Receptivity to E-cigarette Marketing, Harm Perceptions, and E-cigarette Use

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Abstract

Objective—To test whether exposure and receptivity to e-cigarette marketing are associated with recent e-cigarette use among young adults through increased beliefs that e-cigarettes are less harmful than cigarettes.

Methods—Data were collected from 307 multiethnic 4- and 2-year college students; approximately equal proportions of current, never, and former cigarette smokers [mean age = 23.5 (SD = 5.5); 65% female].

Results—Higher receptivity to e-cigarette marketing was associated with perceptions that e-cigarettes are less harmful than cigarettes, which in turn, were associated with higher recent e-cigarette use.

Conclusions—The findings provide preliminary support to the proposition that marketing of e-cigarettes as safer alternatives to cigarettes or cessation aids is associated with increased e-cigarette use among young adults. The findings have implications for development of e-cigarette regulations.

Keywords

e-cigarettes; marketing; low harm perceptions; young adult

Electronic or e-cigarettes are battery-powered devices that deliver vapor which may be inhaled in the manner tobacco is smoked. The vapor is released when a liquid – popularly

known as e-liquid or e-juice – is heated. The e-liquid is usually a solution containing propylene glycol and/or vegetable glycerin, nicotine, and flavor concentrates, although some e-liquids also are sold as non-nicotine containing products. The long- and short-term public health consequences of e-cigarette use, including the effects of e-cigarettes on tobacco use behavior, are not well understood.[1] However, the prevalence of e-cigarette use appears to be undergoing a rapid increase in the US.[2] Approximately 8% of US adults are likely to have tried e-cigarettes and 1.4% are likely to be current users.[3] E-cigarette use prevalence is especially higher among adult cigarette smokers: 32% report trying e-cigarettes and 6% report current use.[3] Further, young adults have been consistently found to be more likely to use e-cigarettes.[3-6]

E-cigarette Marketing and Young Adults

The evidence linking increased exposure and receptivity to tobacco marketing and increased tobacco use, especially among youth, is extensive.[7] Receptivity to the marketing of a product may be defined in terms of the extent of liking the advertising pertaining to the product and the readiness to participate in promotional activities related to the product.[8-10] Advertising involves dissemination of print, visual, audio, or audio-visual materials; promotion includes advertising as well as marketing activities that require some form of interaction with marketers.[11] Young adults (ie, 18-25 year-olds[12]) show the highest prevalence of cigarette smoking (34%) in the US,[12] and for a long time have been the main target of tobacco product marketing.[13-15] As during adolescence, experimentation with different lifestyles continues during young adulthood[16] but young adults have greater pecuniary, legal, and social freedom to pursue lifestyles involving substance use,[17] including use of products such as e-cigarettes that are new and innovative.[18] Currently, e-cigarette marketing includes both advertising and promotions.[19,20] E-cigarette marketing expenditures have increased dramatically in the US: for example, expenditures for the first and second quarters of 2013 were more than double the expenditures for 2012.[21]

In 2013, 51% of US young adults were likely to have been exposed to e-cigarette advertising on TV, 76% to print ads, and over 80% were aware of point-of-sale marketing.[19] Recent studies emphasize increasing prevalence of point-of-sale e-cigarette marketing.[22-24] The largest amount of e-cigarette marketing expenditures has been allocated to young-adult-oriented print media (eg, *Star*, *OK!*, *Rolling Stone*), followed by TV advertising, which is likely to increase as new products such as Vuse (R J Reynolds) and MarkTen (Phillip Morris) launch television campaigning.[19,21] In fact, one study[25] suggests that youth exposure to television e-cigarette advertisements, measured by target rating points, increased 256% between 2011 and 2013. Young adult exposure increased 321% over the same period. Further, several e-cigarette manufacturers (eg, Altria, Lorillard, LOGIC) are known to sponsor young-adult-oriented cultural events (eg, Vuse sponsored Rocky Mountain Music Festival).[20] Thus, given that young adults are highly exposed to e-cigarette marketing, a question that naturally arises is: how is e-cigarette marketing shaping young adults' beliefs about e-cigarettes and their e-cigarette use behavior?

E-cigarette Harm Perceptions

The majority of e-cigarette users and young adults who are aware of e-cigarettes appear to believe that they are safer than traditional cigarettes, are less addictive, and may help smokers quit smoking.[3,5,18,26,27] Research indicates that e-cigarette marketing is designed for potential users to regard e-cigarettes as safer alternatives to cigarettes or smoking cessation aids.[28-31] To date, however, there has been limited empirical evidence linking exposure or receptivity of young adults to e-cigarette marketing and perceptions of e-cigarette being a safer alternative to traditional cigarettes. Such evidence could foster development of effective e-cigarette regulations. Currently, the US Food and Drug Administration (FDA) does not regulate e-cigarettes as cessation devices (eg, similar to Nicotine Replacement Therapy products) or as modified risk tobacco products. The FDA intends to regulate those e-cigarettes that are not marketed as therapeutic devices as "tobacco products" under the Family Smoking Prevention and Tobacco Control Act (TCA). According to the TCA, tobacco products that are not regulated by the FDA as reduced risk or therapeutic should not be marketed as such.

The Present Study

This study investigates the impact of e-cigarette marketing on e-cigarette harm perceptions and use in a sample of young adults. We investigated the associations among exposure and receptivity to e-cigarette marketing, low e-cigarette-related harm perceptions, and recent e-cigarette use in a sample of college students, adjusting for potential interpersonal and demographic influences on low harm perceptions and e-cigarette use. We hypothesized that exposure and receptivity to e-cigarette marketing would be associated with perceptions that e-cigarettes are less harmful than cigarettes, which in turn, would be associated with increased e-cigarette use in the past 30 days.

METHODS

Participants

Participants represented a convenience sample of 307 undergraduate 4- and 2-year college students. Table 1 shows participants' characteristics for the final analysis sample. There were more women than men. We expected this disparate proportion of women because in the university system where the study was based, women are over-represented. Participants' ethnic distribution was similar to the ethnic distribution of the university system's student population except that the proportions of Filipinos and Native Hawaiians/Pacific Islanders (NH/PI) in the sample, 30% and 13%, respectively, were higher and lower than the proportions of Filipino (9%) and NH/PI (17%) students in the university system, respectively. The study was advertised with equal intensity across the 4- and 2-year college campuses and the response rates were proportional to the sizes of the student population at each type of institution.

Procedures

Participants were recruited from one 4-year college/university and 2 2-year community colleges in Oahu, Hawaii, using on-campus advertisements. The study was advertised

through flyers, ads in student newspapers and student life e-mail bulletins that were supposed to reach all full-time students enrolled at the colleges. To reduce selection bias, the study was advertised as a study on young adults' general health behavior rather than a study on e-cigarettes or tobacco products.

Interested students completed a brief screening survey and provided contact information online. Before completing the screening survey, we asked students to provide initial consent. This first consent form described the questions that would be asked in the screening survey and mentioned smoking as an example of health behavior of interest. Those who completed the screening survey were screened to be invited to participate in the main survey based on age (18-40 years) and smoking status: we planned to recruit almost equal proportions of cigarette current smokers, never smokers, and former smokers/experimenters to ensure that adequate numbers of each were represented in the target sample. Because e-cigarette use is known to be more prevalent among current and former cigarette smokers, it was important to represent adequate numbers of current smokers and former smokers/experimenters. Next, eligible students were invited to participate in the main study via e-mail. Students were required to read the second consent form and provide informed consent before initiating the main survey. The second consent form provided a description of the study, including the emphasis on tobacco products, and described in detail the risks and benefits involved in study participation.

Participants' e-mail addresses were unique to each individual (all 3 colleges fall under the same university system). Figure 1 shows the recruitment flowchart. Because far more eligible cigarette never-smokers responded than would be needed to meet the target sample size, a random half of the eligible never-smokers were invited to participate in the study. All eligible smokers and former smokers/experimenters were invited. Of the 326 students who were invited to participate, 307 (94%) completed the main study survey. Participants were provided a $15 Starbucks electronic gift-card each for completing the main study survey. Data were collected online in September-October, 2013.

Measures

Demographics—Data were collected on participants' age, sex, income, and ethnicity. Income was assessed with a single item: "What is your annual household/family income?" (7-point scale; "$0 -$9,999" to "Over $60,000"). Certain racial/ethnic categories were combined to result in 4 broader categories: White, Asian American (56% Japanese, 16% Chinese, 20% Korean, 8% other Asians), Filipino, and Other (75% Native Hawaiian/Pacific Islander).

Cigarette smoking and e-cigarette use—Cigarette smoking was assessed in terms of self-reported lifetime cigarette use ("How many cigarettes have you smoked in your entire life?" Response options included: "None, I have never smoked cigarette," "Less than 100 cigarettes," "100 or more cigarettes"), past 30-day cigarette use frequency ("During the last 30 days, on how many days did you smoke cigarettes?" Response options included "0 days," "1-2 days," "3-5 days," "6-9 days," "10-19 days," "20-29 days," "Used daily"), and current smoking status ("How do you describe your current cigarette smoking behavior?" "I don't

smoke at all," "I smoke sometimes," "I smoke daily"). E-cigarette use was assessed in terms of self-reported lifetime e-cigarette use ("Have you ever used an electronic cigarette?" "Yes," "No") and past 30-day e-cigarette use ("How many times have you used e-cigarettes in the past 30 days?" Response was assessed on a 12-point scale ranging from "0 times," "1-10 times," "11-20 times" to "Over 100 times"). Participants were classified as "current cigarette smokers," "former cigarette smokers/experimenters," and "never cigarette smokers" using algorithms similar to the ones employed in past smoking research involving young adults.[32] Self-identified "daily" or "sometime" smokers who reported use of any cigarette in the past 30 days and 100 or more cigarettes in lifetime were classified as "current cigarette smokers." Self-identified non-smokers who reported lifetime cigarette use but did not report use in the past 30 days were classified as "former cigarette smokers/ experimenters." Self-reported non-smokers who reported never-use of cigarette in lifetime or the past 30 days were classified as "cigarette never-smokers."

Friends' and family members' e-cigarette use—Family members' and friends' e-cigarette use were assessed with 2 open-ended items. Using a separate item, participants were asked to provide the number of family members or friends who used e-cigarettes. For analysis purposes, a latent "interpersonal influence" variable was measured with the numbers of friends and family members using e-cigarettes as indicators.

Exposure to e-cigarette marketing—To assess e-cigarette marketing exposure, participants were asked to rate on a 4-point scale ["1 (never)," "2 (rarely)," "3 (sometimes)," and "4 (often)"] how often they had seen e-cigarette ads across each of the following marketing media: newspapers, magazines, the Internet, television, billboards, sporting or cultural events, convenient stores, gas stations, grocery stores, and malls (an "other" option was also provided with space for open-ended response).[33,34] For analysis purposes, a single "marketing exposure" variable was created by summing the scores across the different channels of exposure assessed. The internal consistency of exposure across marketing channels was high in the current sample (α = .87).

Liking of e-cigarette ads—Liking of e-cigarette ads or commercials was assessed with 5 items adapted from previous research on alcohol ad exposure.[9] The 5 items asked: "Of the ads or commercials you see, how much do you like the ads or commercials for e-cigarettes?" "When you see e-cigarette ads or commercials, do you think they are funny?" "When you see e-cigarette ads or commercials, do you think they are sexy?" "When you see e-cigarette ads or commercials, do you wish you were like people in the ads or commercials?" and "When you see ads or commercials for e-cigarettes, how often do you pay attention to them?"Each item was assessed on a 4-point scale. Response options for the first item were anchored by "I like the e-cigarette ads/commercials most" and "I like the e-cigarette ads/ commercials the least." For all other items, the response options were anchored by "Yes, always" and "No, never"). The items showed good internal consistency in the current data (α = .80) and were summed into an index of ad-liking.

Receptivity to e-cigarette promotions—Two items commonly used to assess receptivity to tobacco promotions[8,10] were adapted for e-cigarettes. The first item asked

participants whether they would wear or use an item that has the name of an e-cigarette product on it (yes/no). The second item asked if they had ever bought or received for free any product which promoted an e-cigarette brand or was distributed by an e-cigarette company (yes/no). For analysis, scores across both items were summed.

Low e-cigarette harm perceptions—Fourteen items based on previous research on potential reduced exposure tobacco products[35,36] were adapted to assess e-cigarette harm perceptions. Each item was measured on a 7-point rating scale, ranging from "strongly disagree" to "strongly agree." The 14 items represented 3 factors representing beliefs that: e-cigarettes are less harmful than cigarettes (eg, "E-cigarettes provide a safer way to get nicotine"; 7 items; α = .92 in the current data), improve the health of current smokers (eg, "E-cigarettes improve breathing and reduce coughing"; 3 items; α = .82 in the current data), and may be used to quit smoking (eg, "E-cigarettes help people quit smoking"; 4 items; α = . 85 in the current data). When examined together, the 14 items showed high internal consistency (α = .94). For analysis purposes, a "harm perceptions" latent variable was measured with scores representing the indices of the 3 factors as indicators.

Statistical Analyses

Descriptive analyses were conducted by using SAS software.[37] In addition to examining participant characteristics by lifetime e-cigarette use status, we computed descriptive statistics for each item of the measures pertaining to liking of e-cigarette ads and low e-cigarette harm perceptions. To test hypotheses, structural equation modeling (SEM) was conducted with M*plus*.[38] SEM enables one to test how well a hypothesized model fits the actual data. The model may test multiple hypothesized relationships among variables simultaneously. The variables may be included in the model as they were measured or observed (ie, manifest variables) or as factors (ie, latent variables) estimated based on observed variables (indicators). The variables, including latent factors, may be treated as independent or dependent variables according to the hypothesized relationships. The hypothesized model is usually presented in a figure (eg, Figure 2) where rectangles represent observed variables and ellipses represent latent variables. Arrowed paths are used to indicate the direction of the effect of one variable on another and the effect is estimated in terms of a regression coefficient. The goodness-of-fit of the model to the data is usually assessed in terms of an absolute index (ie, chi-square) and comparative indices such as the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA).

In the present SEM model, marketing receptivity, interpersonal influence, low e-cigarette harm perceptions, were measured as latent constructs (Figure 2). E-cigarette marketing exposure, marketing receptivity, interpersonal influence, smoking status, and demographic variables were specified as exogenous variables. The low e-cigarette harm perceptions construct was specified as a mediator. Past-30-day e-cigarettes use variable was specified as the criterion variable. Direct paths were specified from all exogenous variables to low harm perceptions (mediator) and to past-30-day e-cigarette use (criterion variable). A direct path was specified from low harm perceptions to past-30-day e-cigarette use. All exogenous variables were specified to co-vary.

The model was fit to the data and the statistical significance of each path coefficient was examined. Next, the model was estimated again with every specification from the previous model intact except for the statistically non-significant paths whose effects were fixed to zero (p < .05). Because past-30-day e-cigarette use had a positively skewed distribution, the model was estimated using the MLR estimator in M*plus* which is robust to non-normality.[39] Mediation was determined based on statistically significant (p < .05) specific indirect effects[40] computed using M*plus*. A point to note is that during initial model testing, which involved specification of direct paths from all exogenous variables to the mediator and the criterion variable, and from the mediator to the criterion variable, even though the model estimation terminated normally, a warning message was generated stating that for some parameters the standard errors may not be trustworthy. We probed the issue further and the problematic parameter was found to be associated with "Other" ethnicity. When the model was re-estimated with non-significant paths constrained to zero, no warning message was generated.

RESULTS

Forty-three percent of participants reported ever-using e-cigarettes and 28% had used e-cigarettes at least once in the past 30 days. E-cigarette ever-use was higher among current cigarette smokers (68.2%) than among former smokers/experimenters (47.7%) and never-smokers (18.4%). Fifty-eight percent of participants reported having seen e-cigarette ads "sometimes" or "often" on TV, 59% on the Internet, 71% in malls, 44% in magazines, 28% in newspapers, 41% in gas stations, and 47% in convenient stores. Approximately 90% of participants reported being exposed to some form of e-cigarette marketing "sometimes" or "often." As shown in Table 1, lifetime e-cigarette users, compared with non-users, tended to be younger, represent lower proportion of Whites and higher proportion of Filipinos, and greater numbers of friends and family members who used e-cigarettes. In addition, lifetime e-cigarette users tended to report higher exposure to e-cigarette marketing, were more likely to like e-cigarette advertising, and were more receptive to e-cigarette promotions.

Table 2 shows participants' response to items pertaining to "liking of e-cigarette ads." Approximately 24% participants tended to like e-cigarette ads or commercials relative to other ads or commercials (ie, scored over 2 on a scale of 1-4), 21.5% tended to find e-cigarette ads or commercials funny, and 10% tended to find e-cigarette ads or commercials sexy.

Table 3 presents descriptive statistics related to low e-cigarette harm perceptions in the current sample. Of the 3 low harm perception factors assessed, participants tended to score generally higher on items pertaining to harm reduction perceptions. Across items, the average score was highest for the perception that e-cigarettes cut down on the harmful effects of secondhand smoke. Sixty-nine percent of the participants agreed that e-cigarettes cut down on the harmful effects of secondhand smoke. Among perceptions related to health benefits of e-cigarettes, the average score was highest for the perception that e-cigarettes improve breathing and reduce coughing. Among perceptions related to usefulness of e-cigarettes in smoking cessation, on average, participants tended to score higher on the perception that e-cigarettes are a good compromise for people trying to quit smoking.

Figure 2 shows the final model representing the relationships among e-cigarette marketing exposure, marketing receptivity, low e-cigarette harm perceptions, and recent e-cigarette use. The model showed a good fit to the data [χ^2 = 98.1, df = 68, p = .01 (scaling correction factor for MLR = 1.03); CFI= 0.96; RMSEA = 0.038, 95% CI = 0.019-0.054). The model explained 23% of the variance in past-30-day e-cigarette use and 25% of the variance in low harm perceptions. Statistically significant factor loadings and effects on dependent variables are presented in Figure 2 in terms of standardized path (regression) coefficients. A standardized path coefficient indicates the expected change on dependent variable in standard deviation units, given an increase on the independent variable of one standard deviation. Thus, a standardized path coefficient is independent of the original scales of the variables involved and standardized path coefficients may be readily compared among each other to evaluate the relative strengths of associations.

The current data indicated a significant effect of marketing receptivity on low e-cigarette harm perceptions such that higher marketing receptivity was associated with perceptions that e-cigarettes are less harmful than cigarettes. Further, lower e-cigarette harm perceptions were significantly associated with higher e-cigarette use. Moreover, low harm perceptions were found to statistically significantly mediate the effect of marketing receptivity on recent e-cigarette use [indirect effect estimate = 0.45, standard error = 0.21, p < .05 (2-tailed)]. The SEM analyses did not find marketing exposure to have a significant effect on harm perceptions or e-cigarette use. In a set of subsidiary analyses, we examined the associations between marketing exposure and lifetime and past-30-day e-cigarette use in logistic regression models, without accounting for low harm perceptions and marketing receptivity, and with and without adjusting for demographic characteristics and cigarette smoking status. Results are presented in Table 4. Marketing exposure was significantly associated with lifetime e-cigarette use, even after adjusting for demographic characteristics and smoking status.

DISCUSSION

To our knowledge, this is the first empirical study to investigate the relationships among e-cigarette advertising, e-cigarette harm perceptions, and e-cigarette use employing a multivariable model. Patterns of e-cigarette use behavior seem to be changing rapidly, especially among younger individuals.[41] The prevalence of lifetime e-cigarette use among cigarette smokers in the current sample (68%) is comparable to the rate among young adult cigarette smokers (65%) reported in a study conducted elsewhere in the US.[19] In addition, the present data are in agreement with other data suggesting that the majority of younger adults who are aware of e-cigarettes tend to believe that e-cigarettes are less harmful than traditional cigarettes.[42]

Importantly, our findings suggest that a large proportion of young adults may be exposed to e-cigarette marketing and among them, those who are more receptive to the marketing are more likely to believe that e-cigarettes are less harmful than cigarettes and, consequently, more likely to use them. In the SEM analysis we did not find marketing exposure to be associated with low e-cigarette harm perceptions or recent e-cigarette use. However, logistic regression analyses found marketing exposure to be associated with lifetime e-cigarette use.

The effects of marketing exposure on attitudes and behavior appear to be smaller than those of receptivity.[11] Hence, future studies employing larger sample sizes are needed to determine the unique effects of marketing exposure on e-cigarette use, accounting for the effects of receptivity.

Increased investment in marketing by the spiraling e-cigarette industry coupled with the lack of regulations on e-cigarette marketing means that currently young adults are likely to be heavily exposed to e-cigarette marketing and its contents that are designed to promote e-cigarette consumption in their age-group. Characteristics of young adults who are more receptive towards e-cigarette marketing are not well understood. Further, not much is known about psychosocial factors that influence e-cigarette marketing receptivity. The tobacco industry is known to use various strategies to make tobacco product marketing particularly attractive to young adults.[7] This has included promoting tobacco products highlighting themes (eg, activities associated with sensation-seeking) and using venues (eg, clubs, bars) or graphics that glorify young adult lifestyles or role models. Perhaps studying the effects of e-cigarette marketing on attitudes and beliefs of young adults would elucidate the strategies being used by e-cigarette marketing to attract young adults.

Clearly, future longitudinal studies that allow lagged assessments are needed to test the causal relationships implied in our findings. Because of the cross-sectional nature of the current data, we acknowledge that the directions of the paths we found to be statistically significant need to be appraised carefully considering the plausibility of reverse effects. The causal mechanisms we proposed attempt to explain the effects of e-cigarette marketing and attitudes on e-cigarette use behavior. However, certain theories such as the theories of attribution[43] and self-perception[44] are known to postulate that individuals may develop attitudes specific to a behavior based on the behavior itself or retrospectively attribute the behavior to certain attitudes. Also, actual use of e-cigarettes may lead individuals to believe that e-cigarettes are less harmful than cigarettes. For example, smokers who reduce cigarette smoking through e-cigarette use may notice improvements in health. Thus, different perspectives may need to be balanced while evaluating the significance of the present findings. Still, our findings may be considered to lend preliminary support to the idea that e-cigarettes are marketed with the effect of making consumers believe that e-cigarettes are tobacco harm reduction products.[28-31]

Past research on marketing effects on tobacco and alcohol use consistently has replicated similar cross-sectional effects in longitudinal designs.[11,45] Longitudinal replication of the current findings would strengthen the rationale for regulating e-cigarettes as modified risk tobacco products. Under modified risk provisions, to market e-cigarettes as less harmful alternatives to cigarettes, e-cigarette manufacturers would be required to demonstrate through scientific evidence that e-cigarettes reduce exposure to toxins common to tobacco products and benefit the health of the public as a whole. Thus, current findings imply that e-cigarettes are being marketed, overtly or covertly, by using health-benefit or reduced-harm claims. Thus, validating current findings through more rigorous future research methods may help apply modified-risk tobacco product provisions to all e-cigarettes.

We found interpersonal influence not to be associated with low e-cigarette harm perceptions but to have a direct effect on e-cigarette use, thereby suggesting that interpersonal influence may occur primarily through modeling.[46] Furthermore, we found younger individuals and men to be more likely to believe that e-cigarettes are safer than cigarettes. These findings related to age and current smoker status are consistent with past research.[3,5] Future research needs to pay attention to potential sex differences in e-cigarette marketing exposure/ receptivity, low e-cigarette harm perceptions and their influence on e-cigarette use.

This study has limitations that need to be considered. First, the current data were cross-sectional. Hence, no causal inferences may be made based on current findings. The sequence in which the exogenous, mediator, and criterion variables were specified in the SEM analysis was not based on actual temporal order but on theoretical assumptions. Second, the current data were based on a convenience sample recruited from colleges, which may raise concerns about the generalizability of current findings, in particular to non-student young adults. Moreover, targeted sampling may have introduced some bias into the sample. Including larger subsamples of never, current, and former cigarette smokers through random sampling would have been desirable. Third, owing to the preliminary nature of the study, the size of the present sample was small, which may have limited our ability to detect small but statistically significant effects. Fourth, some of the measures we used have been newly adapted to e-cigarettes and lack precedence of use. These measures need to be validated in future studies. In addition, inclusion of multiple alternative instruments to assess marketing exposure, past-30-day e-cigarette use and socio-economic status would have been desirable. The current study assessed income with a single item that referred to "household/family income." For some young adults, household/family income may lack clarity because household income may be thought to refer to the income of the family of origin or the individual's own income. Future efforts to replicate the current findings need to address these limitations. These limitations notwithstanding, our study is important for providing preliminary evidence regarding the relationship between e-cigarette marketing and e-cigarette use among young adults.

Acknowledgments

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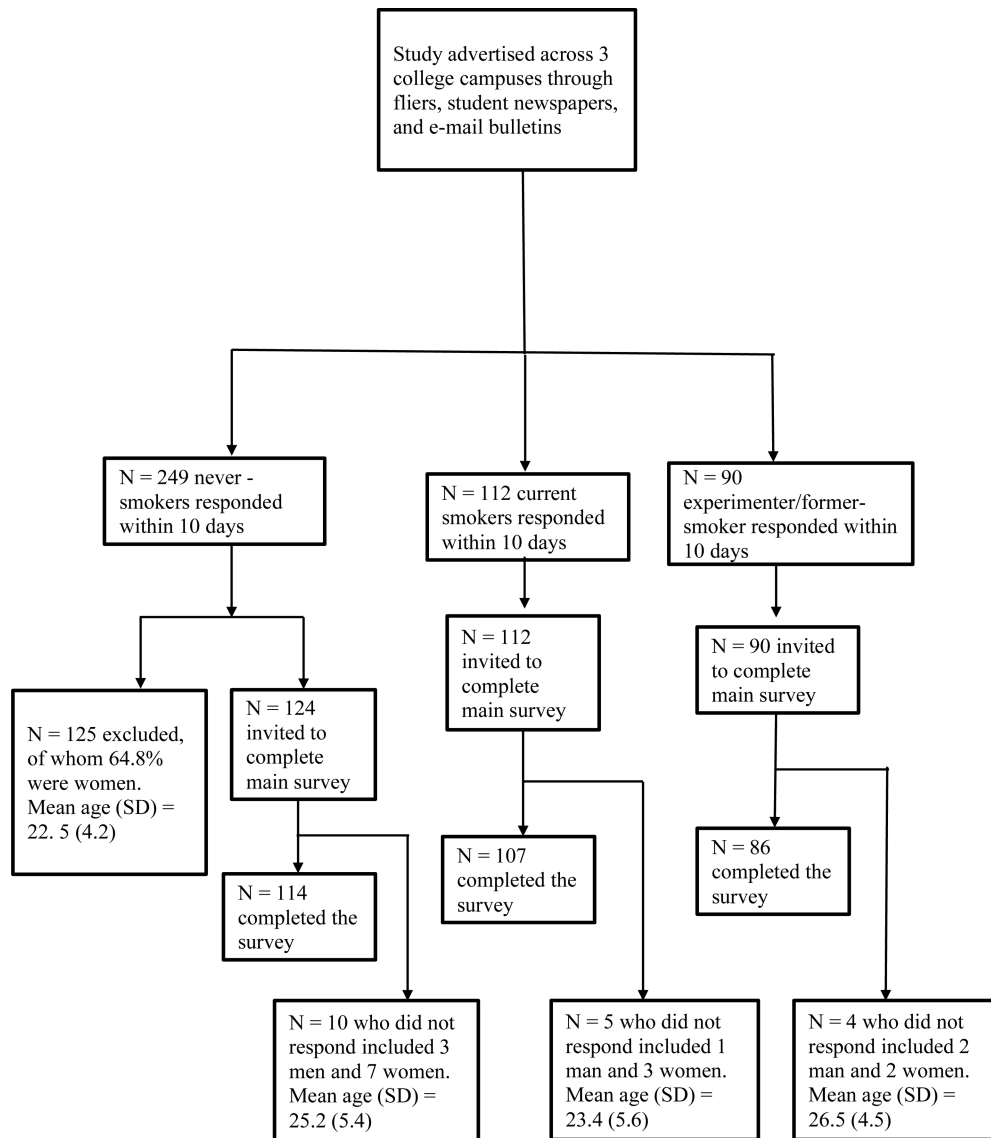
Figure 1.
Recruitment and Participation Flowchart
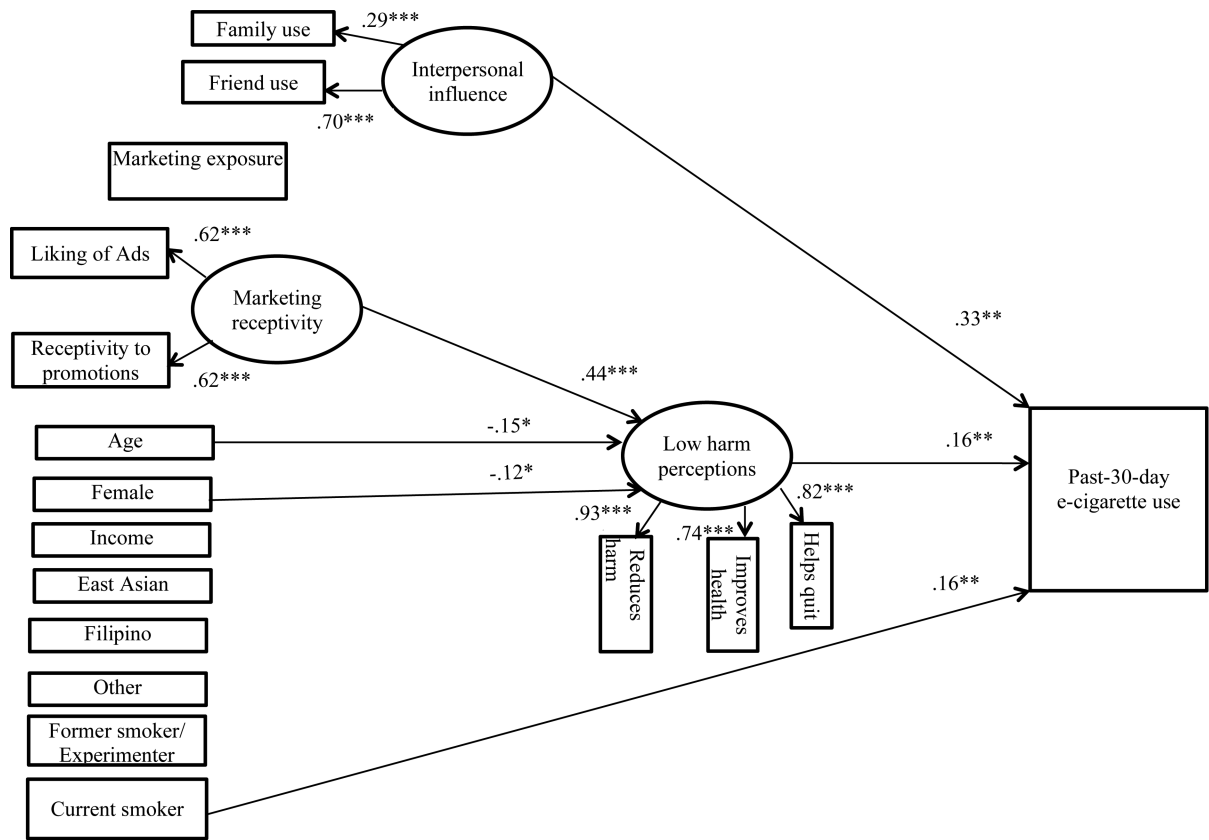
*p < 0.05; **p < 0.01; ***p < 0.001

Note.
Ellipses represent latent constructs and rectangles represent manifest variables. Single-headed arrows represent regression paths. Values represent standardized coefficients. For clarity, only statistically significant (p < .05) paths are presented. Co-variances and residual variances were computed but are not presented in the figure for clarity of presentation. R² values for low harm perceptions and past-30-day e-cigarette use were 0.25 and 0.23, respectively.

Figure 2.
Relationships among Receptivity to E-cigarette Marketing, Harm Perceptions and Past-30-day E-cigarette Use (N = 307)

Table 1

Participant Characteristics for the Final Analysis Sample (N = 307)

Characteristics		Total sample	Lifetime e-cigarette users	Lifetime e-cigarette non-users	Range
			Mean (SD)/Frequency		
Age, years [*]		23.5 (5.46)	22.8 (5.0)	24.1 (5.7)	18-40
Sex	Male	35%	31.9%	37.4%	
	Female	65%	68.1%	62.6%	
Ethnicity [*]	Asian	25%	20.0%	29.1%	
	Filipino	30%	37.0%	24.4%	
	Other	17%	19.3%	15.7%	
	White	28%	23.7%	30.8%	
Income	$0-$9,999	13%	9.8%	15.8%	
	$10,000-$19,999	14%	12.0%	15.8%	
	$20,000-$29,999	16%	18.8%	13.5%	
	$30,000-$39,999	12%	9.8%	12.9%	
	$40,000-$49,999	13%	16.5%	11.1%	
	$50,000-$59,999	10%	8.3%	10.5%	
	Over $60,000	22%	24.8%	20.5%	
College	4-year	64%	60.7%	65.7%	
	2-year	36%	39.3%	34.3%	
Cigarette use [***]	Never smoked	37%	15.6%	54.1%	
	Former smoker/experimenter	28%	30.3%	26.1%	
	Current smoker	35%	54.1%	19.8%	
Past-30-day e-cigarette use		28%			
Number of friends using e-cigarettes [***]		2.22 (3.35)	3.42 (3.9)	1.25 (2.5)	0-20
Number of family members using e-cigarettes [***]		0.45 (1.03)	0.68 (1.2)	0.27 (0.8)	0-10
Harm perception					
	Reduces harm [***]	35.9 (10.9)	34.8 (9.6)	29.4 (9.1)	8-56
	Improves health [*]	11.0 (4.31)	11.7 (4.5)	10.5 (4.1)	3-21
	Reduces addiction [***]	16.1 (5.82)	17.9 (5.5)	14.6 (5.7)	4-28
Exposure to e-cigarette marketing [**]		22.4 (7.1)	23.7 (7.0)	21.4 (7.1)	10-40
Liking of e-cigarette ads [***]		8.01 (2.81)	8.7 (2.6)	7.4 (2.8)	4-20
Receptivity to e-cigarette promotions [***]		2.21 (0.45)	3.4 (0.7)	3.2 (0.4)	2-4

Note.

SD = Standard Deviation.

Asterisks indicate statistically significant difference between lifetime e-cigarette users and non-users.

*
p < .05

**
p < .01

***
p < .001

Table 2

Frequency Distribution of Responses to "Liking of E-cigarette Ads" Items

	Response options				Mean (SD)
	1 (I like e-cigarette ads the least)	2	3	4 (I like e-cigarette ads the most)	
Of the ads or commercials you see, how much do you like the commercials or ads for e-cigarettes?	41.2%	35.0%	19.8%	4.0%	1.87 (0.87)
	1 (Never)	**2**	**3**	**4 (Always)**	
When you see e-cigarette ads or commercials, do you think they are funny?	45.9%	32.6%	17.2%	4.3%	1.80 (0.87)
When you see e-cigarette ads or commercials, do you think they are sexy?	65.9%	24.1%	9.0%	1.0%	1.45 (0.70)
When you see e-cigarette ads or commercials, do you wish you were like people in the ads or commercials?	78.0%	17.7%	3.7%	0.7%	1.27 (0.56)
When you see ads or commercials for e-cigarettes, how often do you pay attention to them?	44.0%	43.7%	11.3%	1.0%	1.69 (0.71)

Note.

SD = Standard deviation

Table 3

Frequency Distribution of Responses to Low E-cigarette Harm Perception Items

	1 (Do not Agree)	2	3	4	5	6	7 (Agree)	Mean (SD)
Harm Reduction								
E-cigarettes are less harmful than cigarettes	7.2%	5.9%	9.8%	22.8%	24.1%	15.3%	15.0%	4.6 (1.7)
E-cigarettes do reduce the harmful effects of cigarette smoking	4.6%	8.5%	14.4%	21.6%	21.6%	15.0%	14.4%	4.5 (1.7)
E-cigarettes cut down on the harmful effects of secondhand smoke	2.9%	6.2%	4.9%	17.0%	18.6%	18.3%	32.0%	5.3 (1.7)
E-cigarettes provide a safer way to get nicotine	5.6%	7.5%	13.4%	27.1%	19.3%	11.4%	15.7%	4.4 (1.7)
E-cigarettes are lower in tar or carbon monoxide than cigarettes	3.6%	3.6%	9.8%	30.1%	18.3%	13.7%	20.9%	4.8 (1.6)
E-cigarettes make smoking safer	9.5%	5.9%	14.1%	27.9%	21.3%	9.8%	11.5%	4.2 (1.7)
E-cigarettes are healthier than cigarettes	11.5%	7.6%	11.5%	25.7%	22.04%	10.2%	11.5%	4.2 (1.8)
Health Benefits								
E-cigarettes improve breathing and reduce coughing	10.1%	10.5%	16.3%	32.4%	15.7%	6.2%	8.8%	3.9 (1.6)
E-cigarettes do not release toxins into the environment	14.2%	10.9%	17.8%	32.3%	11.9%	6.9%	5.9%	3.6 (1.6)
E-cigarettes help improve sense of smell and taste	16.0%	11.8%	15.4%	32.7%	9.2%	7.2%	7.8%	3.6 (1.7)
Smoking Cessation								
E-cigarettes are a good compromise for people trying to stop cigarettes	8.8%	4.9%	12.4%	19.2%	21.2%	13.4%	20.2%	4.6 (1.8)
E-cigarette use balances addictions to tobacco and desires to quit	9.5%	8.6%	13.5%	28.0%	20.1%	9.5%	10.9%	4.1 (1.7)
E-cigarettes are less addictive than cigarettes	19.5%	13.4%	16.6%	26.1%	12.7%	4.2%	7.5%	3.4 (1.8)
E-cigarettes help people quit smoking	8.6%	12.9%	16.2%	23.8%	18.9%	7.6%	11.9%	4.0 (1.7)

Note.

SD = Standard Deviation

Table 4

Exposure to E-cigarette Marketing Regressed on Lifetime and Past-30-day E-Cigarette Use

	Lifetime e-cigarette use		Past-30-day e-cigarette use	
	Unadjusted OR (95% CI)	Adjusted OR[a] (95% CI)	Unadjusted OR (95% CI)	Adjusted OR[a] (95% CI)
Exposure to e-cigarette ads	1.13 (1.06-1.20)[***]	1.08 (1.01-1.16)[*]	1.09 (1.02-1.17)[**]	1.01 (0.93-1.10)

Note.

OR = Odds Ratio, CI = Confidence Interval.

[*]
p < .05 (2-tailed)

[**]
p < .01 (2-tailed)

[***]
p < .001 (2-tailed)

[a]**Model adjusted for age, sex, ethnicity, income, and smoking status.**