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Tobacco Marketing, E-cigarette Susceptibility, and Perceptions among Adults

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Abstract

Objective—Understanding the impact of tobacco marketing on e-cigarette (EC) susceptibility and perceptions is essential to inform efforts to mitigate tobacco product burden on public health.

Methods—Data were collected online in 2016 from 634 conventional cigarette (CC) smokers and 393 non-smokers using a convenience sample from Amazon Mechanical Turk. Logistic regression models, stratified by smoking status and adjusted for socio-demographics, examined the relationship among tobacco advertisements and coupons, EC and CC susceptibility, and EC perceptions.

Results—Among non-smokers, increased exposure to tobacco advertising and receiving tobacco coupons was significantly related to measures of EC and CC susceptibility ($p < .05$). Older, more educated non-smokers had decreased odds of EC susceptibility ($p < .05$). Additionally, increased exposure to tobacco advertising was significantly associated with the perceptions of EC not containing nicotine and being less addictive than CC among smokers ($p < .05$).

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Human Subjects Statement

The Virginia Commonwealth University's Institutional Review Board approved this study October 26, 2015 and qualified it for exemption according to 45 CFR 46.101(b), category 2.

Conflict of Interest Statement

All authors of this article declare they have no conflicts of interest.

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Conclusions—Increased exposure to tobacco advertising outlets could influence future EC and CC use in non-smokers and perceptions in smokers, while receiving coupons could affect EC and CC susceptibility among nonsmokers. Future research is needed to determine whether policies to minimize exposure to tobacco marketing reduce EC use by decreasing susceptibility.

Keywords

tobacco marketing; e-cigarettes; susceptibility; perceptions

Whereas conventional cigarette (CC) smoking has been steadily declining, the use of e-cigarettes (EC) continues to rise in the United States (US). According to the National Health Interview Survey (NHIS), current, or past 30-day, cigarette smoking in adults decreased from 19.4% in 2012 to 15.1% in 2015.¹ The 2010–2013 *HealthStyles* survey found an increase from 1.0% to 2.6% in current EC use among adults.² In 2015, the NHIS determined adult current EC use was at 3.5%, with a higher prevalence of use among younger adults.³ CC smokers are more likely to use EC in comparison to non-smokers; however, EC use was increasing in both groups.^{3,4} The 2015 NHIS results indicated that nearly 60% of adult EC users were also current CC smokers.³ Additionally, more non-smokers are taking up EC use, as over 11% of US adult EC users (40% of young adult 18–24 year-olds) had never smoked CC.³ Given that EC use can lead to CC use,⁵ there is mounting concern over non-smokers using EC. The most common reasons adults reported using an EC were to reduce or quit CC and perceptions that EC are less harmful than CC,^{6,7} despite the lack of clear scientific data on EC safety or efficacy in CC cessation.⁸ One important source for consumers seeking information regarding EC are marketing materials which commonly promote EC as healthier and safer alternatives to CC.^{9,10} Better understanding of how tobacco product marketing influences EC use is essential to inform public health and policy efforts to mitigate tobacco product burden on public health.

Since the introduction of EC to the US in 2007, EC marketing has increased in connection with the rise in EC popularity.^{11,12} EC advertising expenditures grew from \$75 million to \$115 million between 2013 and 2014,¹³ with Internet advertisements particularly popular for EC vendors, due to their ability to reach a large audience quickly and inexpensively.¹⁴ Over 28,000 YouTube videos specific to EC were found in 2013; 13.6% of these videos made health claims, 11.1% offered coupons or discounts, and 9.2% mentioned EC use for CC cessation.¹⁵ Despite marketing claims aiming to influence the perceptions of adults that EC are less addictive and harmful to health than CC, nearly all EC contain nicotine, an addictive chemical, and carcinogens, such as formaldehyde, have been found in EC aerosol.¹⁶ Additionally, a review of EC studies concluded that there is a lack of sufficient evidence to determine if EC enable CC smokers to quit or reduce smoking.¹² There is also limited research on the relationship between marketing and EC use in adults, with the majority of existing studies focusing on young adults. A notable exception is one study finding that 21% of adults 18–65 years old who had viewed an EC advertisement had intentions of using EC, and this intention was higher in CC smokers.¹⁷

Before EC entered the market and regulations restricted tobacco advertising, previous research has shown that CC advertising increased the total number of CC smoked, especially

by attracting new consumers.¹⁸ Despite CC advertising being banned on various outlets through the Public Health Cigarette Smoking Act in 1970 and the Master Settlement Agreement in 1998,¹⁹ CC companies spent nearly \$8.5 billion on US marketing in 2014.²⁰ In these efforts, price reduction at point-of-sale in addition to the use of coupons consistently have been the top 2 CC marketing expenditures.²¹ Mailed coupons have influenced the purchasing behaviors of smokers as well as increased smoking initiation among non-smokers.²² Utilizing coupons when buying CC has been found to be higher in older (over 25 years old), white, and female adults.²³

Limited studies have examined the effects of marketing of tobacco products, including EC products, on EC use among adults. This study focused on the association between tobacco marketing and several EC and CC use behaviors among current CC smokers and non-smokers, including multiple measures on perceptions of EC as well as susceptibility to future EC and CC use among nonsmokers. Study data were gathered using a survey administered through Amazon Mechanical Turk, a form of crowdsourcing using an online marketplace. The purpose of this study was to determine the association between the recall of tobacco marketing (tobacco advertisements and receipt of product coupons) and susceptibility to future EC and CC use as well as perceptions of EC among adult CC smokers and non-smokers.

METHODS

Study Design and Participants

From January to July 2016, potential participants were recruited via Amazon Mechanical Turk to take an initial screening questionnaire. Current research suggests that Mechanical Turk participants are “at least as” diverse as other Internet and traditional study samples and provide comparable quality data.²⁴ participant recruitment, and data collection. In this article, we describe and evaluate the potential contributions of MTurk to psychology and other social sciences. Findings indicate that (a Although this sample is not representative of the US population, this online platform allows recruitment of a large, demographically diverse sample.²⁵ Inclusion criteria on the screening questionnaire included being at least 18 years old, and either a current CC smoker (smoked at least 100 cigarettes in their lifetime and currently smoke either some days or every day), or non-smoker (smoked less than 100 lifetime cigarettes and not current smokers).²⁶ Those screened as former smokers (smoked at least 100 cigarettes but not current smokers) were ineligible to participate in the survey. If deemed eligible, participants were invited to complete a cross-sectional online survey about tobacco product use, tobacco advertising, susceptibility to future use of EC and CC, and EC perceptions and attitudes, among other measures. A total of 1220 individuals completed the screening questionnaire to receive a completion code redeemable via Amazon Mechanical Turk for USD \$0.50. Following eligibility confirmation, an online survey programmed in Qualtrics was administered to 1094 participants. We excluded 67 responses from our analyses due to incomplete data (55) or suspected duplicates (12). The final sample of 1027 adults (634 smokers and 393 non-smokers) was used in analyses. Successful survey completion entitled eligible participants to receive a completion code for USD \$2.00, also redeemable via Amazon Mechanical Turk.

Dependent Variables

EC and CC susceptibility—Validated measures on susceptibility to smoking CC were adapted to assess susceptibility to using EC among non-current users.²⁷ These outcomes were constructed based on participants' responses to the following questions: (1) Do you think that you will use an e-cigarette soon? (2) Do you think that in the future you might experiment with e-cigarettes? (3) Do you think you will use an e-cigarette in the next year? and (4) If one of your best friends were to offer you an e-cigarette, would you smoke it? After each question, participants could endorse “Definitely not,” “Probably not,” “Probably yes,” and “Definitely yes.” Responses across the EC susceptibility questions exhibited a high degree of internal consistency (Cronbach's alpha = 0.97). Based on CC susceptibility literature,²⁷ a dichotomous variable was created, where a response of “Definitely not” was considered not susceptible and any other response was categorized as susceptible for each item. A summary measure of susceptibility to EC was created based on responses to these 4 items such that a participant was categorized as not susceptible on this measure if they responded “Definitely not” to all 4 items. For non-smokers only, the outcome measures of susceptibility to smoking CC was also assessed with the 4 original items;²⁷ dichotomous variables and the summary CC susceptibility measure using identical methods were constructed (Cronbach's alpha = 0.94).

EC perceptions—Participants were asked to rate their agreement with the following 6 statements about EC adapted from previous surveys:^{28–30} (1) E-cigarettes contain nicotine; (2) E-cigarettes can help quit regular cigarette use; (3) E-cigarettes are less harmful than regular cigarettes; (4) E-cigarettes can help reduce regular cigarette use; (5) E-cigarettes can be used in non-smoking environments; and (6) E-cigarettes are less addictive than regular cigarettes. The responses were on a 5-point Likert scale. A dichotomous variable was created for each EC perception outcome to indicate low agreement (Strongly Disagree, Disagree, and Neutral) versus high agreement (Agree and Strongly Agree).

Independent Variables

Tobacco advertisements—Participants responded to the following questions on the frequency of seeing tobacco advertisements:³¹ (1) When you are using the Internet, how often do you see ads or promotions for cigarettes or other tobacco products? (2) When you go to a convenience store, supermarket, or gas station, how often do you see any ads or promotions for cigarettes or other tobacco products? and (3) During the past 30 days, how often did you see any ads or promotions for cigarettes or other tobacco products that were on a billboard or could be seen from outside a store? These items had 5 possible responses: “Never,” “Rarely,” “Sometimes,” “Most of the time,” or “Always.” Responses across the advertising exposure measures were internally consistent (Cronbach's alpha = 0.78). A dichotomous variable was created for each of these advertising exposure items: low (Never and Rarely) and high (Sometimes, Most of the time, and Always). The 3 dichotomous variables were then summed to create a categorical advertising index score summarizing exposure to tobacco advertisement for each participant that ranged from 0 to 3, where 0 represented the category of no exposure to tobacco advertisements, 1 low, 2 moderate, and 3 high. Furthermore, if a participant did not do one of these activities, this response was not

included in analyses. Thus, participants were included in the categorical tobacco advertising index score if they had responded to at least 2 of the 3 advertising questions.

Tobacco marketing coupons—Participants were asked if they had ever received tobacco product coupons via the Internet, email, mail, social networks, text, or on a product. A dichotomous variable was created as ‘yes’ if a participant received at least one coupon from any of those outlets or ‘no’ if the participant never received any coupons. Although advertising on many tobacco products, including CC, is restricted,¹⁹ coupons remain a form of marketing that tobacco companies frequently use to promote their products.

Control variables—Six covariates were included in the regression analyses: age (categorized into quartiles), sex, race/ethnicity, education, marital status, and other current tobacco use. Sex was categorized as “male” or “female.” Race/ethnicity was defined as “white or Caucasian,” “black,” “Asian,” or “Hispanic/Other.” Education was categorized as “HS/GED or below,” “Some College,” “College Graduate,” or “Post-college Education.” Marital status was operationalized as “Non-committed” if they responded “Separated,” “Single,” “Divorced,” or “Widowed,” or “Committed” if they responded “Married,” “Living as if married,” and “Committed relationship, but not living together.” Other current (ie, past 30-day) tobacco use included using any of the following products in the past 30 days: bidis, kreteks, hookah or waterpipe, snus, dissolvable tobacco products, EC, and/or any other new tobacco products. All models also adjusted for having an Internet Protocol (IP) address located within or outside of the US.

Data Analysis

Descriptive analyses were stratified by CC smoking status and summarized participant responses to EC and CC (for non-smokers) susceptibility, EC perceptions, exposure to tobacco product advertising and coupons, and demographic characteristics. Unadjusted associations between CC smokers and non-smokers were examined using Pearson’s chi-square test. Logistic regression models were fit to the data to test for associations adjusted for covariates between: (1) recall of tobacco marketing (advertising index score and coupon receipt) and EC and CC susceptibility (non-susceptible vs susceptible) among non-smokers; and (2) recall of tobacco marketing (advertising index score and coupon receipt) and perceptions of EC (low agreement vs high agreement) stratified by smoking status. To correct the probability of making a Type I error when making multiple comparisons across correlated outcomes, the Benjamini-Hochberg procedure was used with a false discovery rate (Q) of 15%.³² All analyses were conducted using Stata 14.0.

RESULTS

Sample Characteristics and Unadjusted Associations

Across the entire sample, 60% of the participants were male, 62% were white, and 62% had a college or post-college degree (Table 1). CC smokers were more likely than non-smokers to agree that EC contained nicotine, could help to reduce or quit CC, were less harmful and addictive than CC, and could be used in places CC could not ($p < .05$, each). Exposure to tobacco product advertising differed significantly by CC smoking status ($p < .01$), with

smokers reporting higher exposure to advertising in comparison to non-smokers. Over 61% of CC smokers received coupons for tobacco products in comparison to 17% of non-smokers ($p < .01$). Statistically significant differences were found for both race/ethnicity and education by smoking status ($ps < .01$). Additionally, 63% of smokers and 4% of non-smokers currently used another tobacco product other than CC. Of the 375 smokers who were not current EC users, most smokers were susceptible to future EC use across each of the susceptibility measures (83%–91%) as well as the summary measure (92%; Table 2). Non-smokers who were not current EC users ($N = 386$) reported higher levels of susceptibility to EC in comparison to CC across all susceptibility measures ($ps < .01$).

Adjusted Associations between Tobacco Marketing Recall and Susceptibility to EC and CC

Among non-smokers, the high level of tobacco product advertising exposure was positively associated with EC susceptibility in the future (AOR = 2.52, $p < .05$) and in the next year (AOR = 2.59, $p < .05$) after adjustment (Table 3). Receiving tobacco product coupons was also associated with increased odds of susceptibility to using EC soon (AOR = 2.76, $p < .01$), in the future (AOR = 2.04, $p < .05$), and in the next year (AOR = 2.25, $p < .05$). Male non-smokers had increased odds of EC susceptibility if a friend offers (AOR = 1.69, $p < .05$) and on the EC susceptibility summary measure (AOR = 1.72, $p < .05$) compared to females. The oldest non-smokers in the sample (37 years and older) had decreased odds of EC susceptibility, as indicated by all EC susceptibility measures except using EC soon, in comparison to the youngest non-smokers (18–25 year-olds; AOR = 0.28–0.45, $p < .05$). Non-smokers with a post-college education also had lower odds of susceptibility to using EC soon (AOR = 0.13, $p < .01$), in the future (AOR = 0.23, $p < .01$), and on the EC susceptibility summary measure (AOR = 0.39, $p < .05$) in comparison to those with a high school diploma/GED or less.

As with EC susceptibility, a significant positive association was found between exposure to tobacco advertising and CC susceptibility among nonsmokers after adjustment. (Table 4) Specifically, exposure at the high level of the tobacco advertisement index was associated with increased odds of being susceptible to using CC soon (AOR = 5.01, $p < .05$), in the next year (AOR = 3.55, $p < .05$), if a friend offers (AOR = 2.90, $p < .05$), and on the summary CC susceptibility measure (AOR = 2.61, $p < .05$). Receiving tobacco product coupons was also associated with increased odds of CC susceptibility soon (AOR = 4.33, $p < .01$) and in the next year (AOR = 2.98, $p < .01$). No statistically significant associations were found between any of the demographic covariates and the CC susceptibility measures.

Adjusted Associations between Tobacco Marketing Recall and Perceptions of EC

For smokers, moderate tobacco advertising exposure showed a positive association with perceptions that EC can help reduce CC use (AOR = 2.06, $p < .05$) and can be used in non-smoking environments (AOR=1.85, $p < .05$) after adjustment for receiving tobacco coupons and participant characteristics (Table 5). High tobacco advertising exposure was negatively associated with perceptions that EC contain nicotine (AOR = 0.43, $p < .05$) and positively associated with the perception that EC are less addictive than CC (AOR = 1.92, $p < .05$). Males had lower odds of perceiving that EC could help quit CC (AOR = 0.61, $p < .05$), EC could help reduce CC (AOR = 0.60, $p < .05$), and EC could be used in public spaces where

CC use was prohibited (AOR = 0.53, $p < .01$) compared to females. Additionally, Asian participants had decreased odds of perceiving that EC contain nicotine (AOR = 0.43, $p < .01$) and higher odds that EC were less addictive (AOR = 2.88, $p < .01$) than CC compared to white participants. Other current tobacco use was positively associated with the perceptions that EC helps quit (AOR = 1.85, $p < .01$) and reduce (AOR = 1.88, $p < .01$) CC use, and are less harmful (AOR = 2.03, $p < .01$) and addictive (AOR = 1.50, $p < .05$) than CC.

For non-smokers, we found positive associations between high tobacco advertising exposure and the perceptions that EC can be used in non-smoking environments (AOR = 2.23, $p < .05$; Table 6). Nonsmokers receiving coupons had increased odds of perceiving that EC can help quit CC (AOR = 1.94, $p < .05$). The oldest (37 years or older) participants had decreased odds of perceiving that EC can help quit CC (AOR = 0.42, $p < .01$) in comparison to the youngest (18–25 year-old) participants. Compared to white participants, Asian participants had decreased odds perceiving that EC contain nicotine (AOR = 0.52, $p < .05$) and can help reduce (AOR = 0.35, $p < .01$) or quit (AOR = 0.43, $p < .05$) CC.

DISCUSSION

As EC use continues to rise in the face of limited regulations on how these products can be marketed, evidence is needed relating exposure to tobacco advertising, perceptions of EC, and susceptibility to EC use. Importantly, whereas previous studies have focused largely on how tobacco advertisements relate to susceptibility to CC and EC use among youth,^{33–37} the current study adds to the existing literature on these relationships among adults. Our findings suggest similar patterns for adults as those reported in the extant literature examining youth. Increased exposure to tobacco product marketing was associated with EC and CC susceptibility among adult non-smokers and positive perceptions about EC among adult CC smokers and non-smokers. The current study also suggests that those recalling exposure to tobacco advertisements from all 3 outlets (Internet, retail store, billboard/outside) were particularly at-risk, especially among non-smokers. This finding could indicate that observing tobacco advertising via multiple channels could be influential on adults' perceptions of, and propensity to use EC, and for non-smokers, CC as well.

As expected, CC smokers had higher susceptibility to future EC use in comparison to non-smokers, and smokers recalled more tobacco advertising across multiple outlets compared to non-smokers. In addition to advertising, CC smokers were more likely to receive tobacco product coupons than nonsmokers. However, receiving coupons was associated with several susceptibility measures for both EC and CC use among non-smokers. Additionally, the magnitude of adjusted associations between exposure to tobacco advertising and susceptibility among non-smokers appeared larger for EC than CC, as more non-smokers were susceptible to EC rather than CC. This finding suggests that adult CC non-smokers may be more inclined to initiate EC than CC when exposed to tobacco advertising. With the trends in increased uptake of EC among adults,³ studying tobacco marketing practices and susceptibility in this population will be necessary to guide effective tobacco prevention efforts.

Increased exposure to tobacco advertisements also appeared to be associated with perceptions of EC among CC smokers and non-smokers. Smokers who had recalled advertisements from all 3 outlets measured were more likely to hold perceptions that EC were less addictive than CC. Smokers were more likely to perceive that EC could help reduce CC smoking if they reported more exposure to tobacco advertising, and non-smokers who received coupons held similar perceptions that EC could help quit CC smoking. Interestingly, smokers reporting higher exposure to tobacco advertisements were less likely to perceive that EC contained nicotine. However, most EC do contain nicotine, although the effectiveness of delivery and amount delivered vary widely across devices and liquids,¹⁶ and even EC labeled as having no nicotine have been found to contain nicotine when tested.³⁸ Furthermore, many adults are not aware of the variation of nicotine delivered by EC or that they can be addictive,^{39,40} and current tobacco advertisements may take advantage of this lack of knowledge. Tobacco advertising exposure also was related to perceiving that EC can be used in non-smoking environments for both smokers and non-smokers. Taken together, these results show how marketing has been useful in portraying EC as alternatives to CC among both CC smokers and non-smokers.

Susceptibility to using EC and CC and perceptions of EC varied across important participant demographic characteristics, suggesting ways to target prevention efforts for these populations. Male non-smokers may be more susceptible to future EC use. Older non-smokers were less susceptible to EC use and perceived that EC would not assist in CC cessation, which could indicate a lack of interest in EC in this demographic. Smokers and non-smokers who identified as Asian agreed with the perceptions that EC did not contain nicotine. Smokers who were Asian believed that EC are less addictive than CC, and non-smokers of the same demographic did not perceive that EC could help quit and reduce CC use. This finding suggests that EC marketing messages may be particularly effective in the Asian community. In addition, more educated non-smokers were less likely to be susceptible to EC. Exposure to tobacco marketing can differ by socio-demographics and suggest that tobacco prevention efforts, such as anti-tobacco messaging, could be tailored to these at-risk populations.

Our findings have implications for policy, as regulating tobacco marketing is a critical strategy in tobacco prevention efforts, especially for EC. Data from the Global Adult Tobacco Survey in 14 countries from 2008 to 2010 determined that countries with the most bans on tobacco marketing in place had citizens with the lowest awareness of tobacco marketing in prohibited outlets.⁴¹ Although there are advertising and marketing restrictions on CC in the US, there are limited restrictions in place for EC other than those relating to health-based claims. The US-based Truth Initiative indicates that nearly 90% of young adults saw at least one EC advertisement during 2014–2015 and were most aware of EC advertisements in retail stores, followed by TV and the Internet.¹³ The International Control Study in the Netherlands determined that recall of EC advertisements was related to CC quit attempts, although there was no association between advertisements and successful CC smoking cessation.⁴² In 2016 the US Food and Drug Administration (FDA) extended its authority over EC products, including regulation of EC marketing. However, thus far, the only EC marketing regulation includes mandatory warning labels that state that EC products have nicotine and nicotine is addictive.⁴³ Furthermore, there is a debate in the public health

community on whether EC should be used as a CC cessation device.⁴⁴ Clearly, more evidence is needed to inform EC marketing policy in the US and abroad.

Limitations and Strengths

When considering the contribution of these findings, several limitations should be considered. First, as a cross-sectional design, this study could not determine the causal effect of tobacco advertising on measures of EC susceptibility and perceptions. Experimental and longitudinal designs are necessary to improve identification of the influence of advertising on EC behaviors among adults. Also, the measure for advertising exposure encompassed all tobacco products; thus, this study could not identify the specific tobacco products participants had recalled in advertisements. The tobacco advertising index score assessed exposure from the Internet, retail stores, and billboards/outside, which excludes exposure from other potentially important outlets, such as TV or radio. The other current tobacco use variable may not be representative of this sample as current use of cigar products was not included in the survey. Additionally, this sample had few older adults. Findings on the EC susceptibility and perceptions of older smokers who have smoked CC for decades could be important if EC are deemed an effective means of reducing harm from CC among smokers. Recall bias also could play a factor in reporting advertising exposure, as those susceptible to initiate either CC or EC use might recall more advertising compared to those who are not susceptible.⁴⁵ Estimates from our Amazon Mechanical Turk sample may not generalize to the population of adult smokers and non-smokers at large. Regarding the geographic distribution of participants in our online sample, the only information gathered for participants about location was IP address, which is not always an accurate measure of location.^{47,48} A total of 746 participants had IP addresses that were located within the US and 281 did not, despite Amazon requiring Mechanical Turk workers to be US residents 18 years or older with a social security number at the time our study data were collected. Of the participants with a US IP address, the geographical location based on the US Census designation was well-distributed across region, with slightly more participants in the South (35%) and fewer in the Midwest (20%). In our main analyses, we adjusted all models using a binary indicator of whether participants' IP address was located in the US or not. In additional sensitivity analyses using only the subsample with a US IP address (results available from the authors), the magnitude and direction of our main estimates did not differ, but were less compact (ie, wider confidence intervals) due to a loss of statistical power. Nonetheless, participants via Mechanical Turk have been found as more diverse than samples from other online sources or from US colleges.²⁴ Moreover, this online crowdsourcing service rapidly collects reliable data and has been used in other tobacco-focused studies.^{46,47} Despite these limitations, previous research has provided little evidence on the relationship between tobacco product marketing and EC behaviors, particularly among adults. This study offers several contributions on the association of multiple exposures of tobacco advertising on an array of EC susceptibility and perceptions outcomes as well as suggestions to inform future work on advertising and EC behaviors.

Conclusion

This study represents the first analysis of the relationship between tobacco product marketing and EC susceptibility and perceptions among adult CC smokers and non-smokers.

Exposure to multiple outlets of advertising was associated with increased susceptibility to EC and CC use among non-smokers, and positive perceptions of EC in both smokers and non-smokers, including endorsements that EC do not contain nicotine and are less addictive than CC among smokers. Tobacco product coupons, a form of marketing promotions, were associated with EC and CC susceptibility among non-smokers. As tobacco marketing may influence the susceptibility of smokers and nonsmokers to use EC, regulating advertising of tobacco products, especially EC, could help to prevent both alternative and conventional tobacco product use.

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Table 1

Differences in E-cigarette (EC) Susceptibility, EC Perceptions, Tobacco Marketing Recall, and Demographics by Conventional Cigarette (CC) Smoking Status

	% Total (N = 1027)	% CC Smokers (N = 634)	% Non-smokers (N = 393)	p-value ^a
Sex				
Male	59.5	61.8	55.7	.053
Age				
				.793
18–25	22.0	20.7	24.2	
26–29	24.5	25.2	23.4	
30–36	26.5	27	26	
37+	27.0	27.1	26.5	
Race/Ethnicity				
				< .01
White or Caucasian	62.4	63.1	61.3	
Black	5.8	5.2	6.7	
Asian	23.8	21.6	27.4	
Hispanic/Other	8.0	10.1	4.62	
Education				
				< .01
High School/GED or below	13.4	15.6	9.9	
Some College	25.0	27.5	20.9	
College Graduate	40.0	37.8	43.5	
Post-college Education	21.6	19.1	25.7	
Marital Status				
Committed	55.1	57.1	51.9	.104
Other Current Tobacco Use				
	40.3	62.8	4.1	< .01
EC Contains Nicotine				
High Agreement	73.8	76.5	69.5	.013
EC Help Quit CC Use				
High Agreement	65.3	68.5	60.2	.012
EC Less Harmful than CC				
High Agreement	55.3	57.9	51.2	.035
EC Help Reduce CC Use				
High Agreement	75.2	78.7	69.6	< .01
EC Can Use in Non-Smoking Environments				

	% Total (N = 1027)	% CC Smokers (N = 634)	% Non-smokers (N = 393)	p-value^a
High Agreement	45.3	52.5	33.8	< .01
EC Less Addictive than CC				
High Agreement	30.5	35.4	22.7	< .01
Tobacco Advertising Index Score				< .01
None	18.1	12.8	26.7	
Low	30.9	31.7	29.5	
Moderate	31.4	32.7	29.5	
High	19.6	22.9	14.3	
Received Tobacco Coupons				
Yes	44.2	61.4	16.5	< .01

Note.

^a = Bolded p-values indicate statistical significance at .05 comparing CC smokers and non-smokers using Pearson's chi-square test.

Table 2Susceptibility to E-cigarette (EC) and Conventional Cigarette (CC) Use among Smokers and Non-smokers^a

	Smokers (N = 375)	Non-smokers (N = 386)	
	% Susceptible to EC	% Susceptible to CC	% Susceptible to EC
Use Soon	83.2	7.5	18.7
Use in Future	86.4	10.9	23.8
Use in Next Year	85.6	10.6	19.7
Use if Friend Offers	90.9	14.0	29.5
Susceptibility Summary Measure	91.5	15.6	33.5

Note.

^a = EC current, or past 30-day, users were removed from EC susceptibility analyses; this included 259 smokers and 7 non-smokers.

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Table 3

Adjusted Associations between Recall of Tobacco Marketing and E-cigarette (EC) Susceptibility among Non-smokers (N = 386)^d

	E-cigarette Susceptibility Outcomes				
	Use EC Soon AOR (95% CI)	Use EC in Future AOR (95% CI)	Use EC in Next Year AOR (95% CI)	Use EC if Friend Offers AOR (95% CI)	EC Susceptibility Summary AOR (95% CI)
Tobacco Advertising Index Score					
None	1	1	1	1	1
Low	1.80 (0.78–4.16)	1.35 (0.64–2.83)	1.38 (0.63–3.03)	1.04 (0.55–1.97)	1.06 (0.56–1.99)
Moderate	1.47 (0.64–3.39)	1.56 (0.76–3.21)	1.21 (0.55–2.65)	1.00 (0.53–1.90)	1.17 (0.63–2.19)
High	2.57 (0.96–6.89)	2.52* (1.03–6.15)	2.59* (1.03–6.53)	1.18 (0.53–2.63)	1.44 (0.65–3.17)
Received Tobacco Coupons					
	2.76** (1.35–5.66)	2.04* (1.03–4.02)	2.25* (1.11–4.57)	1.73 (0.93–3.22)	1.52 (0.82–2.83)
Male					
	1.28 (0.71–2.33)	1.29 (0.76–2.19)	1.07 (0.61–1.87)	1.69* (1.04–2.73)	1.72* (1.07–2.74)
Age					
18–25	1	1	1	1	1
26–29	0.96 (0.44–2.13)	1.01 (0.51–2.02)	1.06 (0.51–2.22)	1.00 (0.52–1.92)	1.05 (0.55–1.99)
30–36	0.90 (0.40–2.02)	0.63 (0.30–1.32)	0.73 (0.34–1.60)	0.64 (0.32–1.27)	0.67 (0.34–1.31)
37+	0.51 (0.22–1.22)	0.28** (0.12–0.64)	0.34* (0.14–0.84)	0.45* (0.22–0.91)	0.43* (0.22–0.86)
Race/Ethnicity					
White	1	1	1	1	1
Black	0.88 (0.23–3.35)	0.76 (0.25–2.31)	0.70 (0.21–2.32)	1.22 (0.48–3.10)	1.46 (0.57–3.70)
Asian	1.61 (0.77–3.37)	0.95 (0.48–1.91)	1.22 (0.59–2.50)	1.12 (0.60–2.09)	1.29 (0.70–2.38)
Hispanic/Other	1.41 (0.39–5.12)	1.12 (0.34–3.64)	1.65 (0.50–5.50)	1.49 (0.52–4.30)	1.62 (0.57–4.59)
Education					
High School/GED or below	1	1	1	1	1
Some College	0.64 (0.23–1.78)	0.59 (0.23–1.49)	0.96 (0.34–2.70)	1.17 (0.47–2.88)	0.81 (0.34–1.92)
College Graduate	0.62 (0.25–1.58)	0.60 (0.26–1.41)	0.91 (0.35–2.39)	1.17 (0.51–2.70)	0.81 (0.37–1.78)
Post-college Education	0.13** (0.04–0.45)	0.23** (0.08–0.67)	0.34 (0.10–1.11)	0.67 (0.26–1.73)	0.39* (0.16–0.97)

E-cigarette Susceptibility Outcomes					
	Use EC Soon AOR (95% CI)	Use EC in Future AOR (95% CI)	Use EC in Next Year AOR (95% CI)	Use EC if Friend Offers AOR (95% CI)	EC Susceptibility Summary AOR (95% CI)
Committed	0.70 (0.37–1.33)	0.59 (0.33–1.04)	0.47* (0.26–0.87)	0.79 (0.48–1.30)	0.82 (0.50–1.33)

** p < .01,

* p < .05

Note.

All associations reported as adjusted odds ratios (AORs).

^a = The logistic regression models above examine adjusted associations between recall of tobacco marketing (tobacco advertising index score and received tobacco coupons) and EC susceptibility outcomes (non-susceptible vs susceptible), while controlling for covariates and whether or not the participant IP address was located in the United States.

Adjusted Associations between Recall of Tobacco Marketing and Conventional Cigarette (CC) Susceptibility among Non-smokers (N = 393)^a

Table 4

	Conventional Cigarette Susceptibility Outcomes				
	Use CC Soon AOR (95% CI)	Use CC in Future AOR (95% CI)	Use CC in Next Year AOR (95% CI)	Use CC if Friend Offers AOR (95% CI)	CC Susceptibility Summary AOR (95% CI)
Tobacco Advertising Index Score					
None	1	1	1	1	1
Low	1.73 (0.41–7.25)	0.90 (0.34–2.34)	1.17 (0.40–3.42)	1.47 (0.61–3.52)	1.42 (0.63–3.22)
Moderate	1.77 (0.44–7.20)	0.82 (0.32–2.14)	1.41 (0.51–3.93)	1.21 (0.50–2.92)	1.15 (0.50–2.62)
High	5.01* (1.17–21.46)	2.12 (0.77–5.82)	3.55* (1.20–10.51)	2.90* (1.08–7.77)	2.61* (1.03–6.61)
Received Tobacco Coupons					
	4.33** (1.79–10.47)	2.01 (0.90–4.48)	2.98** (1.34–6.64)	1.92 (0.91–4.03)	1.72 (0.84–3.52)
Male					
	1.48 (0.62–3.55)	1.66 (0.82–3.38)	1.37 (0.67–2.83)	1.07 (0.58–2.00)	1.12 (0.63–2.02)
Age					
18–25	1	1	1	1	1
26–29	0.62 (0.19–2.04)	0.94 (0.37–2.44)	1.02 (0.37–2.81)	0.96 (0.41–2.23)	0.80 (0.36–1.77)
30–36	0.41 (0.11–1.43)	0.61 (0.22–1.70)	0.84 (0.29–2.41)	0.61 (0.25–1.51)	0.48 (0.20–1.14)
37+	0.78 (0.25–2.47)	0.85 (0.32–2.25)	1.32 (0.48–3.59)	0.80 (0.33–1.93)	0.61 (0.27–1.42)
Race/Ethnicity					
White	1	1	1	1	1
Black	1.82 (0.35–9.48)	1.42 (0.37–5.45)	1.86 (0.54–6.40)	0.50 (0.11–2.32)	1.04 (0.32–3.38)
Asian	1.29 (0.43–3.85)	1.52 (0.63–3.65)	1.23 (0.49–3.10)	1.58 (0.72–3.49)	1.45 (0.67–3.10)
Hispanic/Other	0.65 (0.06–6.47)	0.98 (0.19–5.09)	0.46 (0.05–4.11)	0.88 (0.18–4.33)	0.71 (0.14–3.45)
Education					
High School/GED or below	1	1	1	1	1
Some College	0.79 (0.16–3.87)	0.81 (0.21–3.13)	0.76 (0.19–3.06)	0.55 (0.17–1.78)	0.67 (0.21–2.11)
College Graduate	0.73 (0.17–3.19)	0.96 (0.28–3.21)	1.16 (0.34–3.95)	0.93 (0.33–2.62)	1.13 (0.41–3.14)
Post-college Education	0.70 (0.13–3.63)	0.92 (0.25–3.48)	0.58 (0.14–2.42)	0.66 (0.20–2.18)	0.96 (0.30–3.02)

Conventional Cigarette Susceptibility Outcomes					
	Use CC Soon AOR (95% CI)	Use CC in Future AOR (95% CI)	Use CC in Next Year AOR (95% CI)	Use CC if Friend Offers AOR (95% CI)	CC Susceptibility Summary AOR (95% CI)
Committed	0.93 (0.36–2.38)	0.95 (0.45–1.98)	0.63 (0.29–2.04)	0.59 (0.30–1.13)	0.68 (0.37–1.27)

*** p < .01,

* p < .05

Note.

All associations reported as adjusted odds ratios (AORs).

^a = The logistic regression models above examine adjusted associations between recall of tobacco marketing (tobacco advertising index score and received tobacco coupons) and EC susceptibility outcomes (non-susceptible vs susceptible), while controlling for covariates and whether or not the participant IP address was located in the United States.

Table 5
Adjusted Associations between Recall of Tobacco Marketing and Perceptions of E-cigarettes (EC) among Conventional Cigarette (CC) Smokers (N = 634)^a

	E-cigarette Perception Outcomes					
	EC Contain Nicotine AOR (95% CI)	EC Help Quit CC Use AOR (95% CI)	EC Less Harmful than CC AOR (95% CI)	EC Help Reduce CC Use AOR (95% CI)	EC Can be Used in Non-Smoking Environments AOR (95% CI)	EC Less Addictive than CC AOR (95% CI)
Tobacco Advertising Index Score						
None	1	1	1	1	1	1
Low	0.52 (0.26–1.04)	0.94 (0.53–1.68)	1.04 (0.58–1.77)	1.16 (0.61–2.21)	1.32 (0.77–2.27)	1.05 (0.57–1.95)
Moderate	0.77 (0.37–1.58)	1.05 (0.58–1.89)	1.73 (0.97–3.08)	2.06* (1.04–4.08)	1.85* (1.06–3.21)	1.42 (0.76–2.65)
High	0.43* (0.21–0.90)	1.19 (0.63–2.24)	1.01 (0.55–1.86)	0.95 (0.48–1.90)	1.55 (0.86–2.78)	1.92* (1.01–3.65)
Received Tobacco Coupons						
	1.49 (0.96–2.32)	0.80 (0.54–1.18)	0.94 (0.65–1.37)	0.85 (0.55–1.32)	1.15 (0.81–1.65)	1.04 (0.69–1.54)
Male	0.87 (0.55–1.37)	0.61* (0.42–0.90)	0.80 (0.55–1.14)	0.60* (0.39–0.94)	0.53** (0.37–0.75)	1.23 (0.83–1.81)
Age						
18–25	1	1	1	1	1	1
26–29	0.97 (0.55–1.71)	1.48 (0.88–2.50)	1.27 (0.76–2.10)	1.83 (1.00–3.36)	1.00 (0.62–1.62)	0.73 (0.44–1.23)
30–36	0.96 (0.54–1.69)	1.25 (0.75–2.10)	1.10 (0.67–1.81)	1.06 (0.60–1.86)	1.01 (0.62–1.63)	0.78 (0.47–1.31)
37+	1.91 (0.99–3.70)	0.92 (0.55–1.54)	0.94 (0.57–1.56)	1.30 (0.72–2.34)	1.00 (0.61–1.64)	0.66 (0.38–1.13)
Race/Ethnicity						
White	1	1	1	1	1	1
Black	0.51 (0.22–1.22)	0.53 (0.25–1.11)	0.65 (0.31–1.36)	0.59 (0.26–1.35)	1.32 (0.63–2.76)	1.07 (0.47–2.39)
Asian	0.43** (0.24–0.78)	0.97 (0.54–1.73)	1.14 (0.65–2.00)	1.01 (0.51–1.97)	1.44 (0.85–2.46)	2.88** (1.66–4.97)
Hispanic/Other	0.71 (0.36–1.38)	1.40 (0.74–2.65)	1.10 (0.62–1.94)	0.81 (0.42–1.55)	1.09 (0.62–1.89)	1.68 (0.95–2.98)
Education						
High School/GED or below	1	1	1	1	1	1
Some College	1.06 (0.52–2.14)	1.32 (0.77–2.28)	1.06 (0.63–1.78)	1.30 (0.71–2.38)	0.71 (0.42–1.18)	0.71 (0.40–1.27)

E-cigarette Perception Outcomes						
	EC Contain Nicotine AOR (95% CI)	EC Help Quit CC Use AOR (95% CI)	EC Less Harmful than CC AOR (95% CI)	EC Help Reduce CC Use AOR (95% CI)	EC Can be Used in Non-Smoking Environments AOR (95% CI)	EC Less Addictive than CC AOR (95% CI)
College Graduate	1.04 (0.53–2.04)	1.15 (0.68–1.95)	1.23 (0.74–2.05)	1.08 (0.60–1.95)	0.84 (0.51–1.38)	1.01 (0.58–1.75)
Post-college Education	1.09 (0.50–2.35)	0.97 (0.51–1.85)	0.84 (0.45–1.56)	1.00 (0.48–2.08)	1.03 (0.56–1.90)	0.85 (0.44–1.65)
Committed	1.03 (0.67–1.59)	1.21 (0.85–1.74)	1.34 (0.95–1.90)	0.92 (0.61–1.38)	0.95 (0.68–1.33)	0.88 (0.61–1.28)
Other Current Tobacco Use	0.85 (0.53–1.35)	1.85 ^{**} (1.27–2.70)	2.03 ^{**} (1.42–2.91)	1.88 ^{**} (1.22–2.88)	1.01 (0.71–1.44)	1.50 [*] (1.01–2.23)

^{**} p < .01,

^{*} p < .05

Note.

All associations reported as adjusted odds ratios (AORs).

^a = The logistic regression models above examine adjusted associations between recall of tobacco marketing (tobacco advertising index score and received tobacco coupons) and EC perception outcomes of low agreement (Strongly Disagree, Disagree, and Neutral) versus high agreement (Agree and Strongly Agree), while controlling for covariates and whether or not the participant IP address was located in the United States.

Table 6

Adjusted Associations between Recall of Tobacco Marketing and Perceptions of E-cigarettes (EC) among Non-smokers (N = 393)^a

	E-cigarette Perception Outcomes						
	EC Contain Nicotine AOR (95% CI)	EC Help Quit CC Use AOR (95% CI)	EC Less Harmful than CC AOR (95% CI)	EC Help Reduce CC Use AOR (95% CI)	EC Can be Used in Non-Smoking Environments AOR (95% CI)	EC Less Addictive than CC AOR (95% CI)	
Tobacco Advertising Index Score							
None	1	1	1	1	1	1	
Low	1.43 (0.77–2.64)	1.19 (0.66–2.12)	1.22 (0.69–2.14)	1.05 (0.56–1.98)	1.08 (0.59–1.98)	1.05 (0.52–2.12)	
Moderate	1.19 (0.65–2.18)	0.70 (0.39–1.26)	0.92 (0.52–1.62)	0.77 (0.41–1.45)	1.16 (0.63–2.14)	0.90 (0.44–1.84)	
High	1.57 (0.72–3.40)	1.00 (0.48–2.08)	1.10 (0.54–2.23)	0.52 (0.25–1.11)	2.23* (1.08–4.61)	2.16 (0.97–4.79)	
Received Tobacco Coupons							
	0.70 (0.38–1.30)	1.94* (1.03–3.64)	1.15 (0.65–2.06)	1.04 (0.55–1.97)	1.10 (0.60–2.02)	1.08 (0.55–2.11)	
Males							
	0.68 (0.43–1.09)	1.09 (0.70–1.68)	1.14 (0.75–1.74)	1.03 (0.65–1.65)	1.21 (0.77–1.90)	1.20 (0.71–2.01)	
Age							
18–25	1	1	1	1	1	1	
26–29	1.12 (0.58–2.15)	0.78 (0.41–1.49)	0.94 (0.51–1.75)	0.90 (0.45–1.79)	1.95* (1.01–3.76)	0.61 (0.29–1.28)	
30–36	1.55 (0.78–3.11)	0.75 (0.39–1.47)	0.80 (0.43–1.51)	1.09 (0.53–2.24)	1.33 (0.67–2.62)	0.76 (0.37–1.59)	
37+	0.91 (0.47–1.77)	0.42** (0.22–0.80)	1.01 (0.54–1.88)	0.70 (0.35–1.39)	1.24 (0.63–2.44)	0.50 (0.23–1.08)	
Race							
White	1	1	1	1	1	1	
Black	0.52 (0.21–1.25)	0.90 (0.38–2.15)	0.41 (0.17–1.02)	0.73 (0.29–1.80)	1.36 (0.57–3.28)	1.09 (0.34–3.50)	
Asian	0.52* (0.29–0.95)	0.43** (0.24–0.79)	0.57 (0.32–1.02)	0.35** (0.19–0.66)	0.85 (0.46–1.57)	1.60 (0.83–3.12)	
Hispanic/Other	1.40 (0.42–4.64)	1.76 (0.53–5.85)	1.44 (0.50–4.16)	0.71 (0.22–2.24)	1.36 (0.47–3.94)	2.62 (0.88–7.80)	
Education							
High School/GED or below	1	1	1	1	1	1	
Some College	1.00 (0.42–2.35)	1.57 (0.68–3.64)	1.37 (0.61–3.10)	2.93* (1.13–7.61)	0.92 (0.38–2.21)	1.08 (0.38–3.07)	
College Graduate	1.44 (0.66–3.17)	1.39 (0.65–2.96)	1.85 (0.88–3.89)	1.27 (0.57–2.83)	1.01 (0.46–2.22)	1.07 (0.41–2.80)	

	E-cigarette Perception Outcomes						
	EC Contain Nicotine AOR (95% CI)	EC Help Quit CC Use AOR (95% CI)	EC Less Harmful than CC AOR (95% CI)	EC Help Reduce CC Use AOR (95% CI)	EC Can be Used in Non-Smoking Environments AOR (95% CI)	EC Less Addictive than CC AOR (95% CI)	
Post-college Education	1.15 (0.48–2.74)	1.06 (0.46–2.44)	1.03 (0.45–2.35)	0.85 (0.35–2.04)	0.98 (0.41–2.34)	1.06 (0.37–3.00)	
Committed	1.22 (0.74–1.99)	1.14 (0.72–1.82)	1.11 (0.71–1.74)	1.30 (0.79–2.13)	1.09 (0.67–1.75)	1.58 (0.90–2.76)	

** p < .01,

* p < .05

Note.

All associations reported as adjusted odds ratios (AORs).

^a = The logistic regression models above examine adjusted associations between recall of tobacco marketing (tobacco advertising index score and received tobacco coupons) and EC perception outcomes of low agreement (Strongly Disagree, Disagree, and Neutral) versus high agreement (Agree and Strongly Agree), while controlling for covariates and whether or not the participant IP address was located in the United States.