Published in final edited form as:

Addiction. 2015 December ; 110(12): 2015–2024. doi:10.1111/add.12838.

Effect of warning statements in e-cigarette advertisements: an experiment with young adults in the US

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Abstract

Background and Aims—This on-line experiment examined whether the addition of ingredient- or industry-themed warning statements in television advertisements for e-cigarettes would affect young adults' craving for and risk perceptions of e-cigarettes and combustible cigarettes, as well as intent to purchase e-cigarettes.

Design—Advertisements for two leading e-cigarette brands were edited to contain a warning statement about product ingredients or about the tobacco industry. Participants were assigned randomly to one of eight treatments or one of two brand-specific control conditions without any warning statement.

Participants—Young adults (n=900, ages 18–34 years) in a web panel were recruited from three groups: recent e-cigarette users, current smokers who used combustible cigarettes exclusively and non-users of either product.

Measurements—Craving and risk perceptions (addictiveness, harmful to health in general, harmful to others) were measured separately for e-cigarettes and combustible cigarettes. The Juster scale measured intention to purchase e-cigarettes.

Findings—Exposure to both types of warnings was associated with lower craving for e-cigarettes among e-cigarette users and smokers who experienced any craving ($P < 0.01$) and lower intention to purchase among all participants ($P < 0.001$). Only exposure to ingredient-themed warnings was associated with lower craving for combustible cigarettes ($P < 0.05$). Participants who saw industry-themed warnings reported greater perceptions of general harm ($P < 0.001$), but also rated e-cigarettes as less addictive than the control conditions ($P < 0.05$).

Conclusion—The addition of ingredient- or industry-themed warning statements to e-cigarette television advertising similarly reduces craving and purchase intent for e-cigarettes, but has inconsistent effects on perceived risks.

Keywords

Advertising; craving; e-cigarettes; intention to purchase; perceived risk; warning labels

INTRODUCTION

Electronic cigarettes (e-cigarettes) are battery-powered, plastic devices that simulate the experience of smoking by heating a flavored solution that usually contains nicotine to create vapor [1, 2]. Although there is evidence that e-cigarette vapor contains toxicants (e.g. acetone and isoprene) and nicotine [3], the exhaled vapor is comparatively less harmful than cigarette smoke [4, 5]. Debate about the efficacy of e-cigarettes for smoking cessation stems from inconsistencies between evidence from randomized clinical trials [with results for e-cigarettes comparable to nicotine replacement therapy(NRT)] [1, 6] and evidence from epidemiological surveys, some of which find lower rates of quit attempts and cessation among dual users [7] and others report higher rates of cessation among smokers who used e-cigarettes than NRT or no aid [8].

In the United States, e-cigarette use is most prevalent among young adults [9]. In a sample of current smokers and recent quitters, 31.5% of young adults aged 18–29 years had tried e-cigarettes and the odds of trying in this age group were twice that of older respondents [10]. Although the majority of e-cigarette users are also smokers [11, 12], e-cigarette use is not exclusive to current and former smokers. Among convenience samples of college students in North Carolina and Hawaii, the prevalence of e-cigarette use ranged from 5 to 28%, and the proportion who were never smokers ranged from 12 to 16% [13][14].

Exposure to widespread marketing is a probable explanation for the increasing popularity of e-cigarettes and for product trial among never smokers. E-cigarette advertising has been criticized for using tactics that are forbidden for combustible cigarettes, including celebrity endorsements, cartoon characters and sponsorship of sporting events [15, 16. Between 2011 and 2013, US young adults' exposure to televised advertisements for e-cigarettes increased by 321% [17].

E-cigarette use so closely mimics smoking so closely that exposure to television advertising could stimulate urges to smoke. In laboratory settings, evidence from cue-reactivity studies indicates that exposure to cigarette imagery, including branded advertisements and pictures of people smoking are sufficient to elicit urges to smoke [18–21]. In a cross-sectional survey of Florida adults, current and former smokers who recalled seeing a televised advertisement for e-cigarettes reported greater urge to smoke combustible cigarettes [22]. Whether such findings translate to exposure to e-cigarette advertising is not known.

This study examined whether and how warning statements could alter young adults' reactions to televised advertisements for e-cigarettes. When designed effectively, warnings about smoking-related risk have reduced urge to smoke [23], increased perceived risks of smoking [24, 25] and decreased intent to purchase cigarettes [26, 27]. Anticipating that warning statements about e-cigarettes could serve similar functions, the current experiment tested the hypotheses that exposure to warning statements embedded in e-cigarette advertisements would be associated with lower craving, greater perceived risk associated with e-cigarette use and lower intent to purchase the product. Although it may seem illogical to warn consumers about a product to compete with smoking that may be considerably safer

than smoking, televised advertising for e-cigarettes could have unanticipated adverse consequences, including stimulating urges to smoke and recruiting non-smokers to use a product that typically contains nicotine. Little is known about long-term, low-level use of nicotine by young people, and while there is no definitive harm, there is possible risk.

This study compared two message frames for warning statements that are common in anti-smoking campaigns: ingredient- and industry-themed warnings. Although we did not have a priori hypotheses about the relative effectiveness of these themes, their selection was informed by previous research. US law requires that manufacturers communicate about harmful constituents in tobacco products [28], and messages that communicate negative health effects of nicotine and toxicants may be effective in motivating cessation [25]. Similarly, anti-industry messages have been persuasive with young adults [29], and an effective deterrent to smoking initiation among adolescents [25, 30]. In the United States, most e-cigarette companies are not tobacco companies [31], but the three largest US tobacco companies produce e-cigarettes [32] and the industries are linked inextricably by membership in the same trade associations [33–35].

DESIGN

This on-line experiment examined the impact of warning statements on young adults' reactions to televised e-cigarette advertisements using a between-subjects factorial design (brand $\times$ type of warning frame $\times$ repetition within warning). Within three user groups (recent e-cigarette users, smokers, non-users of either) defined further below, the participants (n=900) were assigned randomly to one of eight treatment or two control conditions. The treatment conditions represented the combination of two top-promoted US brands, two categories of warnings (industry or ingredient) and two messages for each frame. The control condition for each brand contained no warning.

PARTICIPANTS

Young adults were the focus of this experiment because this age group (18–34 years) is targeted by the tobacco industry [36, 37] and because tobacco use behaviors associated with long-term use are consolidated in early adulthood [38, 39]. Participants were members of a 6000-person US web panel managed by Global Market Insight (GMI), which recruits panelists through social media, other panels, listservs and other methods. Panelist responses to screening questions about use of e-cigarettes and combustible cigarettes defined three user groups: Recent e-cigarette users (n=300) had used e-cigarettes at least once in the past 6 months, regardless of their smoking status. Smokers (n=301) had not used e-cigarettes in the past month, smoked at least 100 combustible cigarettes in their life-time and currently smoked every day or some days. Non-users (n=299) had not tried an e-cigarette in the past 6 months or smoked 100 cigarettes in their life-time.

STIMULI

We created multiple industry- and ingredient-themed warning statements based on information from several sources [40–43] and pre-tested the statements with young adults

(n=60) from the GMI panel. For each theme, we selected the two statements that were rated as being the most believable, convincing and important and new. These criteria have been used to evaluate the efficacy of anti-smoking advertisements [44]. Pre-test participants were not eligible for the subsequent experiment.

Previously broadcast television advertisements for each of the two brands portrayed a male character using the product and featured relevant cues, including branded packing, exhaled vapor and verbal references to smoking. We edited the two advertisements to create five versions of each: two with ingredient warnings (e.g. 'E-cigarettes contain at least 10 toxic substances including lead and formaldehyde'), two with industry warnings (e.g. 'Some e-cigarettes are made by tobacco companies that have been convicted of fraud and racketeering'), and a control version without any warning (see Supporting information, Appendix for warning statements). In the treatment versions, a warning appeared for the entire 30 seconds on an 80% opaque black rectangle that occluded 20% of the screen. In the control versions, the same rectangle appeared without any warning so that occlusion of other visual cues was equivalent.

PROCEDURES

Consent was obtained following procedures approved by a medical school institutional review board (IRB). Participants were asked to complete screening questions about product use and other covariates. Before watching one of the 10 edited television advertisements, participants were instructed to optimize the viewing window and volume, and then asked to identify a sound in an audio test. After exposure, participants answered questions about craving, purchase intent, and perceived risk, in that order. Participants received US\$10 in panel reward points, and a target sample size of 900 was derived from a power calculation.

MEASURES

Craving and perceived risk were measured separately for e-cigarettes and combustible cigarettes in that order. Purchase intent was measured for e-cigarettes only.

Craving

A subset of items from the brief Questionnaire of Smoking Urges (QSU-brief) [45] were adapted to measure craving separately for e-cigarettes and combustible cigarettes, in that order. Using a scale from 0 to 100, participants responded to three statements: 'I have a desire for an e-cigarette [tobacco cigarette] right now,' 'If it were possible I would vape [smoke] right now' and 'I have an urge for an e-cigarette [tobacco cigarette]'. Items were averaged to measure craving for both e-cigarettes (Cronbach's $\alpha=0.97$) and combustible cigarettes (Cronbach's $\alpha=0.97$).

Perceived risk

Using a seven-point scale, participants rated e-cigarettes and combustible cigarettes on addictiveness, harm to health in general, and harm to others. The three items were not combined in a single scale, because they reflect conceptually distinct issues [46].

Purchase intent

Participants indicated their probability of purchasing an e-cigarette of any brand during the next 3 months using the Juster scale, with responses ranging from 10='certain, practically certain (99 in 100) to 0=no chance, almost no chance (1 in 100)' [27]. Because of a highly positively skewed distribution, the responses were collapsed into three categories based on natural breaks in the distribution [median=2, interquartile range (IQR)= 7] and on item wording (e.g. 0=no chance, almost no chance, 1=very slight possibility to fairly good possibility, 2=good possibility to certain). The Juster scale is a predictor of purchase behavior and was used to evaluate consumer responses to warnings and plain packaging [27].

COVARIATES

Marketing exposure

Two items were summed to measure past-month exposure to e-cigarette marketing on television/cable and at the point of sale. Responses were summed: never (0), once or twice (1), three or four times (2), five times or more (3) and not sure (0) and then recoded into low (0) medium (1–2) and high (3–6).

Demographics

Participants reported their age, gender, race/ethnicity, and level of education. Given the distribution of race in the sample, analyses compared whites (reference category) and non-whites; level of education compared high school or less (reference category) with some college and with 4 or more years of college.

Smoking and e-cigarette use

To compare the associations of smoking and e-cigarette use with study outcomes, we created separate variables for smoking status (non-smoker, non-daily smoker, and daily smoker) and e-cigarette use status, which was recoded from participant screening questions as never user, past user (used but not in the past 30 days), or current user (used in the past 30 days).

ANALYSES

The reason for studying two different brands and two versions of each thematic warning was to avoid case-category confound [47]. For all analyses, data were collapsed over brand, because we had no a priori hypotheses about brand differences and there were none. In addition, data were collapsed over warning statements within category (industry version 1 and industry version 2) because, across all outcomes, there were no significant differences between the two statements within each warning category.

Hypothesis 1: Craving

Exposure to warning statements will be associated with lower craving for e-cigarettes and combustible cigarettes. This analysis was restricted to e-cigarette users and smokers (n=565), because self-reported craving by participants who never tried the product was not of interest. Ordinary least squares (OLS) regression was suitable to examine correlates of

craving for combustible cigarettes among all e-cigarette users and smokers. However, for e-cigarettes, the distribution of craving (from 0 to 100) was non-normal, with a spike at zero and a uniform distribution at values greater than zero. Following an analytic strategy used previously [48], we first used logistic regression to examine whether exposure to warnings was associated with any craving (greater than 0) for e-cigarettes. For those who reported any craving for e-cigarettes, OLS regressions examined whether exposure to warnings, alone or in combination with other factors, suppressed craving.

Hypothesis 2: Perceived risk

Exposure to warning statements will be associated with greater perceived addictiveness, general harm and harm to others for e-cigarettes and combustible cigarettes.

A multivariate analysis of variance (MANOVA) tested for a main effect of the warning manipulation on perceived risk and tested simultaneously for the unique effect of experimental condition on each of three measures about perceived risk. MANOVA was selected because risk perceptions were correlated ($r = 0.34$ – 0.70 for e-cigarettes, and $r = 0.46$ – 0.78 for combustible cigarettes). Statistical significance for planned comparisons was reported with Sidak corrections for multiple tests.

Hypothesis 3: Purchase intent

Exposure to warning statements will be associated with lower intent to purchase e-cigarettes. Although purchase intent is typically modeled as a continuous variable [27], the distribution was significantly non-normal with natural breaks in the data that corresponded to tertiles. An ordinal logistic regression was used to test whether exposure to warnings was associated with lower intent to purchase, controlling for e-cigarette use, smoking status and other factors.

For all outcome measures (craving, perceived risk, and purchase intent), we tested for first-order interactions of experimental condition with e-cigarette use and with smoking status, but none were significant.

RESULTS

Of the initial 2209 subjects recruited to participate in this study, 1729 completed the inclusion questions (78% response rate) and 1220 were eligible after screening. Of the screened participants, 319 were not retained after filling quotas for e-cigarette and combustible cigarette use or were missing data. Prior to the experimental manipulation, we administered a brief audio test to confirm that participants could hear the video; 155 participants who did not identify the correct sound were excluded. The analysis sample also excluded 52 participants with unusually long completion time (over 83 minutes), which raised concern about elapsed time between exposure and outcomes. The analysis sample ($n = 847$) excluded one additional participant with missing data for a covariate. Exclusions were unrelated to experimental condition.

The analysis sample [mean age=25.4 years, standard deviation (SD)=4.8] was primarily non-Hispanic white (62.0%) with at least some college education (78.2%). A total of 34.2% were

non-daily smokers and 29.5% were daily smokers, 58.9% had never used e-cigarettes, 19.7% were past users of e-cigarettes and 21.4% used e-cigarettes at least once in the past 30 days (see Table 1 for additional information). Only 3.0% of current e-cigarette users in this sample were not current smokers.

Craving for combustible cigarettes

The average craving for combustible cigarettes measured after advertising exposure was 55.06, $SD=30.87$ among current smokers and e-cigarette users overall: mean craving=54.46, $SD=31.00$ among those exposed to industry warnings, mean=53.74, $SD=30.09$ among those exposed to ingredient warnings and mean=59.05, $SD=32.11$ in the control condition. In an adjusted model, exposure to ingredient warnings was associated with lower urge to smoke (coeff.= -7.12, $P = 0.034$), but exposure to industry warnings was not (see Table 2). In addition, greater exposure to e-cigarette marketing, being a smoker, using an e-cigarette in the past 30 days, being non-white and Hispanic were all associated with higher levels of craving for combustible cigarettes.

Craving for e-cigarettes

Any craving (greater than 0) for e-cigarettes measured immediately after advertising exposure was reported by 85.0% of e-cigarette users and smokers overall, 82.5% exposed to the industry warnings, 82.5% for ingredient warnings, and 88.3% for the control condition. There was no significant association of experimental condition and the likelihood of reporting any craving for e-cigarettes (see Supporting information, Appendix Table S2).

A subsequent analysis examined the effect of exposure to warning statements on the subset of 482 e-cigarette users and smokers who reported any craving for e-cigarettes. Table 2 reports adjusted means for the experimental conditions. Consistent with H1, lower levels of craving were associated with exposure to industry warnings (coeff.= -9.55, $P=0.006$) and ingredient warnings (coeff.= -11.98, $P=0.001$) compared to the control condition.

Characteristics associated with higher levels of craving were greater exposure to e-cigarette marketing, being non-white, being Hispanic, and having 4 or more years of college, and being a current e-cigarette user (Table 2).

Perceived risk

Participants perceived e-cigarettes as less addictive, less harmful in general and less harmful to others than combustible cigarettes (paired t-tests not shown, $P<0.001$). Consistent with H2, there was a significant effect of exposure to warning statements on perceived general harm of e-cigarettes, controlling for other participant characteristics (see Table 3). However, the effects were observed only for industry warnings. Figure 1 portrays the adjusted mean values for addictiveness, general harm and harm to others by experimental condition. Compared to the control condition, participants exposed to industry warnings perceived e-cigarettes to be more harmful in general ($P<0.001$), but less addictive ($P=0.046$). There was no effect of exposure to ingredient warnings on perceived risk of e-cigarettes. There was no effect of experimental treatment on perceived risk of combustible cigarettes.

Compared to participants with less frequent exposure to e-cigarette marketing, participants who reported the most frequent exposure perceived that e-cigarettes were more harmful ($P<0.002$), regardless of experimental condition (see Supporting information, Appendix Table S3). Smoking status was not correlated with risk perceptions, with the exception that non-daily smokers perceived e-cigarettes to be more addictive than did non-smokers ($P<0.017$) (Supporting information, Appendix Table S3).

Purchase intent

Consistent with H3, exposure to industry warnings [odds ratio (OR)= 0.052, $P=0.003$] and ingredient warnings (OR=0.41, $P<0.001$) was associated with lower odds of intending to purchase e-cigarettes, adjusting for all other participant demographics (see Table 4). More frequent exposure to e-cigarette marketing was associated with greater odds of intending to purchase the product. Smoking, using e-cigarettes in the past 30 days, being male, Hispanic and having 4 or more years of college were also associated with greater intent to purchase.

DISCUSSION

This is the first study that we are aware of to demonstrate that the addition of brief, text-based warning statements to televised advertisements for e-cigarettes reduced young adults' craving for combustible cigarettes and e-cigarettes, increased perceived risk of e-cigarette use and reduced intention to purchase an e-cigarette. Two different frames for warnings, ingredient- and industry-themed, produced similar effects on craving and purchase intent, but different effects on perceived risk.

Both ingredient and industry warnings were associated with lower levels of young adults' craving for e-cigarettes immediately after exposure to a television advertisement. In addition, there was some ancillary benefit in that exposure to ingredient warnings was also associated with lower craving for combustible cigarettes. Future research needs to examine the impact of multiple smoking-related cues (branded packaging, product and vapor) on urges to use e-cigarettes among non-smokers and on urge to smoke, particularly among smokers who are trying to quit.

Only industry warnings altered perceived risk of e-cigarette use among young adults. Compared to a control condition, participants exposed to industry warnings rated e-cigarettes as significantly more harmful than the control condition, but also less addictive than the control condition. In light of the counter-hypothetical finding, additional research is needed to understand what underlying processes explain how warning statements influence risk perceptions both in young adults and in adolescents. Ingredient warnings had no impact on young adults' risk perceptions of e-cigarettes. However, more effective warnings may be developed with evidence from future research about the ingredients and long-term use of e-cigarettes, as well as cytotoxicity [49–51].

Regardless of message frame, the presence of any warning statement reduced young adults' intent to purchase e-cigarettes after exposure to a television advertisement. Although similar evidence from experiments about cigarette packaging has informed more stringent regulation of tobacco marketing [27], policymakers will require considerably more evidence

about the relative benefits and risks of including warning statements on televised advertisements that reach consumers other than current smokers. Until more evidence accumulates about product safety, it is developing an evidentiary base to inform marketing restrictions and product labeling is important.

The strengths of this study were the comparison of different types of warning statements, the use of advertisements for different brands and multiple warning statements to avoid case-category confound and the adaptation of standard items to measure craving and risk perceptions for e-cigarettes. Unfortunately, the study did not measure intent to purchase combustible cigarettes, which may have been affected by the warnings. An important limitation is that the study did not address motives for and frequency of use of e-cigarette use, and future research should consider how these factors moderate young adults' responses to advertisements and warnings. Another limitation of this experiment was the lack of an unexposed control group. Although the study determined that exposure to any warning was better than none, it could not test whether exposure to any advertising was worse than none. In addition, the study did not measure elapsed time since last used e-cigarette or combustible cigarette among current users. It was not possible to know if this unmeasured variable differed by experimental condition or affected the results (e.g. number of days a participant used an e-cigarette in the past 30 days or the number of times per day they used), but it seems likely that any potential differences would be controlled by random assignment. Future research should include controls for previous craving or past 24-hour use, and should account for the possibility that e-cigarette users are using e-cigarettes because they are attempting to quit smoking. Finally, future research should also ask about combustible cigarette purchasing.

Regulations proposed by the US Food and Drug Administration may require warning statements about nicotine addiction on e-cigarette products, but did not specify any warning statements on e-cigarette advertising or eliminate television advertising for these products. This study suggests that requiring warning statements on e-cigarette advertising could mitigate potentially adverse consequences of marketing exposure on young adults, although it may reduce the intention of current adult smokers to purchase e-cigarettes. Countering the impact of unregulated e-cigarette advertising is important to protect public health by reducing uptake of a product with unknown potential for health risk. Future research needs to test warning statements on advertisements in other media, at the point of sale and on the products themselves.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This work was supported by the National Cancer Institute (grant number R01-CA067850) and the National Heart, Lung and Blood Institute (grant number T32-HL007034). Thanks are due to Trent Johnson, MPH and Nina Parikh, MPH for research assistance.

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Figure 1.
Perceived harms of combustible cigarettes and e-cigarettes among young adults (n=847), by experimental condition

Table 1

Demographic characteristics of participants, by experimental condition.

	Warning statements			
	Ingredient (n=340)	Industry (n=337)	None (control) (n=170)	Total (n=847)
	% (n)	% (n)	% (n)	% (n)
E-cigarette use				
Never user	59.1 (201)	57.9 (195)	61.6 (103)	58.9 (499)
Past user	18.5 (63)	21.1 (71)	19.4 (33)	19.7 (167)
Current user	22.3 (76)	21.1 (71)	20.0 (34)	21.4 (181)
Smoking status				
Non-smoker	36.8 (125)	35.0 (118)	37.7 (64)	36.3 (307)
Non-daily	27.7 (94)	30.0 (101)	32.4 (55)	29.5 (250)
Daily	35.6 (121)	35.0 (118)	30.0 (51)	34.2 (290)
E-cigarette marketing exposure				
Low	27.4 (93)	25.5 (86)	30.6 (52)	27.3 (231)
Medium	31.5 (107)	32.3 (109)	32.4 (55)	32.0 (271)
High	41.2 (140)	42.1 (142)	37.1 (63)	40.7 (345)
Age(years)				
18–24	48.2 (164)	52.5 (177)	50.0 (85)	50.3 (426)
25–34	51.8 (176)	47.5 (160)	50.0 (85)	49.7 (421)
Sex				
Male	49.7 (169)	50.4 (170)	50.0 (85)	50.1 (424)
Female	50.3 (171)	49.6 (167)	50.0 (85)	49.9 (423)
Race				
White	78.5 (267)	75.4 (254)	75.9 (129)	76.7 (650)
Non-white	21.5 (73)	24.6 (83)	24.1 (41)	23.3 (197)
Ethnicity				
Non-Hispanic	83.2 (283)	84.0 (283)	82.4 (140)	83.4 (706)
Hispanic	16.8 (57)	16.0 (54)	17.6 (30)	16.6 (141)
Education				

Warning statements				
	Ingredient (n=340)	Industry (n=337)	None (control) (n=170)	Total (n=847)
High school	23.0 (78)	21.1 (71)	21.2 (36)	21.8 (185)
Some college	38.2 (130)	37.4 (126)	40.0 (68)	38.3 (324)
4 years of college	38.8 (132)	41.5 (140)	38.8 (66)	39.9 (338)
	<u>Mean (SD)</u>	<u>Mean (SD)</u>	<u>Mean (SD)</u>	<u>Mean (SD)</u>
Days smoked in past month	22.93 (9.74)	21.34 (10.63)	23.65 (9.26)	22.90 (9.75)

There were no significant differences by condition for demographics (χ^2 tests) or days smoked [analysis of variance (ANOVA)]. For marketing exposure, responses were summed: never (0), once or twice (1), three or four times (2), five times or more (3) and not sure (0), and then recoded into low (0) medium (1–2) and high (3–6). E-cigarette use was categorized as never user, past user (used but not in the past 30 days) or current user (used at least once in the past 30 days). SD= standard deviation.

Correlates of craving for combustible cigarettes and e-cigarettes among e-cigarette users and current smokers immediately after advertising exposure.

Table 2

	Craving for combustible cigarettes (n=565)			Craving for e-cigarettes (n=482)		
	Coeff.	95% CI	Mean (SD)	Coeff.	95% CI	Mean (SD)
Experimental condition						
Control	Ref.		57.65 (13.32)	Ref.		61.14 (12.28)
Ingredient	-7.12 *	-13.70, -0.53	51.71 (13.68)	-11.98 ***	-18.75, -5.20	48.67 (13.15)
Industry	-4.61	-11.18, 1.96	54.13 (13.60)	-9.55 **	-16.36, -2.74	52.13 (14.27)
E-cigarette use						
Never user ^a	Ref.		51.37 (12.16)	Ref.		48.53 (11.65)
Past user	1.83	-4.06, 7.71	51.97 (13.12)	-0.22	-6.45, 6.01	46.85 (13.49)
Current user	7.14 *	1.27, 13.02	58.58 (14.87)	11.05 ***	5.01, 17.10	61.52 (12.67)
Smoking status						
Non-smoker ^b	Ref.		29.22 (9.56)	Ref.		41.17 (13.39)
Non-daily	16.50 **	4.48, 28.52	48.52 (11.24)	7.22	-6.50, 20.94	54.15 (13.69)
Daily	30.83 ***	18.75, 42.91	60.73 (11.09)	7.53	-6.24, 21.30	51.92 (14.28)
E-cigarette marketing exposure						
Low	Ref.		40.43 (33.22)	Ref.		36.60 (28.30)
Medium	7.52 *	0.52, 14.52	49.92 (31.92)	7.83 *	0.09, 15.57	47.69 (29.52)
High	17.66	11.06, 24.27	61.51 (27.86)	18.21 ***	11.00, 25.43	60.04 (29.99)
Age (years)						
18-24	Ref.		50.68 (13.60)	Ref.		50.40 (13.10)
25	1.27	-3.91, 6.46	56.35 (13.32)	2.16	-3.25, 7.57	54.24 (14.76)
Sex						
Male	Ref.		56.57 (13.13)	Ref.		58.39 (12.37)
Female	-1.32	-6.29, 3.65	51.14 (13.79)	-7.71 **	-12.91, -2.51	45.90 (13.16)
Race						
White	Ref.		52.04 (13.39)	Ref.		50.02 (13.77)

	Craving for combustible cigarettes (n=565)			Craving for e-cigarettes (n=482)		
	Coeff.	95% CI	Mean (SD)	Coeff.	95% CI	Mean (SD)
Ethnicity						
	Non-White	7.26 [*]	1.28, 13.23	60.88 (12.75)	10.80 ^{**}	4.63, 16.97
Education	Non-Hispanic	Ref.		52.98 (13.71)	Ref.	50.83 (14.18)
	Hispanic	6.93 [*]	0.56, 13.30	57.84 (13.13)	7.52 [*]	0.96, 14.08
Education	High school	Ref.		50.60 (12.17)	Ref.	47.52 (12.59)
	Some college	-0.18	-6.54, 6.19	50.05 (13.50)	-0.60	-7.45, 6.26
	4 years of college	6.27	-0.19, 12.73	59.10 (13.11)	7.61 [*]	0.76, 14.46

^aNever user refers to subset of smokers who never tried e-cigarettes.

^bNon-smoker refers to subset of e-cigarette users who were non-smokers.

Cell entries are coefficients from ordinary least squares regressions and means [standard deviation (SD)], adjusted for all other variables in the table.

^{*} P 0.05;

^{**} P 0.01;

^{***} P 0.001.

Value of craving ranges from 0 to 100 for combustible cigarettes and from 1 to 100 for e-cigarettes, because that model excludes respondents who reported no craving at all (0). Variance inflation factors did not indicate problems with collinearity when e-cigarette use and smoking status were included in the same model. E-cigarette use was categorized as never user, past user (used but not in the past 30 days), or current user (used at least once in the past 30 days). CI= confidence interval.

Table 3

Correlates of young adults' perceived general harm from e-cigarettes and combustible cigarettes (n=847).

	Combustible cigarettes		E-cigarettes	
	F (d.f.)	Partial η^2	F (d.f.)	Partial η^2
Experimental condition	0.30 (6, 1662)	.001	7.68 (6, 1662) ***	.027
E-cigarette use	1.66 (3, 1662)	.006	1.84 (3, 1662)	.007
Smoking status	5.21 (6, 1662) ***	.018	2.17 (6, 1662) *	.008
E-cigarette marketing exposure	1.06 (6, 1662)	.004	4.89 (6, 1662) ***	.017
Age	1.90 (3, 830)	.007	0.58 (3, 830)	.002
Sex	2.21 (3, 830)	.008	2.77 (3, 830) *	.010
Race	3.82 (3, 830) *	.014	3.70 (3, 830) *	.013
Ethnicity	0.63 (3, 830)	.002	0.35 (3, 830)	.001
Education	0.36 (6, 1662)	.001	3.20 (6, 1662) **	.011

Cell entries are F-tests and partial eta-squared from multivariate analysis of variance (MANOVA).

* P 0.05;

** P 0.01;

*** P 0.001.

The effects in this model are adjusted for all variables in the model.

Table 4

Correlates of young adults' intent to purchase e-cigarettes (n=847).

	Adjusted OR	95% CI
Experimental condition		
Control	Ref.	
Ingredient	0.41 ***	0.27, 0.62
Industry	0.52 **	0.34, 0.80
E-cigarette use		
Never user	Ref.	
Past user	1.09	0.74, 1.60
Current use	4.99 ***	3.21, 7.78
Smoking status		
No days smoked	Ref.	
Non-daily smoker	20.74 ***	13.14, 32.73
Daily smoker	19.89 ***	12.62, 31.35
E-cigarette marketing exposure		
Low	Ref.	
Medium	1.82 **	1.21, 2.75
High	3.84 ***	2.56, 5.76
Age (years)		
18–24	Ref.	
25	1.20	0.86, 1.68
Sex		
Male	Ref.	
Female	0.73 *	0.53, 1.00
Race		
White	Ref.	
Non-white	1.34	0.92, 1.97
Ethnicity		
Non-Hispanic	Ref.	
Hispanic	2.21 ***	1.43, 3.42
Education		
High school	Ref.	
Some college	1.20	0.80, 1.80
4 years of college	1.53 *	1.01, 2.32

Cell entries are adjusted odds ratios (OR) and 95% confidence intervals (CI) from ordinal logistic regression.

* P 0.05;

** P 0.01;

*** P 0.001.

E-cigarette use was categorized as never user, past user (used but not in the past 30 days), or current user (used at least once in the past 30 days).

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