						
	Male	32.5	(31.0, 34.1)		1.1	(0.9, 1.2)	0.21	1.0	(0.9, 1.1)	0.95
	Female	31.3	(29.9, 32.9)		(ref)	---	---	(ref)	---	---
School Level[2]				<.05						
	Middle	30.5	(28.8, 32.3)		(ref)	---	---	(ref)	---	---
	High	33.2	(31.4, 35.1)		1.1	(1.0, 1.3)	<.05	0.8	(0.7, 0.9)	<.001
Race/ethnicity[3]				<.0001						
	NH White	30.5	(29.0, 31.9)		(ref)	---	---	(ref)	---	---
	NH Black	28.9	(26.4, 31.5)		0.9	(0.8, 1.1)	0.23	0.9	(0.8, 1.0)	<.05
	Hispanic	38.5	(36.3, 40.9)		1.4	(1.3, 1.6)	<.001	1.3	(1.2, 1.5)	<.001
	NH Other	32.9	(29.7, 36.2)		1.1	(0.9, 1.3)	0.13	1.0	(0.8, 1.2)	0.98
Pro-tobacco Ads Exposure				<.001						
	None	25.2	(22.0, 28.5)		(ref)	---	---	(ref)	---	---
	1–2	31.3	(29.6, 33.1)		1.4	(1.1, 1.7)	<.01	1.3	(1.0, 1.6)	0.05
	3–4	33.6	(32.0, 35.2)		1.5	(1.3, 1.8)	<.001	1.3	(1.1, 1.7)	<.05
Tobacco Marketing Receptivity				<.0001						
	Low	25.7	(23.3, 27.1)		(ref)	---	---	(ref)	---	---
	High	54.7	(52.5, 56.8)		3.5	(3.2, 3.9)	<.001	2.4	(2.1, 2.7)	<.001
Nicotine Dependence				<.0001						
	No	31.3	(67.5, 69.9)		(ref)	---	---	(ref)	---	---

| | Smoking Susceptibility (Yes or No) | | | | | | | | |
| | Prevalence | | | Unadjusted OR | | | Adjusted OR | | |
	%¹	95% CI	p	OR	95% CI	p	AOR	95% CI	p
Yes	74.0	(68.3, 79.0)		6.2	(4.6, 8.5)	<.001	2.3	(1.4, 3.9)	<.01
Household Member Using Cigarettes			<.0001						
No	29.1	(27.9, 30.3)		(ref)	---	---	(ref)	---	---
Yes	39.7	(27.7, 41.8)		1.6	(1.5, 1.7)	<.001	1.2	(1.1, 1.3)	<.001
Cigarettes Harm Perception			<.0001						
Low	42.0	(40.3, 43.7)		2.3	(2.2, 2.5)	<.001	2.0	(1.8, 2.1)	<.001
High	23.6	(22.5, 24.8)		(ref)	---	---	(ref)	---	---
Easiness of Purchasing Tobacco in Stores			<.0001						
Low	27.4	(79.9, 74.2)		(ref)	---	---	(ref)	---	---
High	34.9	(33.4, 36.5)		1.4	(1.3, 1.6)	<.001	1.2	(1.0, 1.3)	<.01
Smoker Prototypes			<.0001						
Less Favorable	18.4	(17.4, 19.5)		(ref)	---	---	(ref)	---	---
Favorable	44.3	(42.6, 46.0)		3.5	(3.2, 3.8)	<.001	2.7	(2.5, 3.0)	<.001
Cigarette Experimentation			<.0001						
No	26.8	(25.7, 28.0)		(ref)	---	---	(ref)	---	---
Yes	63.1	(59.6, 66.5)		4.7	(4.0, 5.5)	<.001	2.8	(2.3, 3.5)	<.001
Cigar Experimentation			<.0001						
No	29.4	(69.4, 71.7)		(ref)	---	---	(ref)	---	---
Yes	56.0	(52.2, 59.7)		3.1	(2.6, 3.5)	<.001	1.1	(0.9, 1.4)	0.18
Other Tobacco Experimentation			<.0001						
No	29.0	(27.8, 30.2)		(ref)	---	---	(ref)	---	---
Yes	58.0	(54.7, 61.2)		3.4	(3.0, 3.9)	<.001	1.8	(1.5, 2.1)	<.001

[1] Weighted percentage.

[2] Students in 6th, 7th, or 8th grades were considered to be in middle school and 9th, 10th, 11th, or 12th grades in high school.

[3] The "Non-Hispanic (NH) Other" category included NH Asian, Native American or Alaska Native, Hawaiian or Pacific Islander, or multiple races.

Table 3.

Stratified Analyses for Demographic Characteristics, Smoking Risk Factors and E-cigarette Use[1]

	Sex**				Nicotine Dependence**				Tobacco Marketing Receptivity**				Cigarette Experimentation*			
	Males		Females		Yes		No		Yes		No		Yes		No	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
E-cigarette Use																
Non-Use	ref		ref		ref		ref		ref		ref		ref		ref	
Plain E-cigs	1.5	(1.0–2.3)*	2.1	(1.2–3.7)*	0.7	(0.2, 3.2)	1.8	(1.3, 2.5)**	1.2	(0.7, 2.1)	2.1	(1.4, 3.3)**	1.5	(0.9, 2.5)	1.9	(1.2, 3.1)*
Flavored E-cigs	2.5	(1.5–4.1)**	6.5	(4.2,9.9)**	0.8	(0.3, 2.1)	4.0	(2.9, 5.5)**	2.0	(1.2, 3.1)*	5.0	(3.5, 7.0)**	2.4	(1.5, 4.0)**	5.0	(3.5, 7.3)**

[1] The multivariate models examining the interactions controlled for all covariates

**
p < .01

*
p < .05