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Comparison of Measures of E-cigarette Advertising Exposure and Receptivity

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Abstract

Objectives—We tested how various measures of e-cigarette advertising exposure and receptivity are related to each other and compare to each other in their associations with e-cigarette use susceptibility and behavior.

Methods—Cross-sectional data were collected from young adult college students ($N = 470$; $M_{age} = 20.9$, $SD = 2.1$; 65% women). Measures of e-cigarette advertising exposure/receptivity compared included a cued recall measure, measures of marketing receptivity, perceived ad exposure, liking of e-cigarette ads, and frequency of convenience store visit, which is considered a measure of point-of-sale ad exposure.

Results—The cued-recall measure was associated with e-cigarette use experimentation but not current e-cigarette use. Marketing receptivity was associated with current e-cigarette use but not e-

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Human Subject Statement

The University of Hawaii Institutional Review Board (Protocol #23645) approved the human subject research protocol for this study.

Conflict of Interest Statement

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cigarette use experimentation. Liking of e-cigarette ads was the only measure associated with e-cigarette use susceptibility. Frequency of convenience store visit was associated with current e-cigarette use but not e-cigarette use experimentation or susceptibility.

Conclusion—Inclusion of multiple measures of marketing exposure and receptivity is recommended for regulatory research concerning e-cigarette marketing. Marketing receptivity and cued recall measures are strong correlates of current and ever e-cigarette use, respectively.

Keywords

e-cigarettes; young adults; marketing; measures

Electronic or e-cigarette use prevalence is increasing rapidly across all age groups in the United States (US) but mainly among youth and young adults. Monitoring the Future (MTF) data¹ indicate that among 8th, 10th, and 12th graders, past-30-day e-cigarette use prevalence has surpassed the prevalence of past-30-day cigarette use. Current e-cigarette use is highest among young adults 18–24 years old (24%).² At present, the long- and short-term health consequences of e-cigarette use are poorly understood. Although widely recognized as being less harmful than combustible cigarettes,³ research suggests that e-cigarettes are not without harm.⁴ There is still a great deal not known about the public health consequences of e-cigarette use.

Tobacco product marketing has been long associated with tobacco use initiation and maintenance.⁵ Currently, e-cigarette devices and marketing are not regulated, even though e-cigarette marketing seems to be expanding aggressively.⁶ The US Food and Drug Administration (FDA) has deemed e-cigarettes as tobacco products, which brings e-cigarette under the regulatory authority of the Family Smoking Prevention and Tobacco Control Act (FSPTCA). The FSPTCA authorizes the FDA Center for Tobacco Products (CTP) to control tobacco product marketing that is targeted towards young people.⁷ In addition, the FDA CTP has authority to regulate new tobacco products that are marketed as modified-risk or reduced-harm alternatives to conventional tobacco products. Specifically, the FDA CTP has the authority to control unsubstantiated reduced-harm or health-benefit claims in tobacco-product marketing.

Survey-based research is important in garnering data necessary to regulate e-cigarette marketing. For example, surveys of youth and young adults can reveal their levels of exposure to e-cigarette marketing as well as how they react to and interact with e-cigarette marketing. Several studies^{6,8,9} have highlighted the extent of youth's and young adults' exposure to e-cigarette marketing, their receptivity towards e-cigarette marketing, and have examined how marketing exposure and receptivity, including receptivity to tobacco marketing in general,¹⁰ are associated with e-cigarette use and susceptibility. A straightforward way of collecting data on marketing exposure is to ask participants how often they have been exposed to the ads for a product of interest (eg, e-cigarettes) across various marketing channels (eg, TV, Internet, radio, magazines, and stores). This may be called self-reported or perceived exposure. Using this method, the 2014 National Youth Tobacco Survey (NYTS)⁶ showed that approximately 69% of US middle and high school students are exposed to e-cigarette advertisements. Other studies^{11,12} have found higher

perceived exposure to e-cigarette advertisements to be associated with higher e-cigarette use among adolescents. However, a limitation of the self-report measure of exposure is that it might be subject to recall bias.

There have been at least 3 more objective methods of assessing exposure to point-of-sale tobacco marketing. One of the methods is to assess participants' patterns of store visits or visits to stores that sell tobacco products.¹³ Researchers can then visit such stores themselves and record the stores' point-of-sale marketing practices. An index for point-of-sale marketing exposure can be computed by combining information on participants' store visit behavior and stores' point-of-sale marketing practices. Another method,⁹ particularly applicable to adolescents, is to count the number of tobacco retailers in the vicinity of schools. Giovenco et al⁹ showed that e-cigarette retailer density around schools was positively associated with ever and past-month use of e-cigarettes. Thirdly, adolescents' frequency of visits to convenience stores that sell tobacco products has been associated with cigarette use behavior and susceptibility.¹³⁻¹⁵

Marketing receptivity refers to the tendency to be receptive towards a product's marketing. Tobacco product marketing receptivity may be assessed in terms of individuals' propensity to participate in the promotion of tobacco products such as willingness to accept and use promotional materials and in terms of how familiar individuals are with tobacco ads.^{16,17} Pokhrel et al⁸ found e-cigarette marketing receptivity to be associated with e-cigarette use among young adults. Furthermore, Pokhrel et al⁸ used a measure of liking of e-cigarette ads as one of the indicators of e-cigarette marketing receptivity. This measure assessed the extent to which participants liked e-cigarette ads compared with ads of other products (eg, found e-cigarette ads funnier). Consistent with past research on alcohol marketing and adolescent alcohol use,^{18,19} Pokhrel et al⁸ found the liking of e-cigarette ads measure reliable and valid.

Thus, several survey-based measures of e-cigarette marketing exposure and receptivity exist and are being used. There are others such as the cued recall measure that has been used in previous alcohol and tobacco marketing research,^{20,21} but has rarely been used in e-cigarette marketing research. The cued recall measure presents participants with print/online ad images or still images from video ads with brand names, logos, and other recognizable product descriptors or catch phrases removed. Participants are asked if they recognize the product and/or the advertisement, and whether they are able to name the product brand. Cued recall measure is more objective than the perceived exposure measure. However, cued recall measures for e-cigarette devices and liquids could be difficult to construct and validate because new devices and brands are continuously appearing on the market.

A gap in the literature on e-cigarette marketing is the lack of understanding as to: (1) which of the measures of e-cigarette marketing exposure and receptivity are better correlates or predictors of e-cigarette use and susceptibility; and (2) how the measures of e-cigarette marketing exposure and receptivity are related to each other. Answering these questions would help researchers choose the best measure to use in their research, including regulatory research. In addition, better understanding the uniqueness of and overlap among measures would help understand the convergence and divergence among findings across studies that

have used disparate measures. Thus, this study compares the following measures pertaining to e-cigarette marketing, on their relationships with each other and with e-cigarette use and susceptibility: cued recall, self-reported exposure, receptivity, liking, and frequency of convenience store visit.

METHODS

Participants

Tables 1 and 2 show participant characteristics in terms of demographics and e-cigarette marketing exposure and receptivity. Participants were 18–25 year-old, undergraduate college students. Approximately 13% of the participants attended 2-year or community colleges. Participants represented the ethnic/racial diversity of Hawaii. Most of the participants were Asian/Pacific Islander. Approximately 25% of the sample represented current e-cigarette users and 17% represented current cigarette smokers. Approximately 47% of the current e-cigarette users and 67% of the current cigarette smokers were dual users of cigarettes and e-cigarettes.

Procedures

Participants were recruited from 2 4-year and 4 2-year colleges belonging to a single university system and located on the island of Oahu in Hawaii, where 75% of Hawaii's population resides. We obtained e-mail addresses for all 18–25 year-old students enrolled in the university system. From this pool of e-mail addresses, we randomly selected 2500 e-mail addresses to invite students to participate in the screener survey, with a goal of recruiting approximately 500 participants in the study. The link to the screener survey was accompanied by an invitation text that described the study as one about marketing and young adult health behavior.

The screener asked questions about age, sex, tobacco, alcohol, and dietary behaviors. Invited students were given on average 2 weeks' time to respond and were provided up to 3 reminders. Approximately 1300 students completed the screener, 742 of whom were invited to participate in the study. Those who were not invited included individuals who did not fall in the 18–25 age range or were never cigarette smokers or experimenters who responded after the quota for never smokers and experimenters was reached. We intended to invite approximately equal numbers of current cigarette smokers, cigarette experimenters, and never smokers to participate in the study. This was because one of our aims, outside the scope of the current study, was to examine the association between e-cigarette use and cigarette use susceptibility among never cigarette smokers and the association between e-cigarette use and smoking cessation related variables in current cigarette smokers. However, fewer current cigarette smokers completed the screener survey than never smokers and experimenters. Therefore, the first 298 and 296 never smokers and experimenters, respectively, who completed the screener were invited to participate in the study. All 148 current smokers who responded were invited to participate. Everyone was provided, on average, 2 weeks' time and 3 reminders to complete the main study survey. Data collection was stopped after the targeted 500 participants responded. The total sample size for the

current analysis was 470 after removing cases with more than 20% missing data. Data were collected via Inquisit Web.

Measures

Demographics—Age and sex were assessed with a single question each. Socioeconomic status was assessed in terms of parental/family income. Ethnicity was determined based on 2 items that were inclusive of ethnicities common in Hawaii (eg, Japanese, Chinese, Korean).²² The first ethnicity item provided participants with a list of racial/ethnic categories and asked them to “select all that apply” to their ethnic/racial background. The second item was like the first but asked participants to choose one racial/ethnic group that they identified with most. As in our previous research,⁸ for analysis purposes, Japanese, Chinese, and Korean groups were combined into a single “Asian” category; these groups share similar health risk profiles in Hawaii, and exhibit similar socio-economic status.

Cued-recall e-cigarette advertising exposure—A total of 14 ads were used, of which 7 were e-cigarette ad images (6 print magazine ads and 1 video still image), 4 were cigarette ad images (all print magazine ads), and 3 were smokeless tobacco ad images (all print magazine ads). For our current purposes, the ads of other tobacco products functioned as “filler” ads. The presence of filler ads helps minimize the biases due to guesswork in response.

Print magazine ads were randomly selected from a pool of ads gathered over a 2-year period by scanning every issue of the following young-adult-oriented magazines: *Ok!*, *Star Magazine*, *Entertainment Weekly*, *US Weekly*, *Sports Illustrated*, *Men’s Journal*, and *Rolling Stone*. The video ad for e-cigarette consisted of the only video ad run in Hawaii for a popular local e-cigarette band (Volcano). The print ads for e-cigarettes represented the following brands that appeared regularly across the magazines we monitored: Blu, MarkTen, Vuse, Fin, and NJoy. Product image, brand, logo, and recognizable descriptors and catchphrases were digitally removed from each image. Although young adults may be less engaged in print media consumption than the Internet or other digital media, for the national ads, the print ads include the same models and color schemes as do TV or Internet ads.

Participants were asked if they recognized the product being advertised, if they recognized the ad itself, and whether they could name the brand that the ad represented. Participants were assigned a score of 1 if they recognized the product, 1 if they recognized the ad, and 2 if they could name the brand. If a participant recognized the product and the ad but could not name the brand, the participant received a score of 2. Thus, for each ad stimulus the score could range between 0–4. For analysis, an e-cigarette cuedrecall index was created by averaging scores across the 7 ads. Internal consistency of ad recognition across the 7 ads was moderate, $\alpha = .50$.

Self-reported or perceived ad exposure—To assess self-reported e-cigarette marketing exposure, we asked participants 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, convenience stores, gas stations, grocery stores, and

malls (an “other” option was also provided with space for open-ended response).⁸ For analysis, a single “marketing exposure” variable was created by summing scores across the different channels of exposure assessed. The internal consistency of exposure across marketing channels was high in the current sample ($\alpha = 0.87$).

E-cigarette marketing receptivity—Four items commonly used to assess receptivity to tobacco promotions¹⁶ 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). The third question asked participants if they had a favorite ad (yes/no). If the response to this question was “yes,” the fourth question asked to name the brand advertised. Participants who reported a valid brand name were assigned a score of 1 for this item. Others were assigned a score of 0. For analysis, scores were summed across the 4 items.

Liking of e-cigarette ads—Liking of e-cigarette ads or commercials was assessed with 5 items adapted from past research on alcohol ad exposure,¹⁸ which have been used in previous e-cigarette research.⁸ The 5 items asked were: “Of the ads or commercials you see, how much do you like the ads or commercials for e-cigarettes?” (7-point scale; “I like the e-cigarette ads/commercials the least”,..., “I like the e-cigarette ads/commercials the most”); “When you see e-cigarette ads/commercials, do you think they are funny? (7-point scale; No, never,..., Yes, always); “When you see e-cigarette ads/commercials, do you think they are sexy?” (7-point scale; “No, never”,..., “Yes, always”). “When you see e-cigarette ads/commercials, do you wish you were like people in the ads/commercials?” (7-point scale; “No, never”,..., “Yes, always”) “When you see ads or commercials for e-cigarettes, how often do you pay attention to them?” (7-point scale; “Never”... “Always”). The items showed good internal consistency in the current data ($\alpha = 0.84$).

Convenience store visit—We asked participants how frequently they visited each type of convenience stores [“1 (never),” “2 (rarely),” “3 (sometimes),” “4 (often)”] from a list provided to them. The list included Walgreens and 7-Eleven, which sell tobacco products in Hawaii. Other options included: gas station stores, neighborhood convenience stores, small markets, and liquor stores. To create an index for frequency of convenience store visit, an average score across the 5 store types was computed.

Family and friend e-cigarette use—Family members’ and friends’ e-cigarette use were assessed with 2 questions, each for family and friend e-cigarette use. Participants provided the number of family members or friends who use e-cigarettes in the blank space provided.

E-cigarette use susceptibility—E-cigarette use susceptibility was assessed based on responses to the items of intentions to use e-cigarette,⁸ which in turn were adapted from a commonly-used measure of cigarette use intentions.¹⁶ The scale includes 4 items ($\alpha = 0.88$; eg, “Do you think that you will use an e-cigarette soon?” “If one of your best friends were to offer you an e-cigarette, would you use it?”), each with a 5-point response scale (1: “Definitely not,”..., 4: “Definitely yes,” 5: “I don’t know”). For the current analysis, affirmative answer to any item was coded as 1, and no to all items as 0.

Cigarette use—Participants self-reported their cigarette smoking history. Data were collected on lifetime cigarette smoking (eg, “How many cigarettes have you smoked in your entire life?” Response options: “I have never smoked a cigarette,” “1–100 cigarettes,” and “Over 100 cigarettes”), past-30-day cigarette smoking (“Within the last 30-days, on how many did you use cigarettes?” Response options: “0 days,” “1–2 days,” “3–5” days,..., “20–29 days,” “Used daily”), and current smoking behavior (“How do you describe your current cigarette smoking behavior?” Response options: “I don’t smoke”, “I smoke sometimes/occasionally”, “I smoke every day”).⁸ Those who had never smoked a cigarette were classified as never smokers. Self-identified smokers and/or past-30-day smokers were classified as current smokers. Self-identified smokers were those who reported “Regularly” or “Sometimes/occasionally” to the following question: “How do you describe your current cigarette smoking behavior?” The rest were classified as experimenters.

E-cigarette use—Lifetime e-cigarette use was measured with a single question (“Have you ever used an electronic cigarette (e-cigarette) or a similar vaping device?” Response options: “Yes,” “No”). To assess current e-cigarette use, we asked participants: “How often, if at all, do you currently use an e-cigarette?” (Response options: “Daily,” “Less than daily, but at least once a week,” “Less than weekly, but at least once a month,” “Less than monthly,” “Not at all”).²³ Current e-cigarette use variable was dichotomized based on the last question, as any current use versus no current use at all.

Data Analysis

We analyzed data using SAS statistical software. Pearson correlation coefficients were computed to examine the zero-order correlations among advertising exposure and marketing receptivity measures. Multinomial logistic regression models were run to test the associations between marketing measures and e-cigarette use (experimental use, current use versus never use). Lifetime e-cigarette users who did not use e-cigarettes currently were classified as experimenters. Ordinary logistic regression was used to test the association between marketing measures and e-cigarette use susceptibility. E-cigarette use susceptibility was examined among e-cigarette never users only. Thus, dependent variables were experimental e-cigarette use, current e-cigarette use, and e-cigarette use susceptibility. First, separate models were run for each marketing exposure/receptivity measure as an independent variable. Next, all exposure and receptivity measures were simultaneously entered in a model, as independent variables, and this model was tested across the 3 dependent variables. All models included the same set of covariates, namely age, sex, parental income, ethnicity, cigarette smoking history (dummy-coded as current smoker and experimenter relative to never smoker), family member and friend e-cigarette use, and college status (2-year vs 4-year).

RESULTS

Correlations among E-cigarette Marketing Exposure/Receptivity Measures

Table 3 shows the zero-order correlations between e-cigarette advertising exposure/marketing receptivity measures. Other than correlations of cued recall measure with liking of e-cigarette ads and convenience store visit, which were not statistically significant,

measures were generally positively and statistically significantly correlated with each other. The correlation coefficients that were statistically significant ranged between small ($r = .12$) to medium ($r = .24$) in size. The self-reported ad exposure measure showed relatively strong correlations with cued recall measure and frequency of convenience store visit.

Associations of E-cigarette Advertising Exposure/Marketing Receptivity Measures with E-cigarette Use and Susceptibility

Table 4 shows the results of the regression analysis conducted separately for each ad exposure/marketing receptivity measure. Liking of e-cigarette ads showed the strongest association with e-cigarette use susceptibility among never-users. When all ad exposure/marketing receptivity measures and covariates (demographic variables, cigarette smoking history, and friend and family e-cigarette use) were included simultaneously in the model, liking of e-cigarette ads was the only measure significantly associated with e-cigarette use susceptibility [OR = 1.73; 95% CI = 1.18–2.55]. Other measures of e-cigarette marketing exposure/susceptibility were not associated with e-cigarette use susceptibility.

In separate models, only the cued-recall measure was associated with e-cigarette experimentation. No other ad exposure/marketing receptivity measure was associated with e-cigarette experimentation. Conversely, except for the cued recall measure, all other measures were associated with current e-cigarette use. When all ad exposure/marketing receptivity measures and covariates were simultaneously included in a model, the cued recall measure was the only measure associated with e-cigarette experimentation [OR = 1.10; 95% CI: 1.02–1.20] and marketing receptivity was the only measure associated with current e-cigarette use [OR = 3.92; 95% CI: 1.79–8.59].

DISCUSSION

E-cigarette use is increasing rapidly among youth and young adults, including never cigarette smokers, and it is likely that unrestrained e-cigarette marketing is, to some extent, accountable for the growth in e-cigarette use prevalence among young people.^{6,12} The FDA CTP has regulatory authority over e-cigarettes, including e-cigarette marketing. Under the Family Smoking Prevention and Tobacco Control Act, the FDA is authorized to control e-cigarette marketing that targets young people. Effective use of this authority would necessitate scientific evidence that e-cigarette marketing does indeed target youth and young adults. Accordingly, there have been several studies that have examined the association between e-cigarette marketing and e-cigarette use among young people. These studies often have been survey-based and have used different methods to assess e-cigarette advertising exposure and/or marketing receptivity. Currently we do not know how different measures of e-cigarette marketing exposure/receptivity associate with each other and with e-cigarette use and susceptibility. To our knowledge, this is the first study to examine how different measures of e-cigarette marketing exposure and receptivity relate to each other and to e-cigarette use and susceptibility.

Examining correlations among the measures revealed that no 2 measures were highly correlated with each other, suggesting that the measures were non-redundant with respect to each other. In other words, none of the measures we examined may be interchangeable.

However, there were differences in the way the measures were correlated with each other. Self-reported ad exposure measure showed relatively stronger correlations with the cued recall measure and with the frequency of convenience store visits compared with the correlations of cued recall measure and frequency of store visit measures with other variables. The cued recall measure showed weak correlations with other measures. This may be because the cued recall measure requires some reflection, whereas other measures, based on straightforward reporting, may elicit more spontaneous responses.²⁴ Marketing receptivity and liking of e-cigarette ads were correlated relatively strongly, which is understandable because both constructs tap the willingness to engage with an advertisement or promotional activity.

We found that liking of e-cigarette ads was a strong correlate of e-cigarette use susceptibility among e-cigarette never users. This is an important finding. This measure rarely has been used in research related to e-cigarette marketing, even though past research on the effects of alcohol marketing among adolescents¹⁹ has shown liking of alcohol ads to have long term effects on alcohol use, including problem alcohol use. In addition, our previous research⁸ has shown that liking of e-cigarette ads is strongly associated with the perceptions that e-cigarettes are less harmful than cigarettes. Thus, future research on youth and young adults may benefit from utilizing the liking of e-cigarette ad measure.

Cued recall was the only measure associated with e-cigarette use experimentation. More research is needed to understand this relationship. The cued recall measure used in the current study assessed exposure to, mostly, print magazine ads. These ads represented national brands of cig-a-like (ie, cigarette look-alike or vape pen type) e-cigarettes. It has been argued that most habitual e-cigarette users do not use this type of e-cigarettes.²⁵ They use advanced personal vaporizers (APV) or mods that usually include adjustable voltage and other modifiable features. The APVs are more expensive than cig-a-likes and are usually sold in shops that specialize in selling vaping products. Individuals experimenting with e-cigarettes may be more likely to experiment with cig-a-likes that can be bought in easily accessible retailers such as convenience or grocery stores. Hence, it is possible that in the current study, the cued-recall measures accurately assessed exposure to cig-a-like ads, which may influence e-cigarette experimentation. Past research has found the cued recall measure to be a better predictor of cigarette use initiation than current use.²⁶

Among the measures of marketing exposure and receptivity we examined, the marketing receptivity measure, which included items on receptivity to marketing promotion and familiarity with ads, was the strongest predictor of current e-cigarette use. This measure¹⁶ has been widely used in research on traditional cigarette marketing and known to predict smoking progression in prospective studies.²⁷ The current findings emphasize the need for inclusion of the receptivity measure in future studies on the effects of e-cigarette marketing. When examined individually in separate models, we found liking of e-cigarette ads, self-reported exposure, and frequency of convenience store visits also to be associated with current e-cigarette use. Although the associations of these other measures were relatively weaker in strength compared with the association of the receptivity measure with current use, our findings suggest that each of the measures considered here, except the cued recall measure, may be a good predictor of current e-cigarette use individually.

Prospective studies are needed to validate the current findings. In addition, future studies with larger sample sizes are needed to examine the individual (eg, impulse control) as well as ethnic, sex, and other demographic [eg, socio-economic status (SES)] differences in response to different marketing measures. For example, the cued recall measure requires some degree of cognitive control to recall a product or a brand. Individuals with weaker executive cognitive functioning may not perform well on the task. Furthermore, studies are needed to examine personality-level and demographic variables as moderators of the influence of marketing on tobacco/e-cigarette use. Understanding such interactive effects would help clarify the influence of marketing on behavior at different levels of vulnerability.

Limitations

Some limitations of the current study need to be noted. We relied almost exclusively on self-report measures. Although this is standard practice in tobacco control research, there may be some concerns about the validity of the self-report measures of substance use. Another limitation is that the current data were cross-sectional. Because of the cross-sectional data, we were not able to determine the test-retest validity of the measures, changes in variables over time, and hypotheses with causal implications. In addition, the sample size was not large enough for us to conduct analyses by demographic subgroups to examine group differences.

The sample was predominantly Asian/Pacific Islander and represented more women than men. Although there is no compelling reason as to why findings based on US Asian/Pacific Islanders will not generalize to other US young adults, whenever a sample is predominantly represented by one ethnic/racial category, some concerns about the generalizability of findings are reasonable. Moreover, because e-cigarette use prevalence is higher among men than women,² a sample with more women than men may be biased because of the underrepresentation of a group that is likely more vulnerable regarding both exposure to e-cigarette marketing and e-cigarette use. Similarly, by being based on college students, the study inadvertently excluded non-college-going or working young adults who may be more vulnerable to e-cigarette and other tobacco product use.

Lastly, there are some limitations related to some of the measures we used. We used only one, relatively indirect, measure of point-of-sale marketing exposure. Including more point-of-sale measures might have provided richer information. In addition, items for the ad liking measure we used did not include a response option that would tap non-exposure to e-cigarette ads. Because of this, even participants who might not have been exposed to e-cigarette ads were forced to report on whether or not they liked e-cigarette ads. Also, the cued recall measure did not tap exposure to non-mainstream e-cigarette marketing. Our measure of family and friend e-cigarette use was open-ended in that we allowed participants to fill in the number of family and friends who used e-cigarette. This kind of method does not take into consideration the size and quality of one's social network.

IMPLICATIONS FOR TOBACCO REGULATION

Despite the limitations, our findings are important because they address an important gap in the literature concerning tobacco regulatory science. Although more studies are needed to

replicate our findings—especially longitudinal studies—some specific recommendations may be made based on the current findings regarding application of e-cigarette marketing exposure/receptivity measures in tobacco regulatory research. Liking of e-cigarette ads measure appears to be especially useful to studies on the effects of e-cigarette marketing on e-cigarette use susceptibility. This measure is relatively short (includes 5 items) and reliable.

The cued recall measure is likely to tap exposure to the specific type of ads on which they are based. There is a great variation in the types of e-cigarettes products (eg, mods, cig-a-likes, e-juices), channels of e-cigarette marketing (eg, print, online, video), and the reach of different e-cigarette ads or commercials (eg, national, regional, local). It is important to consider this while gathering ads to create the cued recall measure. Our findings suggest that the cued recall measure derived from ads of national e-cigarette brands may be predictive of e-cigarette use experimentation. This type of cued recall measure may be especially sensitive as a predictor of e-cigarette use initiation. Thus, studies interested in the effects of e-cigarette marketing on e-cigarette use initiation may benefit from using the cued recall measure. However, the cued recall measure may not always be easy to create and embed in surveys. The marketing receptivity measure, on the other hand, is short (4 items) and easy to incorporate in surveys. This measure appears to be a strong predictor of current e-cigarette use.

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Table 1

Participants' Demographic and Cigarette and E-cigarette Use Characteristics

	Mean (SD)	Frequency (Number)	Sample Size
Age	20.9 (2.1)		470
Sex			470
Men		34.8% (161)	
Women		65.2% (309)	
Ethnicity			462
White		28.1% (130)	
Asian/Pacific Islander		63.2% (292)	
Other		8.7% (40)	
Parental Income			464
0–\$39,999		21.2% (99)	
\$40,000–\$59,999		14.4% (68)	
\$60,000–\$79,999		16.2% (76)	
\$80,000–\$99,999		14.4% (65)	
\$100,000–\$119,999		13.5% (62)	
\$120,000 and over		20.4% (94)	
Community College Students		12.7% (60)	469
Cigarette Smoking Status			470
Never smoker		43.7% (207)	
Experimenter		38.5% (179)	
Current smoker		17.8% (84)	
E-cigarette Use Status			467
Never user		42.5% (197)	
Experimenter		33.0% (155)	
Current user		24.5% (115)	
Never E-Cigarette Users Susceptible for E-cigarette Use		31.4% (62)	197

Note.

SD = Standard deviation

Table 2

Participants' E-cigarette Advertising Exposure and Receptivity Characteristics

	Mean (SD)	Range	N
Cued Recall Ad Exposure	4.97 (3.50)	0–20	470
Self-reported Ad Exposure	2.39 (0.64)	1–4	468
Liking of E-cigarette Ads	1.81 (1.07)	1–7	466
Marketing Receptivity	0.25 (0.60)	0–4	465
Convenience Store Visit	2.29 (0.57)	1–4	469

Note.

SD = Standard deviation. Range represents actual range of scores as opposed to possible range of scores.

Table 3

Zero-Order Correlations among Advertising Exposure and Receptivity Measures

	Cued Recall	Ad Exposure	Liking of Ads	Receptivity	Convenience Stores
Cued Recall	1 (N = 470)				
Self-reported Ad Exposure	.24 *** (N = 468)	1 (N = 468)			
Liking of E-cigarette Ads	.09 (N = 466)	.16 *** (N = 465)	1 (N = 466)		
Marketing Receptivity	.12 ** (N = 465)	.13 ** (N = 464)	.22 *** (N = 462)	1 (N = 465)	
Frequency of Convenience Store Visits	.06 (N = 469)	.24 *** (N = 468)	.16 *** (N = 466)	.19 *** (N = 465)	1 (N = 469)

Note.

**
p < .01,

p < .001

Table 4

Results of Logistic Regression Analysis Testing the Associations between E-cigarette Advertising Exposure/ Receptivity Measures and E-cigarette Use and Susceptibility

	E-cigarette Use Susceptibility (N = 190)	E-cigarette Experimentation (N = 450)	Current E-cigarette Use (N = 450)
	Odds Ratio (95% Confidence Interval)		
Cued Recall	0.99 (0.90–1.11)	1.11 (1.02–1.19) **	1.03 (0.93–1.13)
Self-reported Ad Exposure	0.83 (0.48–1.42)	1.07 (0.73–1.59)	1.62 (1.01–2.68) *
Liking of Ads	1.80 (1.23–2.64) **	1.07 (0.81–1.41)	1.44 (1.06–1.96) *
Marketing Receptivity	3.73 (0.93–15.2)	1.86 (0.88–3.93)	4.35 (2.03–9.38) ***
Frequency of Convenience Store Visits	0.90 (0.48–1.69)	1.27 (0.79–2.04)	1.97 (1.10–3.55) *

*
p < .05,

**
p < .01,

p < .001

Note.

All models adjusted for age, sex, parental income, ethnicity, family and friend e-cigarette use, and cigarette smoking history (experimenter, current smoker, versus never smoker), and college status (community vs 4-year college). Sample sizes regression analyses are different from N = 197 never e-cigarette users and N = 470 total participants because of the missing data.