HHS Public Access

Author manuscript

Tob Control. Author manuscript; available in PMC 2016 November 01.

Published in final edited form as:

Tob Control. 2015 November ; 24(6): 574–581. doi:10.1136/tobaccocontrol-2014-051685.

Socio-demographic Correlates of Self-reported Exposure to E-Cigarette Communications and its Association with Public Support for Smoke-Free and Vape-Free Policies: Results From a National Survey of U.S. Adults

Andy SL Tan[1], **Cabral A. Bigman**[2], and **Ashley Sanders-Jackson**[3]

[1]University of Pennsylvania, Annenberg School for Communication, Philadelphia, USA

[2]University of Illinois at Urbana-Champaign, Department of Communication, Urbana, USA

[3]Stanford University, Stanford Prevention Research Center, Stanford, USA

Abstract

Background—Exposure to e-cigarette communications (e.g., advertisements, news and entertainment media, and interpersonal discussion) may influence support for smoke-free or vape-free policies. This study examined the socio-demographic correlates of self-reported exposure to e-cigarette communications and their relationships with support for restricting vaping and smoking in public venues.

Method—Online survey data was collected from a representative sample of U.S. adults (n=1,449) between October and December 2013 (mean age=50 years, 51% female, 8% African-American, 10% Hispanic, 6% other races) and weighted to match the U.S. adult population. We fitted multiple regression models, adjusting for demographic variables, to examine associations between support for policies to restrict vaping and smoking in public venues and self-reported frequency of exposure to e-cigarette communications in the preceding month. We fitted separate models to assess associations between policy support and frequency of exposures weighted by whether each category of e-cigarette communications was perceived as positive or negative.

Results—Higher self-reported exposure to advertising (B=-.022, p=.006), other media (B=-.022, p=.043), and interpersonal discussion (B=-.071, p<.0005) perceived as positive were associated with lower support for vaping restrictions, adjusting for covariates. Exposure to e-cigarette communications was associated with lower support for smoking restrictions in bivariate analyses but was not significant after adjusting for covariates.

Conclusion—Further research is needed to assess whether messages portraying e-cigarettes as a way to circumvent smoking restrictions from advertisements and other media are influencing

Corresponding author: Andy SL Tan, MBBS, MPH, MBA, PhD, University of Pennsylvania, Annenberg School for Communication, 3620 Walnut Street, Philadelphia PA 19104, andytan@alumni.upenn.edu, Telephone: 215-746-3402, Fax: 215-898-2024.

COMPETING INTERESTS STATEMENT

No, there are no competing interests.

CONTRIBUTORSHIP STATEMENT

AT and CB designed the study and survey questionnaire. CB and AS conducted the literature review. AT conducted the data analyses. AT, CB, and AS interpreted the results and drafted the paper. AT is responsible for the overall content as guarantor.

public support for vape-free policies. These findings provide empirical evidence to inform the policy debate over regulating specific e-cigarette advertising claims.

Keywords

electronic cigarette; tobacco control policy; United States; public opinion

INTRODUCTION

Smoke-free laws and smoking restrictions have been effective in minimizing exposure to environmental tobacco smoke and denormalizing tobacco use.[1,2] Increasing use of electronic cigarettes (e-cigarettes) in places where smoking is currently prohibited could undermine the success of smoke-free laws in reducing population harm from tobacco-related pollutants. Several toxicological analyses of e-cigarette vapor have shown detectable levels of tobacco-related pollutants that may affect indoor air quality. Although these levels are considerably lower than secondhand smoke from combustible cigarettes,[3,4] the long-term health consequences of exposure to pollutants at these levels especially among vulnerable populations (e.g., infants and pregnant women) remain unclear and require further investigation.

It has been suggested that the similarity between e-cigarette use and smoking combustible cigarettes could also interfere with the compliance and enforcement of smoke-free policies.[5] These devices are easily mistaken for combustible cigarettes, especially in dimly-lit indoor venues including certain restaurants or bars. The most popular brands of e-cigarettes are shaped like combustible cigarettes and provide a similar look and feel. Users exhale visible vapor and some e-cigarettes sport a glowing tip that mimics combustible cigarettes. Permitting e-cigarette use in places where smoking is prohibited could cause confusion among smokers, leading them to think it is legal to smoke in these environments and prompting them to smoke combustible cigarettes.[5] Businesses and workplaces would also face challenges in distinguishing between e-cigarette and conventional cigarette users and this would hamper the effectiveness of enforcing smoke-free regulations in these venues.[6]

Apart from potential health concerns of pollutants in secondhand vapors, there is much concern that e-cigarette use may re-glamorize smoking. Because of the similarity between e-cigarettes and combustible cigarettes, concerns have been expressed that increasing prevalence of e-cigarette use and presence of e-cigarettes advertising or media portrayals could potentially undermine smoking denormalization efforts.[7,8] Although the regulatory environment is in flux, e-cigarettes use in public places and advertising has thus far escaped strong federal oversight.

Both mass media and interpersonal communications play a role in shaping smoking and tobacco-related opinions and behavior.[9,10] In recent years, advertising, news coverage, and appearance of e-cigarettes in entertainment and social media have increased.[11–13] Public awareness of e-cigarettes has also increased in tandem.[14] Among young adults, e-cigarette awareness and use has been linked with having a close friend who uses e-cigarettes.[15] When participants in a recent U.S. survey were asked where they had heard about e-cigarettes, face-to-face conversations emerged as one of the top sources; television

was the number one source.[16] In advertisements,[17] social media,[12] and news coverage,[18] e-cigarettes are frequently highlighted as healthier alternatives to combustible cigarettes and as a way to circumvent smoke-free restrictions in public venues. Repeated exposures to such messages in the media and social environment could influence public acceptance of e-cigarette use in places where smoking is not permitted. This process may be especially pronounced among disadvantaged populations. Lower income and education populations have higher smoking prevalence, higher exposures to secondhand smoke, and lower quit rates.[19] Historically, tobacco companies targeted minorities in their marketing and promotion,[20] raising the possibility that e-cigarette communication may also be targeted at specific populations such that health inequalities in tobacco use or cessation rates may widen over time due to communication inequalities.[21]

The first objective in this study is to examine the socio-demographic correlates of reporting being exposed to e-cigarette communications, defined as exposure to e-cigarette information from advertising, other media, and interpersonal discussion. We considered e-cigarette advertising separately from other media even though most advertisements appear within various media because advertising messages could have distinct effects from other media content including news or entertainment. In addition, advertising of e-cigarettes potentially could be regulated. Interpersonal discussion of e-cigarettes was included in this study because this is an important way that people learn about e-cigarettes.[16] Second, we test the hypothesis that self-reported exposure to e-cigarette communications would be associated with lower support for policies to restrict e-cigarette use (vaping) in public venues. Because e-cigarettes have only recently become prominent in the public sphere, the perceived valence of information about them may be a particularly important factor in influencing the public's impression of these new products. We hypothesize that those who perceived more favorable information about e-cigarette communications would have lower support for restricting vaping in public places. Third, we also test whether there are spillover effects from e-cigarette messages to public opinions toward policies to restrict smoking combustible cigarettes. On one hand, we might expect exposure to e-cigarette communications to be associated with lower support for smoking in public places if such communications glamorize smoking behaviors. On the other hand, if these communications distinguish e-cigarettes as a healthier or more socially acceptable alternative to traditional combustible smoking, we may instead find that greater exposure is associated with stronger support for policies to restrict smoking in public venues.

METHODS

Study sample and data collection

The Annenberg National Health Communication Survey (ANHCS) is a monthly cross-sectional survey among adults aged 18 years and older in the United States, conducted from 2005 to 2013 by GfK (previously Knowledge Networks). Respondents of the ANHCS are invited from Knowledge Panel, a nationally representative online research panel randomly recruited by probability-based sampling of households using random-digit dial (RDD) and address-based sampling methods (see www.knowledgenetworks.com/knpanel/). Online surveys of probability samples have been validated in prior research and yield more accurate

population estimates than online surveys involving non-probability samples.[22,23] Participating households are supplied with hardware and internet service if needed. ANHCS participants completed a survey module of items specific to public perceptions about e-cigarettes from October through December 2013, yielding a total sample of 1551 respondents. Participants were excluded if they indicated that they had never heard about e-cigarettes (n=102), resulting in an analysis sample of 1449 respondents (aged 18–94 years). Survey completion rates of respondents in these months were 56%, 51%, and 51%, respectively. Participation in the survey was voluntary and consent was implied from completion of the survey. No personally identifiable data was collected through the ANHCS. The institutional review board of the University of Pennsylvania granted the ANHCS exempt status.

Measures

Outcome variables—Support for policies to restrict smoking in public venues was measured using standard items obtained from the National Adult Tobacco Survey.[24] Three items asked respondents to indicate whether smoking indoors in restaurants, smoking indoors in bars/casinos/clubs, and smoking at parks should (1) always be allowed, (2) be allowed only at some times or in some places, or (3) never be allowed. Responses to these items were then averaged into a scale of support for smoking restrictions (Cronbach's alpha = 0.74). Support for policies to restrict vaping was measured using parallel items that asked respondents to indicate if electronic cigarettes should be allowed in the above three venues. Responses to these items were averaged into a scale of support for vaping restrictions (Cronbach's alpha = 0.88).

Self-reported exposure to e-cigarette advertising, media, and interpersonal discussion—Three survey items measured the frequency of exposure to advertisements promoting electronic cigarettes in the preceding 30 days in (1) convenience stores, liquor stores, or gas stations, (2) television, radio, or newspapers and magazines, (3) social media such as Facebook, Twitter, or YouTube. The response options ranged on a four-point scale (i.e., never, once or twice, three or four times, and five times or more). Participants' responses to these three items were averaged into a scale for the frequency of advertising exposure.

If participants indicated exposure to at least one form of advertisements (n=1056), they were asked to indicate the valence of information in advertisements with the following question: "In your opinion, was the information in the advertisements promoting electronic cigarettes…?" The response ranged on a five-point scale (completely positive, mostly positive, a mix of positive and negative, mostly negative, or completely negative) and was reverse-coded such that higher values indicate more positive valence. Valence is defined here as whether the information is perceived as positive or negative.[25] Because the valence measure is contingent on participants having encountered e-cigarette ads, we computed a valence-weighted advertising exposure by multiplying the frequency of advertising exposure scale with the perceived valence of the information in advertisements.

Similarly, we measured respondents' frequency of exposure to media exposure of e-cigarettes other than advertisements in the preceding 30 days from (1) news on television, newspapers, or magazines, (2) television shows other than news (e.g., drama, late night comedy, celebrity talk shows, reality television), and (3) using social media. These three items were averaged into a scale for other media exposure and we computed the valence-weighted exposure using the procedure described earlier for those who reported at least some media exposure (n=699).

Interpersonal discussion about e-cigarettes was measured with a single item that asked how often a respondents' close friend or family member talked to them about e-cigarettes. The valence-weighted interpersonal discussion measure was computed with the same procedure as above for respondents who had discussed with others about e-cigarettes (n=305).

Covariates—We adjusted for covariates including age (years), gender (male/female), race/ethnicity (non-Hispanic White, non-Hispanic African American, Hispanic, and other), household income (below $25000, $25000 to $49999, and $50000 and above), education (some school or below, some college, college graduate or higher), health status (scale of 1–6 from very poor to excellent), political ideology (scale of 1 to 7 from extremely liberal to extremely conservative), political party identification (scale of 1 to 7 from strong Republican to strong Democrat), smoking status (non-smoker, former smoker, or current smoker using standard measures of lifetime cigarette use, and current use of cigarettes),[24] and having ever used e-cigarettes (yes/no). We also adjusted for how often respondents saw other people use e-cigarettes in four venues: (1) indoors at their workplace, (2) indoors in restaurants, (3) indoors in bars/casinos/clubs, and (4) at parks in the preceding 30 days. The responses for these four items ranged from never to five times or more along a four-point scale and were averaged into a scale for observing others vaping.

Data Analysis

After examining descriptive statistics, we assessed the socio-demographic correlates of frequency of exposure to each form of e-cigarette communications (advertising, other media, and interpersonal discussion). We then examined correlations (Spearman's rho) of the frequency of exposure measures, valence-weighted exposures, and the two policy support outcomes. Next, we fitted a series of multiple regression models to assess associations between policy support for restricting smoking and vaping with each of the frequency of exposure measures at a time and also with all three measures in combination. The amount of missing data across all variables was minimal (2.4%) and list wise deletion was utilized for handling missing values in these regression analyses. We also fitted separate regression models to examine associations between policy support outcomes using each valence-weighted exposure measure at a time. The analyzed samples for these models were restricted to respondents who had reported at least some exposure to advertisements (n=1056), other media (n=699), or interpersonal discussion (n=305) because those who had no exposure to these forms of e-cigarette communications were not asked the valence questions (see Figure 1 for flow diagram of analyzed sample; web only). All regression models adjusted for demographic and tobacco use variables and the Stata 13 SVY program was used to weight the analysis sample to the most recent data from the Current Population Survey (CPS).[26]

RESULTS

Sample characteristics

The mean age of the sample was 49.5 years, 51.3% were female, 76.6% were non-Hispanic white, and 35.5% completed college education or higher. Other characteristics of the sample and weighted distributions (matching the CPS data) are summarized in Table 1. Overall, the weighted prevalence of ever trying an e-cigarette was 13.6%. Among non-smokers, 3.8% have ever tried e-cigs. Among former smokers, 12.7% have ever tried e-cigs. Among current smokers, 47.2% have ever tried e-cigs. These proportions were slightly higher but comparable with data from a national U.S. survey of adults in February and March 2012. [16] In that survey, 8.1% had tried e-cigarettes overall. Among non-smokers, long-term former smokers, recent former smokers, and current smokers, the proportions of adults who ever tried e-cigs were respectively 1.0%, 2.4%, 26.8%, 32.2%. We think that the increases in prevalence of ever trying e-cigs between 2012 and 2013 appear in line with the explanation that more adults have tried e-cigs over the intervening period.

Descriptive statistics of key variables

Table 2 summarizes the weighted proportions of responses for supporting vaping or smoking restrictions in each public venue. Overall, respondents tended to favor restricting vaping or smoking in public places; means of the support for restricting vaping and smoking scales were 2.1 and 2.5 respectively (on a scale ranging from 1 ‘always be allowed’ to 3 ‘never be allowed’). On average, participants reported infrequent exposures to all three forms of e-cigarette communications in the preceding 30 days; the mean frequency of exposure to advertising, other media, and interpersonal discussion were 1.6, 1.4, and 1.3 respectively (on a scale ranging from 1 ‘never’ to 4 ‘five times or more’).

Associations between support for vaping and smoking restricting policies and self-reported exposure to e-cigarettes communications

Frequency of exposure from advertising, other media, and interpersonal discussion were associated with lower support for policies to restrict vaping and smoking in public places (Spearman’s rho ranged from −0.074 to –0.233, all p-values<0.01). Valence-weighted exposures from these three forms of e-cigarette communications were also negatively associated with lower support for vaping and smoking restrictions (Spearman’s rho ranged from −0.086 to –0.443, all p-values<0.05).

Socio-demographic correlates of exposure to self-reported e-cigarettes communications

Table 3 shows the socio-demographic correlates of the frequency of exposure to advertising, other media, and interpersonal discussion among U.S. adults. There were no significant differences in frequency of e-cigarette communications by race/ethnicity and socioeconomic position (i.e., education or household income). Older adults had higher exposure to other media and females reported higher exposure to interpersonal discussion about e-cigarettes than males. Current smokers reported higher exposures to advertising while those who have tried e-cigarettes had more interpersonal discussion. Observing others vaping in various venues was associated with higher frequency of exposure to all three types of e-cigarette

communications. Identifying with being more Republican was associated with higher frequency of interpersonal discussion about e-cigarettes.

Multiple regression analyses predicting policy support for restricting vaping[1]

Table 4 shows the multiple regression analyses predicting support for policies to restrict vaping in public places with the frequency of exposure from advertising, other media, and interpersonal discussion. Models 1a to 3a included one of these three exposure measures separately, adjusting for covariates. Of the three exposure measures, self-reported frequency of exposure to interpersonal discussion about e-cigarettes was associated with lower support for restricting e-cigarette use in public places (Model 3a) after adjusting for covariates. Model 4a included all three exposure measures as predictors and shows that interpersonal discussion about e-cigarettes was associated with lower support to restrict vaping in public places ($B=-0.138$, $p<.0005$) over and above exposure to advertising and other media. Covariates that predicted higher support included observing others vaping, older age, lower educational attainment, being a nonsmoker, and not having tried e-cigarettes in the past. These models accounted for 19.6 to 21.0% of the variance of the outcome measure.

The regression models predicting support for policies to restrict vaping in public places with the valence-weighted exposure measures are presented in Table 5. Parallel to the above analyses with the frequency of exposure measures, Models 1b to 3b included each of the valence-weighted exposure measures separately, adjusting for covariates. Valence-weighted exposures to e-cigarette advertising, other media and interpersonal discussion about e-cigarettes were all associated with lower support for restricting e-cigarette use in public places (Model 1b, 2b, and 3b) after adjusting for covariates. In other words, among respondents who were exposed to each of these forms of e-cigarette communications, higher exposure to information perceived as more positive was associated with lower support for policies to restrict vaping in public venues. Models 1b–3b accounted for 22.1 to 32.5% of the variance of support for restricting vaping.

Multiple regression analyses predicting policy support for restricting smoking[2]

Adjusting for covariates and sampling weights, frequency of exposure to e-cigarette advertising, other media, and interpersonal discussion was not significantly associated with support for policies to restrict smoking in public places (Models 1c to 4c; detailed results available on Appendix A in Web version only). Reporting more frequent encounters of

[1]We performed sensitivity analyses fitting ordered logistic regression models to predict public support for vaping restrictions across each of the three venues (restaurants, bars/clubs/casinos, and parks) as ordinal variables (i.e., always be allowed, allowed only at sometimes or in some places, and never be allowed). Consistent with results in Table 4, we found that frequency of exposure to interpersonal communication was significantly associated with lower odds of support for vaping restrictions in all three venues. Largely consistent with Table 5, we found that valence-weighted exposures to ads and interpersonal communications were associated with lower odds of support for vaping restrictions in all three venues. Valence-weighted media exposure was marginally non-significant as a predictor of support for vaping restrictions in bars ($p=.09$) and parks ($p=.06$) and was not a significant predictor of support for vaping restrictions in restaurants. Due to reasons of parsimony and space constraints, we have not presented these data in this paper. However, full details of these sensitivity analyses are available from the authors upon request.

[2]We performed parallel sensitivity analyses fitting ordered logistic regression models to predict public support for smoking restrictions across each of the three venues (restaurants, bars/clubs/casinos, and parks) as ordinal variables (i.e., always be allowed, allowed only at sometimes or in some places, and never be allowed). Consistent with results in Appendices A and B, frequency of exposure or valence-weighted exposure to e-cigarette communications were not significantly associated with support for smoking restrictions for all three venues. Full details of these sensitivity analyses are available from the authors upon request.

others vaping was associated with lower levels of support, males had lower support than females, former and current smokers had lower support than nonsmokers, and those who identified as being more Republican had lower support than Democrats. The valence-weighted exposures to e-cigarette advertising, other media and interpersonal discussion about e-cigarettes were not significantly associated with support for restricting smoking in public places (Model 1d, 2d, and 3d) after adjusting for covariates (Appendix B in Web version only).

DISCUSSION

This current study represents, to our knowledge, the first attempt to explore differences in self-reported exposure to e-cigarette communications across sociodemographic characteristics and the associations between such exposures and public support for smoke-free and vape-free restrictions in public venues. In a representative sample of U.S. adults, there was no difference in reported exposures to e-cigarette advertising, other media, or interpersonal discussion across race/ethnicity and socioeconomic position characteristics including education or household income. These results contrast with those from national surveys conducted between 2009 and 2012 that reported lower awareness of e-cigarettes among U.S. adults who had lower education attainment, lower household income, or who were from minority race/ethnic groups.[14] It is likely that the rapid rise in e-cigarette communications in the recent months may have eliminated gapsin being exposed to e-cigarette information between different socioeconomic groups.[13]

Concerning vape-free policy support, we found evidence that reporting higher frequency of exposure to certain forms of e-cigarette communications (e.g., interpersonal discussion) was associated with lower support for policies that restrict the use of e-cigarettes in three venues (restaurants, bars/clubs/casinos, and parks), over and above other significant predictors (i.e., smoking status, ever use of e-cigarettes, and observing others vaping). More specifically, respondents who had higher exposure to information that they perceived to be positive through all three forms of e-cigarette communications reported slightly lower support for restricting e-cigarette use in public venues. Although the strength of the above associations tend to be small in magnitude, we think that this finding is important because e-cigarette communications are increasing and some forms of communications (i.e., advertising) would be amenable to policy intervention compared to other significant predictors which are less modifiable (e.g., it would not be possible to reverse individuals' ever trying an e-cigarette).

One possible explanation for these results is these communications frequently emphasize e-cigarette vapors as being much less harmful than combustible cigarette smoke and that e-cigarettes could be used everywhere, including places where smoking is prohibited.[17] These messages may resonate with the public such that they do not view vaping restrictions in public venues to be necessary. The implication of this finding is that e-cigarette communications could potentially undermine public support for ongoing local and state legislative efforts to restrict vaping in smoke-free venues. Additionally, if vaping is seen as more acceptable in smoke-free venues, this could result in a new source of tobacco-related pollutants or confusion over the compliance and enforcement of smoke-free policies. Because of the correlational nature of this data, it is not possible to ascertain the causal

direction of the relationships between e-cigarette communications, specific messages embedded in these forms of communications, and public support for vaping restrictions. For instance, it is conceivable that respondents already believe that vaping restrictions are not necessary and their beliefs influence their recall of encountering e-cigarette communications. We recommend further research to assess if the above hypothesis is valid and close monitoring of health claims about e-cigarettes especially on advertising and other media.

For the research question on potential spillover effects on smoke-free policy, there was minimal support in this analysis for concluding that e-cigarette communications were associated with public support for restricting smoking in various venues. Although we observed correlations between awareness of e-cigarette communications and lower support for smoking restrictions, these associations were non-significant after adjusting for socio-demographic and tobacco use covariates. One explanation for the current findings is the majority of the public believes that secondhand smoke is harmful and therefore approves of smoking bans in these venues (e.g., mean support for smoking restrictions in this sample was 2.5 on a scale ranging from 1 to 3). Having exposure to e-cigarette communications may not necessarily counter these long-held beliefs. It is also possible that exposure to e-cigarette communications reinforces these beliefs by contrasting the benefits and reduced harms of this new product against the health risks and social disadvantages of smoking regular cigarettes.[18] This comparative information between e-cigarettes and combustible cigarettes may be emphasizing that usage of these tobacco products are distinct behaviors.

In the models predicting support for vaping and smoking restrictions with the frequency of exposure measures (Models 1a–4a and 1c–4c), we note that participants who reported higher frequency of observing others using e-cigarettes in various venues tended to have lower support for smoke-free and vape-free policies. This suggests that people may be influenced through direct experiences with others vaping to have more favorable attitudes toward e-cigarette use by others in public venues and hence lowered support for vaping restrictions. Importantly, this result suggests that observing others vaping could potentially undermine tobacco control policies to reduce population exposures to harm of secondhand cigarette smoke by lowering the public's support for smoke-free policies and possibly renormalizing smoking. While we note that this result represents correlational associations and not causal effects on public support for smoke-free restrictions, we recommend additional research to study if increasing occurrences of vaping in public places over time could hamper the enactment or the enforcement of smoke-free policies in public venues.

Strengths of this study include measurements of not just how frequently people were exposed to e-cigarette communications but also the perceived valence of these communications, obtaining survey data from a diverse probability sample of U.S. adults, adjustment for a comprehensive number of covariates, and weighting the analyses to extrapolate to the general U.S. adult population. However, the cross-sectional design precludes making any causal inferences in the observed associations. While we have adjusted for various socio-demographic covariates in the analyses, there could be potential unobserved variables (e.g., positive or negative experiences of breathing secondhand vapors from others, selective attention to e-cigarette communications, or underlying interest in e-

cigarettes) that could confound the relationship between remembering exposure to e-cigarette communications and supporting restrictions for vaping. To partially address potential confounding due to these reasons, the analyses adjusted for respondents' previous observations of others vaping, their smoking status, and having tried an e-cigarette. Although we noted that this internet panel is a nationally representative panel based on probability sampling, we observed a slight under-representation of certain population subgroups in the study population when compared with the Current Population Survey (e.g., fewer participants were from minority race/ethnic groups and fewer participants had high school or lower education attainment). Future studies involving national probability samples with other survey modes may be necessary to replicate these findings. The measures of perceived valence do not provide information about the specific content of e-cigarette communications respondents found to be positive or negative. Additional qualitative research would be helpful in that regard. Because smoking and vaping could be easily confused, it is possible some respondents may have mistaken other people smoking combustible cigarettes with using e-cigarettes However, we think the risk that participants are over-reporting others vaping by including people who are smoking combusted cigarettes is low given that the mean for the observed others vaping scale is 1.2 on a scale ranging from 1 to 4. Further validation research would be necessary to gauge the accuracy of reporting other people vaping.

In sum, this study provides new empirical evidence regarding e-cigarette communications for tobacco control policy. Exposure to e-cigarettes advertising and other media perceived as favorable is associated with lower support for restricting e-cigarette use in public venues. This could potentially undermine current local and state legislative efforts to restrict vaping in smoke-free venues. The study contributes to the body of literature examining the potential impact of e-cigarette communications in the media and social environment on public opinion about smoke-free and vape-free policies and serves to inform the debate over the regulatory challenges posed by the increasing popularity of e-cigarettes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

ACKNOWLEDGEMENTS AND FUNDING

Data for this research came from the Annenberg National Health Communication Survey, supported by the Annenberg School at the University of Pennsylvania and the University of Southern California. Andy Tan conducted this work while a postdoctoral fellow at the Center of Excellence in Cancer Communication Research at the University of Pennsylvania. Cabral Bigman conducted this work while an assistant professor at the University of Illinois at Urbana-Champaign. Ashley Sanders-Jackson conducted this work while a postdoctoral fellow at Stanford Prevention Research Center. No financial disclosures were reported by the authors of this paper. This work was supported by National Heart, Lung, and Blood Institute grant number T32 CA8481567 and National Cancer Institute grant number P20CA095856.

REFERENCES

1. Hopkins DP, Razi S, Leeks KD, et al. Smokefree policies to reduce tobacco use: a systematic review. Am J Prev Med. 2010; 38:S275–S289. [PubMed: 20117612]

2. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. The health consequences of smoking - 50 years of progress: a report of the Surgeon General. Atlanta, GA: 2014.
3. Czogala J, Goniewicz ML, Fidelus B, et al. Secondhand exposure to vapors from electronic cigarettes. Nicotine Tob Res. 2013:ntt203. EPub Ahead of Print.
4. Schober W, Szendrei K, Matzen W, et al. Use of electronic cigarettes (e-cigarettes) impairs indoor air quality and increases FeNO levels of e-cigarette consumers. Int J Hyg Environ Health. 2013 e-pub ahead of print.
5. Philadelphia Department of Public Health. [accessed 13 Mar2014] Electronic cigarette fact sheet. 2013. http://www.phila.gov/health/pdfs/ElectronicCigaretteFactSheet_72513_final.pdf
6. Kurutz, S. [accessed 2 Mar 2014] Confounding a smoking ban, and bouncers. N. Y. Times. 2013. http://www.nytimes.com/2013/08/08/fashion/smoking-is-back-without-the-stigma.html
7. Benowitz NL, Goniewicz ML. The regulatory challenge of electronic cigarettes. JAMA. 2013; 310:685–686. [PubMed: 23856948]
8. Fairchild AL, Bayer R, Colgrove J. The renormalization of smoking? E-cigarettes and the tobacco 'endgame'. N Engl J Med. 2014; 370:293–295. [PubMed: 24350902]
9. Durkin S, Brennan E, Wakefield M. Mass media campaigns to promote smoking cessation among adults: an integrative review. Tob Control. 2012; 21:127–138. [PubMed: 22345235]
10. Van den, Putte B.; Yzer, M.; Southwell, BG., et al. Interpersonal communication as an indirect pathway for the effect of antismoking media content on smoking cessation. J Health Commun. 2011; 16:470–485. [PubMed: 21337250]
11. Elliott, S. [accessed 30 Aug2013] E-cigarette makers' ads echo tobacco's heyday. N. Y. Times. 2013. http://www.nytimes.com/2013/08/30/business/media/e-cigarette-makers-ads-echo-tobaccos-heyday.html
12. Paek H-J, Kim S, Hove T, et al. Reduced harm or another gateway to smoking? Source, message, and information characteristics of e-cigarette videos on YouTube. J Health Commun. 2013 Epub ahead of print.
13. Huang, J.; Kornfield, R.; Szczypka, G., et al. [accessed 13 Mar 2014] Marketing and promotion of electronic cigarettes on Twitter. APHA. 2013. https://apha.confex.com/apha/141am/webprogram/Paper281540.html
14. Pepper JK, Brewer NT. Electronic nicotine delivery system (electronic cigarette) awareness, use, reactions and beliefs: a systematic review. Tob Control. 2013 tobaccocontrol-2013-051122.
15. Choi K, Forster J. Characteristics associated with awareness, perceptions, and use of electronic nicotine delivery systems among young US Midwestern adults. Am J Public Health. 2013; 103:556–561. [PubMed: 23327246]
16. Zhu SH, Gamst A, Lee M, et al. The use and perception of electronic cigarettes and snus among the U.S. population. PLoS ONE. 2013; 8:e79332. [PubMed: 24250756]
17. Richardson A, Ganz O, Stalgaitis C, et al. Noncombustible tobacco product advertising: How companies are selling the new face of tobacco. Nicotine Tob Res. 2013:ntt200. e-pub ahead of print.
18. Rooke C, Amos A. News media representations of electronic cigarettes: an analysis of newspaper coverage in the UK and Scotland. Tob Control. 2013 tobaccocontrol-2013-051043.
19. Legacy. Tobacco control in low SES populations. Washington, D.C: 2010. http://www.legacyforhealth.org/content/download/645/7527/file/Low_SES_Booklet.pdf [accessed 3 Mar 2014]
20. National Cancer Institute. The role of the media in promoting and reducing tobacco use. Bethesda, MD: U.S. Department of Health & Human Services, National Institutes of Health, National Cancer Institute; 2008. http://cancercontrol.cancer.gov/brp/tcrb/monographs/19/m19_complete.pdf [accessed 4 Mar2014]
21. Viswanath K, Nagler RH, Bigman-Galimore CA, et al. The communications revolution and health inequalities in the 21st century: implications for cancer control. Cancer Epidemiol Biomarkers Prev. 2012; 21:1701–8. [PubMed: 23045545]

22. Chang L, Krosnick JA. National surveys via RDD telephone interviewing versus the internet comparing sample representativeness and response quality. Public Opin Q. 2009; 73:641–678.

23. Yeager DS, Krosnick JA, Chang L, et al. Comparing the accuracy of RDD telephone surveys and internet surveys conducted with probability and non-probability samples. Public Opin Q. 2011; 75:709–47.

24. Centers for Disease Control and Prevention. [accessed 24 Jan2014] National Adult Tobacco Survey (NATS). 2013. http://www.cdc.gov/tobacco/data_statistics/surveys/nats/

25. Lang A. Using the Limited Capacity Model of Motivated Mediated Message Processing to Design Effective Cancer Communication Messages. J Commun. 2006; 56:S57–S80.

26. U. S. Census Bureau. [accessed 2 Mar 2014] Current Population Survey (CPS). 2012. https://www.census.gov/cps/data/

What this paper adds

- There is a dearth of prior research on the socio-demographic correlates of exposure to e-cigarette communications and the relationships between these exposures and support for policies restricting vaping and smoking in public places.
- This study found that exposure to information about e-cigarettes through advertisements, other media, and interpersonal discussion did not differ by race/ethnicity or socioeconomic position. Smokers reported higher exposure to advertising, those who tried e-cigarettes had more interpersonal discussion, and those who saw others vaping reported more exposure to all three forms of e-cigarette communications.
- Exposure to information perceived as favorable about e-cigarettes from advertisements, other media, and interpersonal discussion were associated with lower support for vape-free policies after adjusting for covariates. In contrast, exposure to these forms of e-cigarette communications was not associated with support for smoke-free policies after adjusting for covariates.
- This study suggests that e-cigarette communications could potentially undermine public support for ongoing local and state legislative efforts to restrict vaping in smoke-free venues.

Table 1

Analyzed sample characteristics (n=1449)

	Unweighted		Weighted to Current Population Survey	
	Mean (SD)	**%**	**Mean (SE)**	**%**
Age (years)	49.5 (16.9)		46.6 (0.6)	
Sex				
Male		48.7		49.5
Female		51.3		50.4
Race/Ethnicity				
White		76.6		69.4
African-American		7.5		10.6
Hispanic		10.0		13.9
Other[a]		5.9		6.0
Education				
Completed high school or below		33.7		40.4
Some college		31.9		29.6
College graduate or higher		35.5		30.0
Annual household income				
<$25,000		15.7		16.4
$25,000–49,999		23.7		22.9
≥$50,000		60.7		60.7
Health Status (scale of 1–6 from very poor to excellent)	4.3 (0.9)		4.3 (0.0)	
Smoking Status				
Non-smoker		55.8		55.9
Former		29.1		27.1
Current		15.1		17.0
Tried e-cigarettes at least once				
No		87.9		87.4
Yes		12.1		13.6
Observed others vaping (scale of 1 to 4 from never to five times of more in the past 30 days)	1.2 (0.4)		1.3 (0.0)	
Political ideology (scale of 1 to 7 from extremely liberal to extremely conservative)	4.2 (1.5)		4.2 (0.0)	
Party identification (scale of 1 to 7 from strong Republican to strong Democrat)	4.1 (2.1)		4.2 (0.1)	

Table 2

Weighted distribution of support for vaping and smoking restrictions (n=1449)

	Weighted to Current Population Survey
	%
Restrict vaping indoors in restaurants[a]	
Always be allowed	14.9
Be allowed only at some times or in some places	38.6
Never be allowed	46.4
Restrict vaping indoors in bars, casinos, or clubs[b]	
Always be allowed	22.0
Be allowed only at some times or in some places	46.2
Never be allowed	31.4
Restrict vaping at parks[a]	
Always be allowed	29.7
Be allowed only at some times or in some places	44.7
Never be allowed	25.6
Restrict smoking indoors in restaurants	
Always be allowed	2.3
Be allowed only at some times or in some places	22.6
Never be allowed	75.1
Restrict smoking indoors in bars, casinos, or clubs	
Always be allowed	8.2
Be allowed only at some times or in some places	42.9
Never be allowed	48.9
Restrict smoking at parks[c]	
Always be allowed	17.9
Be allowed only at some times or in some places	45.6
Never be allowed	36.5

Note.

[a] 2 missing cases.

[b] 4 missing cases.

[c] 1 missing case.

Table 3

Correlates of self-reported frequency of exposure to e-cigarette communications: U.S. adults (N=1449)

	Ad Exposure	Other Media Exposure	Interpersonal Exposure
Independent variables	**B (95% CI)**	**B (95% CI)**	**B (95% CI)**
Age (years)	0.002 (−0.001,0.004)	0.002 (0.000,0.004)*	−0.001 (−0.003,0.001)
Sex – Female	−0.059 (−0.134,0.015)	0.027 (−0.034,0.089)	0.080 (0.012,0.147)*
Race/Ethnicity (White is referent)			
African-American	0.066 (−0.063,0.195)	0.067 (−0.044,0.177)	−0.013 (−0.112,0.086)
Hispanic	0.049 (−0.085,0.183)	0.091 (−0.038,0.220)	0.096 (−0.037,0.229)
Other[a]	−0.003 (−0.172,0.166)	0.054 (−0.075,0.183)	0.128 (−0.082,0.338)
Education (High school or below is referent)			
Some college	−0.045 (−0.137,0.047)	0.020 (−0.059,0.099)	0.030 (−0.065,0.125)
College graduate or higher	0.026 (−0.074,0.126)	0.034 (−0.039,0.107)	−0.037 (−0.119,0.045)
Annual household income (<$25,000 is referent)			
$25,000–49,999	0.061 (−0.057,0.178)	−0.012 (−0.114,0.090)	−0.044 (−0.166,0.078)
≥$50,000	0.032 (−0.076,0.140)	−0.029 (−0.122,0.064)	−0.103 (−0.224,0.017)
Health Status	−0.032 (−0.072,0.009)	−0.027 (−0.059,0.006)	0.011 (−0.027,0.048)
Smoking Status (Non-smoker is referent)			
Former	−0.033 (−0.122,0.057)	−0.062 (−0.129,0.004)	0.043 (−0.039,0.125)
Current	0.198 (0.069,0.328)**	0.107 (−0.020,0.234)	0.096 (−0.049,0.240)
Tried e-cigarettes at least once	0.141 (−0.003,0.284)	0.018 (−0.121,0.156)	0.384 (0.201,0.567)***
Observed others vaping	0.412 (0.326,0.498)***	0.341 (0.245,0.436)***	0.343 (0.217,0.469)***
Political ideology	−0.009 (−0.039,0.021)	−0.010 (−0.034,0.015)	−0.008 (−0.043,0.027)
Party identification	−0.016 (−0.041,0.008)	−0.007 (−0.028,0.015)	−0.027 (−0.051,−0.002)*
Constant	1.251	0.975	0.912
R-squared	0.166	0.144	0.212

Note. Cell entries are B/beta from multivariate regressions adjusting for all variables in the table. Self-reported exposure measures are frequency of exposure on scale with a maximum value of 4. Party identification ranged from strong Republican to strong Democrat along a 7-point scale.

* p<.05,

** p<.01,

*** p<.0005

Table 4

Multivariate analyses predicting support for policies to restrict e-cigarette use with self-reported frequency of exposure measures (N=1449)

	Model 1a	Model 2a	Model 3a	Model 4a
Independent variables	**B (95% CI)**	**B (95% CI)**	**B (95% CI)**	**B (95% CI)**
Ad exposure	−0.026 (−0.092,0.040)	−	−	−0.029 (−0.107,0.049)
Other media exposure	−	0.000 (−0.072,0.072)	−	0.029 (−0.056,0.114)
Interpersonal discussion	−	−	−0.138 (−0.210,−0.066)***	−0.138 (−0.209,−0.066)***
Age (years)	0.002 (0.000,0.005)	0.002 (0.000,0.005)	0.002 (0.000,0.005)	0.002 (0.000,0.005)
Sex – Female	0.018 (−0.057,0.093)	0.021 (−0.055,0.096)	0.034 (−0.041,0.108)	0.028 (−0.047,0.103)
Race/Ethnicity (White is referent)				
African-American	0.051 (−0.096,0.198)	0.049 (−0.098,0.196)	0.047 (−0.098,0.192)	0.047 (−0.097,0.192)
Hispanic	0.115 (−0.012,0.243)	0.119 (−0.009,0.247)	0.132 (0.008,0.255)*	0.127 (0.002,0.251)*
Other[a]	0.119 (−0.025,0.263)	0.119 (−0.025,0.262)	0.135 (−0.007,0.277)	0.135 (−0.007,0.277)
Education (High school or below is referent)				
Some college	−0.099 (−0.194,−0.003)*	−0.097 (−0.193,−0.002)*	−0.093 (−0.188,0.001)	−0.095 (−0.189,−0.001)*
College graduate or higher	0.023 (−0.075,0.121)	0.025 (−0.072,0.123)	0.023 (−0.075,0.120)	0.017 (−0.080,0.115)
Annual household income (<$25,000 is referent)				
$25,000–49,999	−0.015 (−0.142,0.111)	−0.016 (−0.143,0.111)	−0.023 (−0.148,0.103)	−0.021 (−0.146,0.105)
≥$50,000	−0.016 (−0.133,0.102)	−0.015 (−0.133,0.103)	−0.029 (−0.146,0.087)	−0.029 (−0.145,0.088)
Health Status	0.007 (−0.035,0.050)	0.008 (−0.034,0.050)	0.010 (−0.031,0.051)	0.010 (−0.032,0.051)
Smoking Status (Non-smoker is referent)				
Former	−0.122 (−0.211,−0.034)**	−0.122 (−0.211,−0.033)**	−0.116 (−0.204,−0.028)*	−0.115 (−0.203,−0.027)*
Current	−0.408 (−0.547,−0.269)***	−0.413 (−0.551,−0.274)***	−0.399 (−0.538,−0.260)***	−0.397 (−0.536,−0.258)***
Tried e-cigarettes at least once	−0.334 (−0.475,−0.193)***	−0.338 (−0.479,−0.198)***	−0.286 (−0.426,−0.145)***	−0.281 (−0.423,−0.140)***
Observed others vaping	−0.221 (−0.329,−0.113)***	−0.232 (−0.343,−0.121)***	−0.185 (−0.290,−0.080)**	−0.182 (−0.295,−0.069)**
Political ideology	−0.004 (−0.036,0.028)	−0.003 (−0.035,0.028)	−0.004 (−0.036,0.027)	−0.005 (−0.036,0.027)
Party identification	0.011 (−0.012,0.034)	0.012 (−0.011,0.035)	0.008 (−0.015,0.030)	0.007 (−0.015,0.030)
Constant	2.417	2.386	2.510	2.518
R-squared	0.196	0.197	0.210	0.209

Note:

* p<.05,

** p<.01,

*** p<.0005.

Table 5

Multivariate analyses predicting support for restricting vaping in public places with valence-weighted exposure measures

	Model 1b (N=1056)	Model 2b (N=699)	Model 3b (N=305)
Independent variables	**B (95% CI)**	**B (95% CI)**	**B (95% CI)**
Valence-weighted ad exposure	−0.022 (−0.038,−0.006)**	–	–
Valence-weighted other media exposure	–	−0.022 (−0.043,−0.001)*	–
Valence-weighted interpersonal discussion	–	–	−0.071 (−0.091,−0.051)***
Age (years)	0.004 (0.001,0.007)*	0.003 (−0.001,0.006)	0.003 (−0.003,0.008)
Sex – Female	0.006 (−0.083,0.095)	−0.022 (−0.126,0.082)	0.068 (−0.084,0.221)
Race/Ethnicity (White is referent)			
African-American	−0.006 (−0.166,0.155)	−0.057 (−0.263,0.150)	−0.121 (−0.459,0.218)
Hispanic	0.142 (−0.001,0.284)	0.117 (−0.057,0.291)	0.024 (−0.192,0.240)
Other[a]	0.174 (0.007,0.342)*	0.148 (−0.041,0.337)	0.173 (−0.101,0.447)
Education (High school or below is referent)			
Some college	−0.084 (−0.194,0.026)	−0.063 (−0.189,0.062)	−0.052 (−0.227,0.123)
College graduate or higher	0.058 (−0.058,0.175)	−0.106 (−0.240,0.028)	0.132 (−0.083,0.346)
Annual household income (<$25,000 is referent)			
$25,000–49,999	−0.013 (−0.153,0.126)	0.064 (−0.102,0.230)	0.024 (−0.213,0.260)
≥$50,000	−0.003 (−0.137,0.131)	0.082 (−0.082,0.246)	−0.023 (−0.232,0.186)
Health Status	0.011 (−0.037,0.059)	0.045 (−0.013,0.102)	0.017 (−0.072,0.106)
Smoking Status (Non-smoker is referent)			
Former	−0.108 (−0.210,−0.007)*	−0.194 (−0.314,−0.074)**	−0.120 (−0.308,0.068)
Current	−0.403 (−0.542,−0.264)***	−0.432 (−0.597,−0.267)***	−0.418 (−0.662,−0.175)**
Tried e-cigarettes at least once	−0.279 (−0.422,−0.136)***	−0.376 (−0.554,−0.199)***	−0.162 (−0.358,0.034)
Observed others vaping	−0.184 (−0.294,−0.074)**	−0.150 (−0.266,−0.033)*	−0.076 (−0.209,0.057)
Political ideology	0.003 (−0.033,0.040)	0.009 (−0.034,0.053)	−0.010 (−0.072,0.052)
Party identification	0.010 (−0.017,0.037)	0.010 (−0.020,0.041)	−0.004 (−0.052,0.045)
Constant	2.321	2.169	2.556
R-squared	0.221	0.246	0.325

Note:

* p<.05,

** p<.01,

*** p<.0005