College students' perceptions of risk and addictiveness of e-cigarettes and cigarettes

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Abstract

Background—As conventional cigarette use is declining, electronic cigarette ("e-cigarette") use is rising and is especially high among college students. Few studies examine dual use of e-cigarettes and cigarettes among this population. This study explores the relationship between dual and exclusive e-cigarette / cigarette use and perceptions of harm and addictiveness of both products.

Methods—This is a cross-sectional analysis of data from students attending 24 colleges in Texas (n=5,482). Multinomial logistic regression was employed to test the association between current e-cigarette / cigarette use and perceived harm and addictiveness of both products. Three tobacco groups were included: cigarette only users, e-cigarette only users, and dual users.

Results—Dual users reported lower perceived harm of e-cigarettes most consistently (p<0.001, all comparisons). Perceived harm of cigarettes was significantly lower among cigarette only and dual users only, compared to non-users (p<0.001, all comparisons). Compared to non-users, all three groups reported significantly lower perceived addictiveness of e-cigarettes (p<0.001, all comparisons). The same finding was observed for perceived addictiveness of cigarettes, though findings were less consistent for the e-cigarette only group (p<0.02, all comparisons except one).

Conclusion—Findings demonstrate that among college students, perceptions of harm and addictiveness of e-cigarettes are lower than those for conventional cigarettes. For both products, perceptions of harm and addictiveness were lower among exclusive and dual users, compared to non-users.

Keywords

Alternative tobacco use; electronic cigarettes; tobacco use; young adults

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Between 2005 and 2014, the prevalence of conventional cigarette use in the United States declined significantly, and the decrease was greatest among young adults aged 18–24 years.[1] The use of electronic cigarettes (or "e-cigarettes"), however, is rapidly climbing.[2] Among the adult population, multiple studies have found that the prevalence of ever use of e-cigarettes is highest among young adults in particular.[3–6] It is well established that among college students and young adults, current cigarette smokers are more likely to report use of e-cigarettes.[3,7] However, one study among college students also suggests that although e-cigarette use is most common among students who also smoke conventional cigarettes, it is not exclusive to them: 12% of e-cigarette users had never smoked a conventional cigarette.[8] Young adults, often experiencing periods of transition in their lives, are vulnerable targets of tobacco marketing[9] and are prone to both experimenting with and solidifying substance use.[10]

The alarming statistics related to the consequences and epidemiology of conventional cigarette smoking[11] are well known. Recent evidence regarding the potential dangers of e-cigarette use for young adults include the adverse effect of nicotine exposure on the prefrontal cortex, an area of the brain that is still maturing during this period,[12,13] deleterious effects on the developing fetus,[14] and exposure to toxins in aerosol.[15] Thus, it seems increasingly important to understand perceptions about e-cigarette use among this age group, including those who use e-cigarettes or conventional cigarettes alone and those who use both products (ie, dual users). Although there is agreement that perceptions of harm regarding traditional cigarettes influence decisions to use these products,[16] the literature is still nascent regarding how harmful young adults perceive e-cigarettes to be, as well as how these perceptions may affect e-cigarette experimentation or consistent use.

To date, several studies have investigated risk perceptions of e-cigarettes, but the majority of the studies has included only e-cigarette users. These studies also use a measure of relative harm of e-cigarettes compared with cigarettes. Evidence suggests that e-cigarette users perceive e-cigarettes to be less harmful than conventional cigarettes,[17–22] but the magnitude of the difference of perceived harm between products is largely unknown. In terms of addictiveness, one study found that 60% of e-cigarette users believed e-cigarettes were addictive, but less so than conventional cigarettes.[21] Berg et al[23] compared perceptions of tobacco products in college students and found that marijuana, hookah, and e-cigarettes were perceived as the least harmful and the least addictive among multiple substances.

Dual use of tobacco products is an important phenomenon to understand because it is common in young adults[24,25] and may lead to decreased likelihood of quitting tobacco use over time.[26] However, we have limited knowledge about how perceptions of tobacco products may differ between young adult dual– and single– tobacco product users. One exception is a study that found that college poly-tobacco users reported the least perceived dangers of various tobacco products as compared with single product users.[27] This study contributes to our limited understanding of dual use of cigarettes and e-cigarettes, by separating dual and exclusive users of each product. The specific aim of the study is to evaluate risk perceptions and perceived addictiveness of e-cigarettes and cigarettes among 4 groups of college students (cigarette only users, e-cigarette only users, dual users of both products, and nonusers of either product).

Methods

Study design

This study consists of a cross-sectional analysis from baseline data (November 2014–February 2015) from "Marketing and Promotions Across Colleges in Texas (Project M-PACT)," a rapid response surveillance study of tobacco use among Texas college students.

Participants

Participants were students attending one of twenty-four 2- and 4-year colleges in the 5 counties surrounding the 4 largest metropolitan areas in Texas (Houston, Dallas/ Ft. Worth, San Antonio, Austin). There were 2 eligibility criteria for participating students. First, participants were required to be full- or part-time degree-seeking undergraduate students attending a 4-year college or a vocational/technical program at a 2-year college. Recruitment at 2-year colleges was limited to students enrolled in vocational/technical programs because they have an elevated prevalence of cigarette use[28] and in turn use of alternative tobacco products.[29,30] Secondly, participants were required to be 18–26 years old if they were a lifetime non-tobacco user or 18–29 years old if they were a lifetime tobacco user. Lifetime tobacco use was defined by having ever smoked at least 100 cigarettes, or at least 20 cigars, or having ever used smokeless/spit/chewing tobacco at least 20 times. Because overall goals of the surveillance study are to examine transitions in tobacco use and since initiation is unlikely to occur after the age of 26,[31] lifetime non-tobacco users over the age of 26 were excluded from participation.

Procedure

A total of 65 colleges were identified in the 4 target cities. Three colleges of each type were selected from each city, for a total of 6 colleges per city, to comprise a total of 24 colleges (twelve 2-year colleges with vocational programs and twelve 4-year colleges). Eligible students attending the 24 colleges were recruited to participate in the online survey via e-mail invitation, which included a link to an eligibility survey. Students at 15 schools received an invitation e-mail from project staff, whereas students at the remaining schools received the e-mail invitation from a school administrator. The introductory invitation provided a brief description of the study and a hyperlink to the survey. Students receiving an e-mail invitation from project staff received a reminder e-mail 5 days after the introductory invitation and then again 6 days later. Upon completion of the survey, each student received a $10 e-gift card and all students were entered into a drawing to win one of twenty $50 e-gift cards. Overall, 13,714 students were eligible to participate in the study, and of these, 40% (*n* = 5,482) provided consent and completed the survey. This rate of participation is similar to, or exceeds, other online studies of college students.[32,33] The university's institutional review board (IRB) approved this study's protcol and procedures.

Measures

Measures for the current study were modeled after existing surveys and were initially reviewed by 9 tobacco control experts who provided guidance on revisions. Final item

modifications were conducted through an iterative process of cognitive interviewing[34] with 25 young adults who were not part of the present study.[35]

Outcome variables

This paper focuses on 4 outcome variables. The first and second outcome variables measure absolute risk perceptions of e-cigarettes and cigarettes. For each product, the survey question asked: "How harmful are — products to health?" There are 4 response options ranging from "1 = not at all harmful" to "4 = extremely harmful." For analysis of both variables, responses were collapsed into 3 categories because of small cell size. Those with a code of 1 or 2 were collapsed to represent the no/low perceived harm category, those with a code of 3 represent the medium perceived harm category, and those with a code of 4 represent the extreme perceived harm category. The third and fourth outcome variables measured the absolute perceived addictiveness of e-cigarettes and cigarettes. For each product, the survey question asked, "How addictive are — products?" Three response options were given, including "not at all addictive," "somewhat addictive," and "very addictive."

Exposure

Current user status of e-cigarettes and/or cigarettes was the exposure of interest. To assess past-30-day use of e-cigarettes, respondents were asked, "During the past 30 days, have you used any ENDS (ie, an e-cigarette, vape pen, or e-hookah), even one or two puffs, as intended (ie, with nicotine cartridges and/or e-liquid/e-juice)?" Responses were yes/no. To assess past-30-day cigarette smoking status, respondents who indicated they have ever tried cigarette smoking (even 1 or 2 puffs) were asked, "On how many of the past 30 days did you smoke cigarettes?" Responses greater than zero days were considered past-30-day use.

Based on these questions, user status was examined in 4 categories. Respondents who selected that they had not used either e-cigarettes or cigarettes in the past 30 days represented the "nonuser" group. Respondents who selected that they have used e-cigarettes (but not cigarettes) in the past 30 days represented the "e-cigarette only" group. Respondents who selected that they have used cigarettes (but not e-cigarettes) in the past 30 days represented the "cigarette only" group. Respondents who selected that they had used both e-cigarettes and cigarettes in the past 30 days represented the "dual user" group.

Covariates

The following covariates were included in the multivariable models to control for effects of sex, age, race/ethnicity, past-30-day use of other tobacco products, school type (2-year/vocational or 4-year college), and parental education. A new variable was created to assess additional tobacco product use and included the number of tobacco products the respondent had used at least once in the past 30 days, including hookah, cigars, and/or smokeless tobacco.

Statistical methods

Descriptive statistics were calculated on user status, sex, race/ethnicity, age, number of other tobacco products used, parental education, and school type across the 3 levels of perceived harm and addictiveness. Multinomial regression analyses were used to test the primary

hypothesis to investigate if e-cigarette and/or cigarette user status (ie, e-cigarette only, cigarette only, and dual use) was associated with perceptions of risk and addictiveness for e-cigarettes and cigarettes.

Separate multinomial logistic regression models were conducted for each 3-level outcome (perceived harm and perceived addictiveness), with e-cigarette and cigarette user status as the independent variable. The nonuser group served as the reference category in the regression; however, to make additional comparisons between user groups (ie, cigarette only versus e-cigarette only, cigarette only versus dual users, and e-cigarette only versus dual users), the 95% confidence intervals around each estimate were examined. Estimates for which the intervals did not overlap were considered significantly different from one another. For perceived harm, the multinomial regression model included the following comparisons: no/low relative to extreme harm and medium relative to extreme harm, where extreme harm served as the reference category. For perceived addictiveness, the multinomial regression model included the following comparisons: not at all relative to very addictive and somewhat relative to very addictive, where very addictive served as the reference category.

Missing data due to nonresponse or a response of "don't know" ranged from 0% to 1.5%; therefore, a complete case analysis was performed.[36] The overall sample size was 5,482; the analyses presented here included the complete cases ($n = 5{,}203$). School level clustering was accounted for by adjusting the standard errors to account for within-cluster correlation.[37] The Hosmer-Lemeshow goodness of fit test for multinomial logistic regression was conducted to evaluate model fit.[38] Analyses were conducted using STATA 13.1 (College Station, TX).

Results

Sample characteristics

Descriptive statistics for the variables of interest are displayed in Table 1. The majority of college students in the sample were female, the average age was approximately 21 years, and the sample was racially and ethnically diverse. Seven in 10 students did not use either cigarettes or e-cigarettes. Exclusive cigarette users constituted 12% of the sample, followed by dual users (9%) and exclusive e-cigarette users (8%), respectively.

Perceived harm and addictiveness

As seen in Figures 1 and 2, although the overwhelming majority of college students saw conventional cigarettes as extremely harmful (84%) and very addictive (86%), almost the exact opposite was observed for e-cigarettes, where 79% of students saw e-cigarettes as posing little to moderate harm and 71% saw them as not or somewhat addictive.

Results from the adjusted multinomial logistic regression for perceived harm of e-cigarettes and cigarettes are presented in Table 2. Results for perceived addictiveness of e-cigarettes and cigarettes are presented in Table 3. The Hosmer-Lemeshow goodness-of-fit tests for all models were not significant, indicating good model fit (see Tables 2 and 3).

E-cigarettes

Compared with nonusers, exclusive e-cigarettes users were equally likely to report that e-cigarettes pose medium harm and almost 3 times as likely to report that they pose low to no harm. Similarly, compared with nonusers, exclusive cigarette smokers were equally likely to report that e-cigarettes pose medium harm and 20% more likely to report that they pose low to no harm. In contrast, compared with nonusers, dual users were twice as likely to report that e-cigarettes pose medium harm and 3.5 times as likely to report that they pose little to no harm. By comparing 95% confidence intervals to determine differences between both exclusive and dual user groups, it is evident that both the e-cigarette only and the dual users were more likely to report that e-cigarettes pose low to no harm compared with the cigarette only smokers (Table 2).

Compared with nonusers, all 3 user groups were more likely to view e-cigarettes as less than very addictive. No differences between exclusive and dual user groups were found in perceptions of addictiveness of e-cigarettes (Table 3).

Cigarettes

Compared with nonusers, exclusive cigarette smokers were 2.3 times more likely to report that cigarettes pose medium harm and 3.1 times more likely to report that they pose no to low harm. In contrast, compared with nonusers, exclusive e-cigarette users were equally likely to report that cigarettes pose medium and no to low harm. Dual users were 2.1 times more likely to report that cigarettes pose medium and 2.3 times more likely to report that they pose no to low harm, compared with nonusers. Again, by comparing 95% confidence intervals to determine differences between both exclusive and dual user groups, exclusive cigarette smokers and dual users were more likely to report that cigarettes posed medium harm than exclusive e-cigarette users (Table 2).

Compared with nonusers, exclusive cigarette smokers were 2.7 times more likely to report that cigarettes were somewhat addictive and 1.9 times more likely to report that they were not at all addictive. Exclusive e-cigarette users were equally likely to report that cigarettes were somewhat addictive and 1.8 times more likely to report that they were not at all addictive compared with nonusers. Compared with nonusers, dual users were 1.9 times more likely to report that cigarettes were somewhat addictive and 1.8 times more likely to report that they were not at all addictive. By comparing 95% confidence intervals, exclusive cigarette users were more likely to report that cigarettes were somewhat addictive compared with exclusive e-cigarette users (Table 3).

Comment

This study evaluates perceptions of harm and addictiveness of e-cigarettes in a population of college students, adding to the relatively limited literature on the perceptions of e-cigarettes among young adults and confirming the association between lower perceived risk and tobacco product use. Rather than using measures of relative harm and addictiveness, the current study employs comparisons of absolute risk, allowing us to compare the magnitude of differences between perceptions of cigarettes and e-cigarettes. This study also extends the

existing body of literature by differentiating the association among dual users, cigarette only, and e-cigarette only users. Results show that, in general, college students who used e-cigarettes and/or cigarettes perceived the product used as less harmful and addictive compared with the perceptions of those who did not use either product. Further, e-cigarettes were perceived to be *much* less harmful than cigarettes, for all user categories.

Findings from this study confirm what we currently know about conventional cigarettes and risk perceptions: that college student smokers underestimate the risk of health effects from smoking.[39] Results further expand upon the emerging literature evaluating perceptions of harm and addictiveness of e-cigarettes in relation to use of such products in young adults or college students, from which findings have been mixed. Agarwal and Loukas[7] found that college students who perceived lower absolute harm from e-cigarettes had a higher probability of current e-cigarette use, and 2 other studies found similar results, although researchers used a relative measure comparing e-cigarette harmfulness with conventional cigarettes among college students[40] and young adults.[3] In contrast, Sutfin et al[8] found that e-cigarette use was associated with a lack of knowledge about the relative harm of e-cigarettes compared with conventional cigarettes in college students. In another study of young adults, positive perceptions (an index including both perceived harm and addictiveness) of e-cigarettes were higher among cigarette smokers, but not among e-cigarette users.[23]

Our findings regarding dual use and perceived harm of e-cigarettes and cigarettes were contrary to what one might expect. Although it seems intuitive that, compared with nonusers, the effect would be strongest in the dual user group, this was only true when examining the perceived harm of e-cigarettes. This finding generally aligns with another study of college students, in which poly-tobacco users reported lower perceived danger for most alternative tobacco products (including e-cigarettes) than exclusive users of cigarettes and exclusive users of alternative tobacco products.[27] However, contrary to expectations, the current study also found that the effect for the relationship between low perceived harm of traditional cigarettes and use was strongest in the cigarette only group compared with nonusers.

Perceived addictiveness of e-cigarettes has been evaluated in very few studies to date, and none have linked e-cigarette use to low perceived addictiveness. Two previous studies among a wide range of adults found that younger adults and current conventional cigarette smokers were more likely to believe that e-cigarettes were less addictive than conventional cigarettes.[5,41] Choi and Forster[3] found that among young adults, ever e-cigarette use was not associated with the belief that e-cigarettes were less addictive than cigarettes; however, current smokers believed that e-cigarettes were less addictive than conventional cigarettes. In the current study, all 3 user groups were more likely to report that e-cigarettes were not at all or somewhat addictive compared with nonusers. Interestingly, compared with nonusers, the effect size for this association was greatest for the e-cigarette only group. This finding has not been reported previously, so the explanation for the strong association is not entirely apparent. Perhaps believing that e-cigarettes are not at all or somewhat addictive is an antecedent to use, and individuals who use only e-cigarettes have been more greatly influenced by e-cigarette marketing or advertisements claiming that e-cigarettes are generally safe or healthy.[42] It is also possible that it is a belief following e-cigarette use, and

that individuals who use only e-cigarettes do not "feel" addicted or have few or minimal cravings. Future research is needed to understand the nature and directionality of this association more clearly.

For cigarettes, both dual users and cigarette only users were more likely to report that cigarettes were not at all or somewhat addictive compared with nonusers. Similarly, the effect size was largest in the cigarette only group. It is possible that the dual users are using e-cigarettes to quit or reduce smoking conventional cigarettes, and for this reason do not have the lowest perceptions of addictiveness for cigarettes. Future research should explore harm perceptions of tobacco products with consideration of motivations for use or relative to self-reported measures of nicotine addiction.

The current study demonstrates vast differences in overall perceptions of cigarettes and e-cigarettes. The serious health effects and addictive nature of conventional cigarettes appear to be well understood among the sample as a whole. However, consistent with 2 previous studies, we found that a low degree of perceived harm and addictiveness of e-cigarettes was a commonly held belief among young adults.[3,23] These findings warrant attention, as recent literature suggests that e-cigarette aerosol (vapor) contains toxic substances that could be harmful,[43,44] and some e-cigarettes have been shown to deliver higher amounts of nicotine than conventional cigarettes.[45]

This study offers important information on the perceptions of e-cigarettes within a context of rapidly increasing young adult exposure to advertising of these novel devices,[46] as well as unregulated marketing strategies that include themes such as sexual imagery, freedom, and rebellion, among others, that are appealing to young populations.[47] College students' perceptions of e-cigarettes may, at least in part, be influenced by how they are portrayed through advertising. Given that e-cigarette marketing is not currently regulated in the same way as conventional cigarettes, its scope is more far-reaching than advertising and marketing for conventional cigarettes. In 2012, for example, 2 leading e-cigarette brands began airing cable television advertisements,[48] a practice that has been banned for conventional cigarettes for over 40 years. Although e-cigarettes are not approved smoking cessation aids, and their short- and long-term safety has not been consistently evaluated, advertisements for these products and information present on social media platforms, such as Twitter, often suggest otherwise.[49,50]

These findings have several implications for tobacco regulation and public health practice. In May 2016, as authorized by the Family Smoking Prevention and Tobacco Control Act (2009), the Food and Drug Administration (FDA) released a final rule to extend its regulatory authority to include other tobacco products, including e-cigarettes. Current results provide scientific rationale supporting FDA's need to regulate e-cigarettes. FDA's final rule assures that makers of e-cigarettes are only able to make direct and implied claims of reduced risk if FDA determines there is scientific evidence to do so.[51] In addition, the rule also requires manufacturers to include health warnings to newly regulated products. Health warnings have been shown to be influential factors in communicating risks from tobacco products and may deter their use.[52]

The current study shows that risk perceptions and perceived addictiveness are associated with current use of e-cigarettes and cigarettes and that there are much lower perceptions of risk and addictiveness for e-cigarettes compared with cigarettes. These findings highlight the need to communicate to college students that the use of any tobacco product is more harmful than the use of none, shifting the commonly used referent of comparison from cigarettes to no tobacco use.[53] Furthermore, health educators should acknowledge dual use in existing prevention and intervention programs for college students.

Strengths and limitations

This study has at least 2 limitations. First, it is cross-sectional that prevents us from making causal inferences regarding the findings. More research is needed with a longitudinal design to better understand if the perceptions explored are antecedents or successive to e-cigarette use. Further, the study population was limited to Texas students in 2-year colleges/vocational schools and 4-year universities. Therefore, findings may not be generalizable outside of the study's sample. However, an important strength of this study is our use of a measure of absolute rather than relative harm and addictiveness, adding to the limited number of studies assessing perceptions of these products without using a relative measure comparing e-cigarettes with conventional cigarettes in a young adult population.[7,23,27,54] In fact, recent research has warned about the unintended consequences of comparing perceived risk across tobacco products (and using cigarettes as the default comparison) in the current landscape of increasing tobacco product options as it reinforces the belief that the health effects of tobacco use can be lessened by substituting other products for cigarettes.[53] The current study's method of measuring perceived risk of alternative and conventional tobacco products in separate questions is preferred as it allows for absolute comparisons and avoids the scenario in which respondents rate the alternative product more positively in relation to cigarettes than they would in isolation.[55]

Conclusion

A striking percentage of college students hold the belief that, unlike conventional cigarettes, e-cigarettes are low in harmfulness and addictiveness. This belief was found to be tied to current use of e-cigarettes, and the relationship between low perceived risk and use was not necessarily largest in the dual user group. Results suggest that individuals who believe these products present a low degree of harmfulness and addictiveness may be more inclined to use them, and e-cigarette users are likely to be misinformed. Public health professionals and college administrators should implement tobacco programs and policies for college students that clarify misperceptions about the addictiveness of nicotine and potentially harmful effects of e-cigarette use.

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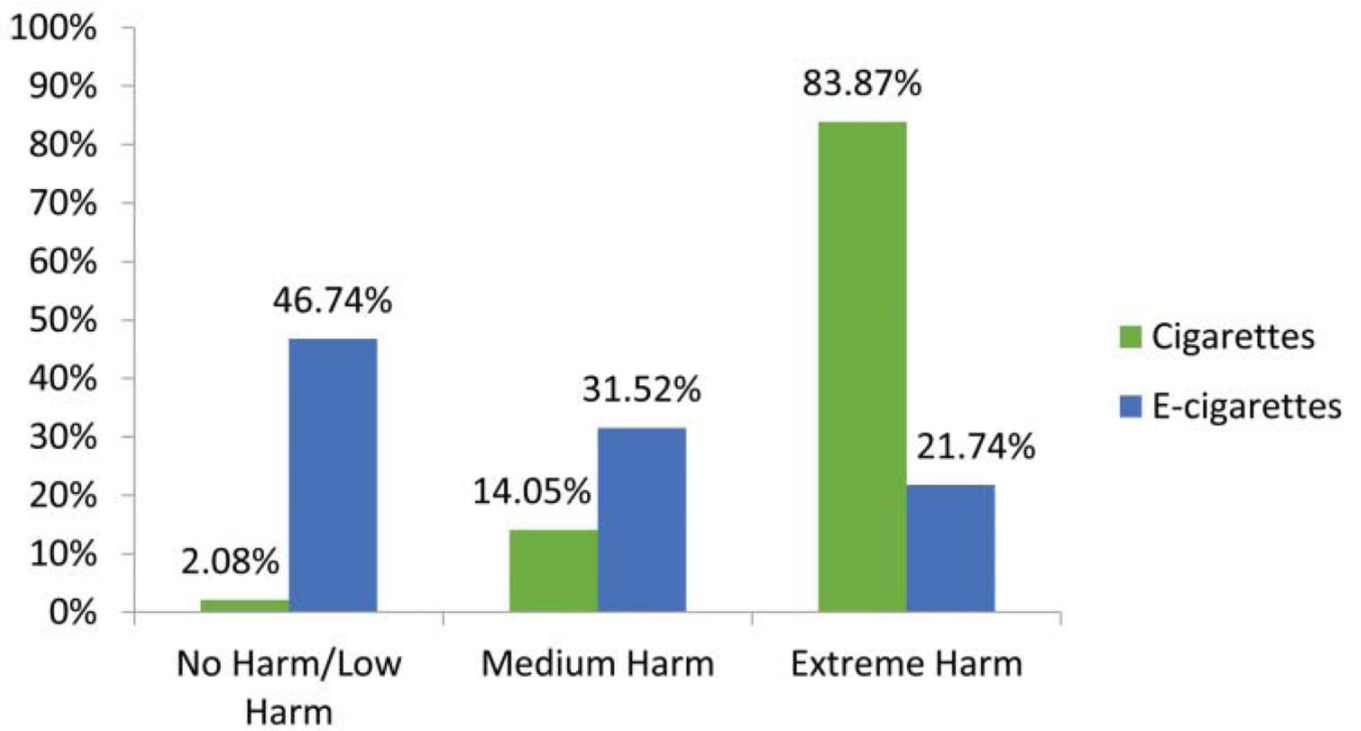**Figure 1.**
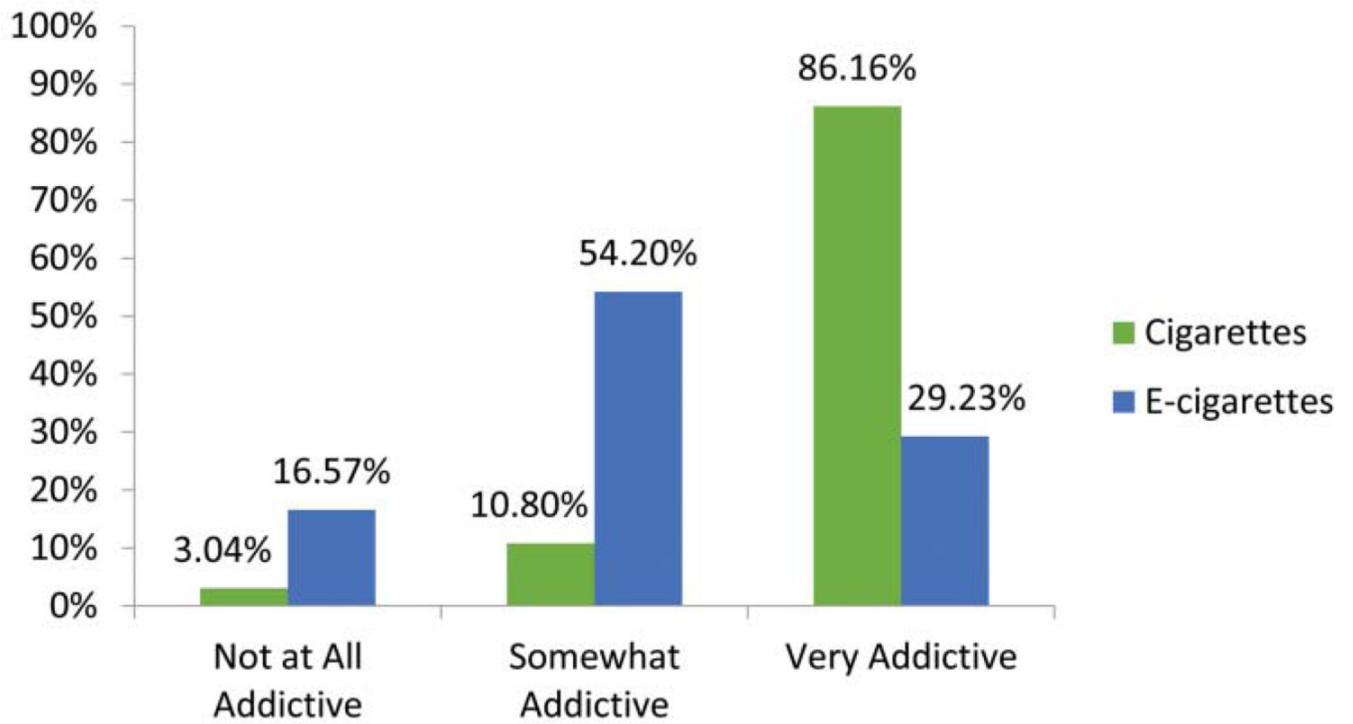Perceived harm of e-cigarettes and cigarettes among college student users and nonusers ($n = 5,203$).

Figure 2.
Perceived addictiveness of e-cigarettes and cigarettes among college student users and nonusers ($n = 5,203$).

Table 1

Sociodemographic characteristics and tobacco use behaviors of college student population, ages 18–29 ($n =$ 5,203).

Characteristic	*n*	%
Gender		
Male	1,903	36.6%
Female	3,300	63.4%
Race		
White	1,951	37.5%
Hispanic	1,609	30.9%
Asian	967	18.6%
Black	418	8.0%
Other/multiple	258	5.0%
Mean age 95% CI	20.50 20.4–20.6	
Mother's education		
High school or below	1,318	25.3%
Some college/2-year degree	1,796	34.5%
Bachelor's or higher	2,089	40.2%
Father's education		
High school or below	1,506	28.9%
Some college/2-year degree	1,224	23.5%
Bachelors or higher	2,473	47.5%
School type		
4-year college	4,831	92.9%
2-year/vocational college	372	7.2%
Current user status		
Nonuser	3,663	70.4%
Cigarette only	633	12.2%
E-cigarette only	429	8.3%
E-cigarette + cigarette	478	9.2%
Number other tobacco products (current use)		
0 products	3,994	76.8%
1 product	917	17.6%
2 or 3 products	292	5.6%

Table 2

Adjusted multinomial logistic regression of perceived harm of e-cigarettes and cigarettes.

| | E-cigarettes | | | | | | Cigarettes | | | | | |
| | Medium vs extreme harm[a] | | | No/low vs extreme harm[a] | | | Medium vs extreme harm[b] | | | No/low vs extreme harm[b] | | |
Cigarette use	OR[c]	95% CI	p value[d]	OR[c]	95% CI	p value[d]	OR[c]	95% CI	p value[d]	OR[c]	95% CI	p value[d]
Nonuser (reference)	1.00		—	1.00		—	1.00		—	1.00		—
Cigarette only	1.12	0.89–1.40	.330	1.20	1.01–1.43	**.043**	2.26	1.77–2.89	**<.001**	3.12	1.68–5.82	**<.001**
E-cigarette only	1.37	0.97–1.93	.077	2.97	2.08–4.26	**<.001**	0.90	0.66–1.22	.493	2.03	0.93–4.41	.073
E-cigarette + cigarette	2.02	1.40–2.93	**<.001**	3.48	2.76–4.38	**<.001**	2.10	1.59–2.79	**<.001**	2.29	1.10–4.76	**.027**

[a]*Note.* The Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 10.66$, $p = .830$; reference is extreme harm.

[b]The Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 25.13$, $p = .068$; reference is extreme harm.

[c]Odds ratios adjusted for sex, race/ethnicity, age, total number of other tobacco products (cigars, hookah, and smokeless tobacco), mother's education, father's education, and school type.

[d]Bolded *p* values indicate significance when $\alpha < .05$.

Table 3

Adjusted multinomial logistic regression of perceived addictiveness of e-cigarettes and cigarettes.

| | E-cigarettes | | | | | | Cigarettes | | | | | |
| | Somewhat vs very addictive | | | Not at all vs very addictive | | | Somewhat vs very addictive[c] | | | Not at all vs very addictive[c] | | |
Cigarette use	OR[c]	95% CI	p value[c]	OR[c]	95% CI	p value[c]	OR[c]	95% CI	p value[c]	OR[c]	95% CI	p value[c]
Nonuser (reference)	1.00	—	—	1.00	—	—	1.00	—	—	1.00	—	—
Cigarette only	1.54	1.29–1.84	**<.001**	2.11	1.43–3.12	**<.001**	2.70	2.10–3.49	**<.001**	1.87	1.19–2.92	**.006**
E-cigarette only	1.76	1.46–2.13	**<.001**	3.52	2.85–4.34	**<.001**	1.20	0.90–1.60	.206	1.82	1.26–2.62	**.001**
E-cigarette + cigarette	1.62	1.37–1.91	**<.001**	2.36	1.67–3.36	**<.001**	1.92	1.50–2.46	**<.001**	1.79	1.10–2.90	**.019**

[a]*Note.* The Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 18.32$, $p = .306$; reference is very addictive.

[b]The Hosmer-Lemeshow goodness-of-fit test: $\chi^2 = 10.26$, $p = .853$; reference is very addictive.

[c]Odds ratios adjusted for sex, race/ethnicity, age, total number of other tobacco products (cigars, hookah, and smokeless tobacco), mother's education, father's education, and school type.

[d]Bolded *p* values indicate significance when $\alpha < .05$.