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E-cigarette Dual Users, Exclusive Users and Perceptions of Tobacco Products

Maria Cooper, PhD [Post-doctoral Fellow],

University of Texas Health Science Center, School of Public Health, Austin Regional Campus, Austin, TX

Kathleen R. Case, MPH [Pre-doctoral Fellow],

University of Texas Health Science Center, School of Public Health, Austin Regional Campus, Austin, TX

Alexandra Loukas, PhD [Professor],

University of Texas at Austin, Department of Kinesiology and Health Education, Austin, TX

MeLisa R. Creamer, PhD, MPH [Faculty Associate], and

University of Texas Health Science Center, School of Public Health, Austin Regional Campus, Austin, TX

Cheryl L. Perry, PhD, MPH [Professor and Regional Dean]

University of Texas Health Science Center, School of Public Health, Austin Regional Campus, Austin, TX

Abstract

Objectives—We examined differences in the characteristics of youth non-users, cigarette-only, e-cigarette-only, and dual e-cigarette and cigarette users.

Methods—Using weighted, representative data, logistic regression analyses were conducted to examine differences in demographic characteristics and tobacco use behaviors across tobacco usage groups. Multiple linear regression analyses were conducted to examine differences in harm perceptions of various tobacco products and perceived peer use of e-cigarettes by tobacco usage group.

Results—Compared to non-users, dual users were more likely to be white, male, and high school students. Dual users had significantly higher prevalence of current use of all products (except hookah) than e-cigarette-only users, and higher prevalence of current use of snus and hookah than the cigarette-only group. Dual users had significantly lower harm perceptions for all tobacco products except for e-cigarettes and hookah as compared to e-cigarette-only users. Dual users reported higher peer use of cigarettes as compared to both exclusive user groups.

Contact Dr Loukas; alexandra.loukas@austin.utexas.edu.

Human Subjects Statement

This study's procedures have been approved by Texas A&M University's Institutional Review Board - Human Subjects in Research.

Conflict of Interest Disclosure Statement

None of the authors has any competing interests.

Conclusion—Findings highlight dual users' higher prevalence of use of most other tobacco products, their lower harm perceptions of most tobacco products compared to e-cigarette-only users, and their higher perceived peer use of cigarettes compared to exclusive users.

Keywords

tobacco use; adolescents; electronic cigarettes

Electronic cigarettes, or “e-cigarettes,” are devices that consist of a battery-operated element which heats a mixture of propylene glycol, vegetable glycerin, liquid nicotine and flavorings for the user to inhale. Whereas their overall safety, as well as their role in smoking cessation, is the topic of ongoing debate,¹ there is no doubt that the prevalence of e-cigarette use has increased rapidly among all age groups.^{2,3} Among adolescents, nationally-representative estimates indicate that past 30-day use for e-cigarettes is higher than conventional cigarettes, and a considerable proportion of e-cigarette users are dual users of cigarettes.⁴ That is, a nontrivial number of adolescents—2.2% of 8th graders, 4.3% of 10th graders and 7.3% of 12th graders—reported using both e-cigarettes and cigarettes in the past 30 days.⁴ Several e-cigarette product features are raising concerns about the potential to appeal to youth. For example, characteristics such as candy flavorings and easy access have been implicated as reasons for youth experimentation.⁵ E-cigarettes also are marketed heavily on the Internet. A content analysis of e-cigarette retail websites found frequent appeals to youth such as use by celebrities, enhanced social activity, and romance.⁶

Adolescent Dual Product Use

Increasingly, youth who use tobacco products are using more than one type of product.^{7,8} Between 2002 and 2011, rates of poly-tobacco use increased significantly among users under age 26.⁹ According to estimates from the National Youth Tobacco Survey, the majority of current tobacco users in middle and high school report use of more than one tobacco product.^{10,11} Thus, use of multiple tobacco products by youth is more common than exclusive use of one product alone. As such, it is important to understand the correlates associated with and characteristics of adolescent users of multiple tobacco products. To date, evidence suggests that, in general, adolescents who use 2 or more tobacco products are demographically distinct from those who use one product. Dual product users (in particular, those who use cigarettes and smokeless tobacco) are more likely to be male and white than female and non-white.^{7,12} In addition, current cigarette/smokeless tobacco dual product users are more likely to be in high school than middle school,¹³ and current cigar/cigarette dual users are more likely to have a lower grade point average as compared to non-users.¹⁴ However, the demographic characteristics of adolescent dual product e-cigarette and cigarette users are largely unknown.

The literature describes the deleterious effects of multiple tobacco product use among adolescents, including increased nicotine dependence, as well as increased risk for substance use disorders.^{7,15,16} However, to date, there is limited research examining the characteristics of adolescents who use e-cigarettes and at least one other tobacco product. Some studies have explored youth e-cigarette use with a focus on the prevalence of concomitant cigarette

use, motivations for e-cigarette use, abstinence from cigarettes and intentions to use other tobacco products,¹⁷⁻²⁰ but with a limited focus on social-cognitive risk factors. An exception is a study by Wills et al²¹ that examined current e-cigarette and cigarette use among high school students in Hawaii. The researchers assessed differences in risk factors and protective factors among students reporting no tobacco use, exclusive current e-cigarette or cigarette use, and dual use. Findings indicated that risk status varied across usage groups, with dual users of e-cigarettes and cigarettes reporting the most risk factors and the fewest protective factors, and e-cigarette-only users representing an intermediate category between non-users and dual users.

Perceptions of Harm and Peer Use of E-cigarettes

According to the theory of planned behavior, individuals' perceptions, including their attitude toward a behavior, normative beliefs, and perceived control, influence their decision to take part in a particular behavior.²² Consistent with this theory, adolescents who use tobacco products are expected to be less likely to perceive risks from their use than non-users.²³ Therefore, users of multiple tobacco products are likely to hold the lowest harm perceptions as compared to users of only one tobacco product and non-users of tobacco; this relationship has been demonstrated already.²⁴ Moreover, adolescent ever smokers who believe it is safe to smoke are more likely than their peers to use tobacco products other than cigarettes (smokeless tobacco, cigars, and bidis).²⁵ However, few studies have examined harm perceptions as they relate to adolescents' use of e-cigarettes, and even fewer have focused on adolescents who use e-cigarettes with at least one other tobacco product. This is particularly important given the controversies around the harmful effects of e-cigarette use,¹ and the need for more substantive research to document the potentially harmful effects of e-cigarette use in adolescence.²⁶

To our knowledge, only 3 studies assess harm perceptions of e-cigarettes in an adolescent population. Amrock et al²⁷ found that several characteristics were associated with adolescents' perceptions of e-cigarettes as relatively safer than cigarettes: being white, using other tobacco products, and having family members who used tobacco. In addition, adolescents who had ever used e-cigarettes perceived them as less harmful than cigarettes, as compared to those who had never used e-cigarettes. Ambrose et al²⁸ found that whereas one in 3 adolescents believed e-cigarettes were less harmful than cigarettes, the majority of current smokers (54%) held this belief as compared to fewer of the ever smokers (41%) and never smokers (25%). Additionally, ever use of an e-cigarette had a strong relationship with perceiving e-cigarettes as less harmful than cigarettes. In particular, dual users of e-cigarettes with cigarettes were more than twice as likely to perceive e-cigarettes as less harmful compared to exclusive cigarette smokers, and adolescents who used e-cigarettes alone had a 6-fold increase in their likelihood of perceiving e-cigarettes as less harmful than cigarettes, compared to adolescents who had never used either product. Wills et al²¹ found that current e-cigarette-only users were more likely to report that e-cigarettes were a healthy alternative to cigarettes as compared to non-users, but no differences were found between exclusive e-cigarette and cigarette user groups or between exclusive e-cigarette and dual use groups.

As stated in the theory of planned behavior, normative beliefs are influenced by perceptions about whether others in an individual's social network perform the behavior of interest.²² Prior research demonstrates that peers have a strong influence on both adolescents' initiation and escalation in cigarette use.²⁹ Interestingly, perceived prevalence of smoking rather than actual prevalence of peer smoking is associated with an increased risk of smoking among youth.³⁰ There are few published articles, however, that describe peer use in relation to youth use of tobacco products other than cigarettes. The limited evidence suggests that having peers who used other tobacco products or exposure to peer smoking are both significant predictors of adolescent use of alternative tobacco products such as cigars, smokeless tobacco, bidis and kreteks.^{25,12} Wills et al²¹ reported that among high school students, perceptions of peer smoking differed according to tobacco usage group. Perceived peer smoking was higher among exclusive e-cigarette users as compared to non-users as well as higher among dual users as compared to exclusive e-cigarette users. No differences were found for peer smoking between e-cigarette-only and cigarette-only groups.

According to the Campaign for Tobacco-free Kids, Texas ranks 32nd out of 50 US states in prevalence of conventional cigarette smoking among high school students.³¹ Additionally, our 2015 paper showed that e-cigarette use was higher in Texas than both national estimates and those documented in other states.³² Furthermore, Texas receives more tobacco industry marketing dollars than any other state except California³³ and ranks 40th among states in spending for tobacco prevention.³⁴ Therefore, youth in Texas, who represent 9.6% of all US youth,³⁵ are a vulnerable population, making the state an important backdrop to understand characteristics and perceptions associated with tobacco use in adolescents.

The purpose of the current study was to examine Texas adolescents' harm perceptions of various tobacco products and perceived peer use of e-cigarettes based on usage group. There were 3 aims. First, we examined pairwise differences among 4 usage groups—non-cigarette and non-e-cigarette users, cigarette-only users, e-cigarette-only users and dual users—in their demographic characteristics and tobacco use behaviors. Second, we examined pairwise differences among the 4 usage groups in perceptions about the harms of various tobacco products and alcohol use, as well as perceived peer use of tobacco products. Third, we examined differences in cigarette harm perceptions and e-cigarette harm perceptions by usage group. We hypothesized that dual users would more likely be older, white, and male as compared to other usage groups. We also hypothesized that dual users would have higher rates of perceived peer use as well as lower reported rates of perceived harm for all tobacco products. This study furthers understanding of perceptions of tobacco products and peer use among both exclusive and dual users of e-cigarettes and cigarettes.

METHODS

Participants

Participants were 13,602 6th through 12th grade students attending 69 public schools in 27 counties in Texas; 49.9% were female; 43.9% were non-Hispanic Whites, 5.8% were African Americans, 41.1% were Hispanics, and 9.2% reported another ethnicity.

Procedure

Data were drawn from the 2014 Texas Youth Tobacco Survey, which sampled students from public school districts across the state. Recruitment of schools occurred in one of 2 ways: (1) school districts in 12 “coalition” counties involved in a state-funded tobacco prevention and control project were recruited to participate in the study; of the 65 school districts in these counties, 23 participated (N = 52 schools); and (2) proportional probability sampling (recruitment probability is proportional to size of the school) was used to recruit an additional 17 schools from 15 additional counties. The school response rate was 25%, whereas student participation rate was 87%. In spring 2014, 13,602 students voluntarily completed the 38-item anonymous survey, either via paper-and-pencil (N = 59 schools) or online (N = 10 schools), in their classrooms during class time.

Measures

Tobacco use categories—To generate categories of current tobacco use, responses from 2 items adapted from the Centers for Disease Control and Prevention’s (CDC) 2013 National Youth Tobacco Survey were analyzed: (1) “During the past 30 days, on how many days did you use electronic cigarettes or e-cigarettes, such as Ruyan or NJOY?” and (2) “During the past 30 days, on how many days did you smoke cigarettes?” From these 2 items, 4 usage groups were generated: non-users of e-cigarettes or cigarettes; e-cigarette-only users; cigarette-only users; and e-cigarette and cigarette dual users. Participants who reported not using either product during the past 30 days were classified as non-users of e-cigarettes or cigarettes, participants who reported using e-cigarettes at least one day during the past 30 days and reported using cigarettes zero days during the past 30 days were classified as e-cigarette-only users, participants who reported using e-cigarettes zero days during the past 30 days and reported using cigarettes on at least one day during the past 30 days were classified as cigarette-only users, and participants who reported using both products on at least one day during the past 30 days were classified as e-cigarette and cigarette dual users.

Other current and lifetime tobacco use—Current and lifetime use of other tobacco products including chew, snus, hookah and flavored tobacco products also was analyzed. For each of the tobacco products, students reporting at least one day of other tobacco product use in the past 30 days were classified as current users, and those who reported ever using a tobacco product were classified as lifetime users. Lifetime use of e-cigarettes and of cigarettes also was included; thus, students reporting ever using those products were classified as lifetime users.

Harm perceptions of tobacco products and alcohol—To measure harm perceptions for various products, respondents are asked: “How dangerous do you think it is for a person your age to use: (1) Cigarettes; (2) Chewing tobacco, snuff, or dip, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, or Copenhagen; (3) Snus, such as Skoal, General, Camel or Marlboro Snus; (4) Tobacco in a hookah or a water pipe; (5) Electronic cigarettes or e-cigarettes, such as Ruyan or NJOY; (6) Tobacco products that are flavored; (7) Alcohol.” Response options are given on a 4-point scale, and include: “very dangerous,

somewhat dangerous, not very dangerous, and not dangerous at all.” Responses were reverse coded from “not dangerous at all” (1) to “very dangerous” (4).

Perceived peer use of tobacco products—To measure perceived peer use for various products, respondents are asked: “About how many of your closest friends: 1) Smoke cigarettes? (2) Use chewing tobacco, snuff or dip such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, or Co-penhagen? (3) Electronic cigarettes or e-cigarettes, such as Ruyan or NJOY?” Response options are given on a 6-point scale, and include: “none, a few, some, most, all, not sure.” Respondents who chose “not sure” were removed from the analysis on peer use. Therefore, responses ranged from “none” (0) to “all” (4).

Data Analysis

Logistic regression analyses were used to examine differences in demographic characteristics, grades in school, and tobacco use behaviors across usage groups. Demographic characteristics, grades in school, and tobacco use behaviors served as the dependent variables, while usage group served as the independent variable. All dependent variables were dichotomized using dummy variables, and separate regression models were conducted for each of the dependent variables. Results were adjusted to account for multiple comparisons using the Bonferroni correction. Additionally, one-way analysis of variance (ANOVA) was conducted to determine differences in mean grades in school across the 4 usage groups. Multiple linear regression analyses were conducted to examine differences in harm perceptions and perceptions of peer use by usage groups, adjusting for age, sex, and race/ethnicity. Pairwise comparisons using the Bonferroni correction were obtained post-estimation to determine differences in harm perceptions and perceived peer use between: (1) non-users of e-cigarettes and cigarettes versus dual users; (2) e-cigarette-only users versus dual users; and (3) cigarette-only users versus dual users. Finally, to examine differences in cigarette harm perceptions and e-cigarette harm perceptions by usage group, multiple linear regression analyses were conducted to generate mean harm perceptions for each of the usage groups. Multiple linear regression analyses also were performed to determine the difference in mean by each current usage group and to test if the difference was significantly different from zero. Analyses were adjusted for age, sex, and race/ethnicity.

All analyses were conducted using state sampling weights, and school level clustering was accounted for by including schools as the cluster variable in regression models, thereby making the study representative of schools in Texas. Whereas the overall sample size was 13,602, the sample sizes varied for each model due to missing data, which ranged from 0.8% to 2.3% for the included variables.

RESULTS

Differences across 4 Usage Groups in Demographic Characteristics and Tobacco Use Behaviors

The majority of participants (82.2%) were non-users of either product. Nearly 8% were dual users, over 6% were e-cigarette-only users and close to 4% were cigarette-only users. As Table 1 shows, dual users were significantly more likely to be male than non-users. The

proportion of dual users in high school was significantly higher than the proportions of cigarette-only and non-user groups in high school (versus middle school). Dual users were more likely to be white than both the cigarette-only and non-user groups. Non-users were more likely to be Hispanic than dual users (but not more likely than the e-cigarette-only or cigarette-only groups). In addition, differences were found among usage groups for self-reported academic performance in the last school year. Both non-users and e-cigarette-only users had higher mean grades than the cigarette-only group, and the non-user group had higher mean grades than the dual user group.

Significant differences in prevalence of other tobacco product use were found across all categories of products. Non-users differed from all 3 usage groups, and had the lowest prevalence of current and lifetime use other tobacco products with one exception being no significant difference between non-users and cigarette-only users in current hookah use. Current and lifetime use of other products was not significantly different between e-cigarette-only and cigarette-only groups. Dual users did not differ from cigarette-only users on lifetime use of any tobacco product. However, lifetime prevalence estimates for chew (60.6%) and snus (53.9%) were higher among dual users than e-cigarette-only users and non-users. Moreover, dual users had higher prevalence of current use of all products (except hookah) than e-cigarette-only users, as well as significantly higher prevalence of current use of snus (47.3%) and hookah (54.3%) than the cigarette-only group.

Harm Perceptions and Peer Use across Usage Groups

As Table 2 shows, significant differences were found in the perceptions of harm of tobacco products and alcohol use among usage groups. Non-users were significantly more likely to rate all tobacco products and alcohol use as more harmful than did the dual use group. The e-cigarette-only group perceived cigarettes as more harmful, when compared to the dual user group, and the cigarette-only group rated e-cigarettes significantly more harmful than the dual use group. There were similar patterns of differences in perceptions of harm for both chew and snus. The e-cigarette-only group perceived both products as more harmful than the dual use group, whereas no differences were seen between the cigarette-only group and the dual use group. No significant differences were found between e-cigarette-only users or cigarette-only users and dual users in their perceptions of harm of hookah. Similar patterns also were seen in perceptions of harm for general tobacco and alcohol. Whereas no differences were found between the cigarette-only group and the dual user group, e-cigarette-only users were more likely to rate both general tobacco and alcohol use as more harmful than the dual user group.

Regarding peer use, there were significant differences between groups on perceived peer use of cigarettes, e-cigarettes and chew (Table 2). Dual users perceived higher peer use of all products as compared to non-users. Dual users also perceived higher peer use of cigarettes as compared to both the e-cigarette-only and cigarette-only groups. No differences were seen in perceived peer use of either e-cigarettes or chew between dual users and exclusive user group comparisons.

Comparisons in Harm Perceptions of Cigarettes and E-cigarettes within Usage Groups

Comparisons of cigarette and e-cigarette harm perceptions by tobacco usage group are displayed in Table 3. The mean harm perceptions score was significantly higher for cigarettes than for e-cigarettes among all usage groups. The difference in mean harm perceptions between cigarettes and e-cigarettes was 0.46 ($p < .001$) for non-users, 1.44 ($p < .001$) for e-cigarette-only users, 0.55 ($p = .003$) for cigarette-only users, and 0.89 ($p < .001$) for dual users.

DISCUSSION

The current study adds to the limited body of literature describing patterns of e-cigarette use among middle and high school students, perceptions of harm, and peer use for these relatively new products whose prevalence of use is on the rise, as well as other types of tobacco products. Findings from the 2014 Texas Youth Tobacco Survey confirm results from other studies on the emerging patterns of e-cigarette use among youth, showing that a large number of youth are using e-cigarettes only, and many are using e-cigarettes in conjunction with conventional cigarettes.^{2,4}

Findings highlight demographic differences based on usage group. Interestingly, non-users and e-cigarette-only users did not differ on any of the sociodemographic characteristics we examined. Dual users had the most differences across groups. They were more likely to be male, older, white, and have lower mean grades than non-users. They were also more likely to be older and white compared to the cigarette-only group. Dual users consistently had the highest prevalence of other tobacco product use, except for lifetime hookah use, indicating that teens using both e-cigarettes and cigarettes are more likely to use other types of products, such as chew, snus and any flavored product.

Across the various tobacco products, harm perceptions differed among usage groups. For example, e-cigarette-only users viewed conventional cigarettes as more harmful than the dual user group. This is a novel finding that has not been reported previously in the literature. The same pattern was not seen for e-cigarettes, however. Interestingly, there were no differences in how harmful the e-cigarette-only and the dual user groups rated e-cigarettes, however, the cigarette-only group rated e-cigarettes as more harmful than the dual user group. This study differs from one performed by Wills et al²¹ in that it measures absolute harm of e-cigarettes rather than relative harm compared to cigarettes; our results follow similar trends. For example, no differences in perceived harmfulness of e-cigarettes were found between e-cigarette-only and dual user groups. Findings also generally confirm results from studies by Amrock et al²⁷ and Ambrose et al²⁸ that found that adolescents who use e-cigarettes perceive them as less harmful than those who do not. Consistent with Ambrose et al,²⁸ dual users in our sample were more likely to perceive e-cigarettes as less harmful compared to exclusive cigarette smokers, and in terms of differences between harm perceptions of e-cigarettes and cigarettes, our results also generally align with the finding that the highest risk of perceiving e-cigarettes as less harmful than cigarettes was held by the exclusive e-cigarette users. Specifically, although the current study found that all 4 usage groups rated cigarettes as more harmful than e-cigarettes, the magnitude of the difference in harm perceptions was greatest for the e-cigarette-only users followed by the dual users.

These findings are consistent with the theory of planned behavior.²² According to the theory, dual users would perceive e-cigarettes to be less harmful than non-users and cigarette-only users, which may be why they would use them. Students who perceive e-cigarettes as more harmful would be less likely than their counterparts to initiate use of these products.

Another striking finding was that harm perceptions for hookah followed the same pattern as that of e-cigarettes in that, unlike all other tobacco product comparisons, perceptions of harm did not differ between e-cigarette-only and dual user groups. Few studies offer explanation as to why perceptions of harm may be similar for both products. One study, however, highlighted a connection between e-cigarette and hookah use, finding that adolescent e-cigarette-only users were more likely than cigarette smokers to use hookah.¹⁹ Given the limited evidence, we can only speculate that similar ratings of harmfulness between e-cigarettes and hookah may be related to both products having a multitude of available flavorings or similarities between the sensation of inhaling e-cigarette aerosol and hookah smoke which has been cooled by the water pipe. For perceptions of chew and snus, group comparisons were generally consistent with prior literature that has found that perceived risk of harm for smokeless tobacco varied by the tobacco product use groups, with a higher proportion of nonsmokers perceiving great risk of harm.³⁶

Our results on perceived peer cigarette smoking are consistent with Wills et al's²¹ finding that differences exist between exclusive e-cigarette users and dual users. Perceived peer use of e-cigarettes and chew differed only between non-users and dual users, a finding that has not been reported previously. Consistent with the theory of planned behavior, students who perceive higher levels of peer use are more likely to use tobacco products.²² These findings highlight the need to better understand the role of peers in adolescents' e-cigarette use.

Limitations

This study is subject to at least 3 limitations. First, the cross-sectional design precludes us from making causal inferences about the findings. Second, the study participants are limited to Texas youth; therefore, findings may not be generalizable to populations outside of the sample. Finally, the survey item on flavored tobacco products does not make a distinction between types of product. Furthermore, it is unknown whether adolescents consider e-cigarettes to be tobacco products.

Conclusion

This study provides demographic characteristics of adolescents who were exclusive e-cigarette users, exclusive cigarette users, and dual users of cigarettes and e-cigarettes, a novel contribution to the field. Our findings confirm in many ways what we know about harm perceptions and tobacco use, that is, using a tobacco product is tied strongly to believing that it is less harmful than those who choose not to use the product. However, our findings also offer a new understanding of how tobacco usage groups rate the harmfulness of various tobacco products. Dual users were more likely to have lower harm perceptions as compared to exclusive e-cigarette users for all tobacco products except for e-cigarettes and hookah, and they differed from the cigarette-only group only in their harm perceptions of e-cigarettes, which they rated as less harmful. Dual users also were more likely to perceive

higher peer use of cigarettes than the non-users and both exclusive user groups. Within the 4 tobacco usage groups, the e-cigarette-only users had the largest difference in their perceptions of e-cigarettes as less harmful than cigarettes.

Implications for Practice and Policy

The Family Smoking Prevention Tobacco Control Act (2009) permitted the US Food and Drug Administration (FDA) to regulate cigarettes, smokeless tobacco, and roll-your-own tobacco; however, the FDA also has the authority to regulate other products. In 2014, the FDA proposed to deem other tobacco products, including e-cigarettes, within its purview. Findings in this study indicate that other tobacco products, including e-cigarettes, are popular among youth, and provide additional scientific evidence to support the need for these products to be regulated by the FDA. Our study's results also provide important implications for public health practice. Interventions should include the full spectrum of tobacco products as students in our sample who used e-cigarettes were more likely to perceive e-cigarettes as less harmful and more likely to think their peers used e-cigarettes and smokeless tobacco. Therefore, interventions should provide information regarding the harmfulness of e-cigarettes and focus on changing the normative beliefs associated with these products.

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Table 1
Demographic Characteristics in Usage Groups (Logistic Regression Analyses) — 2014
Texas Youth Tobacco Survey

	Non-e-cigarette/ Cigarette Users (N = 11,431)	E-cigarette-only Users (N = 638)	Cigarette-only Users (N = 474)	Dual Users (N = 761)
Overall (%)	82.2	6.38	3.87	7.55
Sex				
% Female	52.06	50.76	43.51	28.99 ^a
% Male	47.94	49.24	56.49	71.01 ^a
School Level				
% Middle School	49.54	32.58	31.05 ^a	19.36 ^{a,c}
% High School	50.46	67.42	68.95 ^a	80.64 ^{a,c}
Race/Ethnicity				
% White	42.22	47.11	44.71	58.12 ^{a,c}
% Black	6.39	2.29	9.49	1.96
% Hispanic	43.12	35.36	33.10	27.08 ^{a,b}
% Other	8.27	15.24	12.70	12.84
Mean Grades^d	3.14	3.13	2.52 ^{a,b}	2.83 ^a
Current Tobacco Use				
% Chew	1.88	22.55 ^a	41.12 ^a	52.47 ^{a,b}
% Snus	0.45	10.15 ^a	15.20 ^a	47.33 ^{a,b,c}
% Hookah	1.86	45.40 ^a	17.04	54.26 ^{a,c}
% Flavored	1.67	38.23 ^a	37.93 ^a	64.82 ^{a,b}
Lifetime Use				
% E-cigarette	9.15	--	55.03 ^a	--
% Cigarette	12.45	54.78 ^a	--	--
% Chew	7.12	30.81 ^a	50.65 ^a	60.61 ^{a,b}
% Snus	2.56	21.41 ^a	37.93 ^a	53.88 ^{a,b}
% Hookah	5.49	60.02 ^a	32.32 ^a	59.87 ^a
% Flavored	6.86	56.64 ^a	60.33 ^a	76.74 ^a

Note.

^aSignificantly different from Non-e-cigarette/Cigarette users, $p < .05$

^bSignificantly different from E-cigarette-only users, $p < .05$

^cSignificantly different from Cigarette-only users, $p < .05$

^dMeasured on 0 to 4 scale, from “Mostly Fs” to “Mostly As”; ANOVA conducted to determine differences in mean grades

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Table 2
Adjusted Means (SE) for Variables across Usage Groups with Regression Coefficients
from Multiple Linear Regression—2014 Texas Youth Tobacco Survey

	Non-e-cigarette/ Cigarette Users (N = 11,431)	E-cigarette- only Users (N = 638)	Cigarette- only Users (N = 474)	Dual Users (N = 761)	Non-users vs Dual Users	E-cigarette- only vs Dual Users	Cigarette- only vs. Dual Users
Harm Perceptions^a							
Cigarettes	3.59 (.02)	3.51 (.10)	2.84 (.05)	2.76 (.06)	0.83***	0.74***	0.07
E-cigarettes	3.13 (.04)	2.11 (.06)	2.46 (.14)	1.91 (.07)	1.22***	0.20	0.55***
Chew	3.57 (.02)	3.21 (.06)	2.91 (.13)	2.82 (.06)	0.75***	0.39***	.10
Snus	3.61 (.02)	3.36 (.10)	2.90 (.13)	2.83 (.06)	0.78***	0.53***	.07
Hookah	3.43 (.02)	2.47 (.17)	2.66 (.13)	2.50 (.09)	0.93***	−0.03	0.16
General Tobacco	3.43 (.02)	2.77 (.06)	2.71 (.13)	2.54 (.05)	0.89***	0.23**	0.17
Alcohol	3.42 (.03)	3.06 (.05)	2.91 (.06)	2.68 (.06)	0.74***	0.38**	0.23
Peer use^b							
Cigarettes	0.55 (.02)	1.01 (.13)	1.67 (.12)	2.11 (.05)	−1.56***	−1.10***	−0.44*
E-cigarettes	0.73 (.04)	1.76 (.08)	1.57 (.25)	2.01 (.13)	−1.28***	0.25	−0.44
Chew	0.58 (.02)	1.11 (.15)	1.60 (.26)	1.71 (.09)	−1.13***	−0.60	−0.11

Note.

Analyses adjusted for age, sex and race/ethnicity, using state sampling weights and accounting for school-level clustering; results adjusted for multiple comparisons using Bonferroni adjustment

*
p < .05

**
p < .01

p < .001

^a Measured on a 1 to 4 scale from “not dangerous at all” to “very dangerous”

^b Measured on a 0 to 4 scale from “none” to “all”

Table 3
Comparison of Cigarette and E-cigarette Harm Perceptions by Usage Group (Multiple Linear Regression Analyses) —2014 Texas Youth Tobacco Survey

	Cigarette Harm Perceptions ^a Mean (SE)	E-cigarette Harm Perceptions ^a Mean (SE)	Difference ^b Mean (SE)
Use Behavior			
Non- e-cigarette/Cigarette Users N = 11,020)	3.59 (.02)	3.13 (.04)	0.46 (.02) p < .001
E-cigarette-only Users (N = 611)	3.53 (.11)	2.09 (.08)	1.44 (.07), p < .001
Cigarette-only Users (N = 448)	3.03 (.06)	2.48 (.14)	0.55 (.18), p = .003
Dual Users (N = 729)	2.80 (.07)	1.91 (.07)	0.89 (.11) p < .001

Note.

Analyses adjusted for age, sex and race/ethnicity, using state sampling weights and accounting for school-level clustering Means presented in Table 3 differ slightly from those in Table 2 as a result of differences in sample size due to missing data

^a measured on a 1 to 4 scale from “not dangerous at all” to “very dangerous”

^b Cigarette- e-cigarette Harm Perceptions