

BRIEF REPORT

How U.S. Adults Find Out About Electronic Cigarettes: Implications for Public Health Messages

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ABSTRACT

Introduction: Electronic cigarettes (e-cigarettes) are battery-powered nicotine delivery systems that have become increasingly popular in the United States. We sought to understand how U.S. adults hear about e-cigarettes.

Methods: A national sample of 17,522 U.S. adults (≥18 years old) completed an online survey in March 2013 assessing their awareness of and sources of information about e-cigarettes.

Results: Most respondents (86%) had heard of e-cigarettes. Current and former smokers were more likely to be aware of e-cigarettes than non-smokers. Males, younger adults, non-Hispanic Whites, and those with higher education were also more likely to have heard of e-cigarettes. The most commonly reported sources of information were another person, ads on television, and seeing e-cigarettes being sold, although the relative frequency of these sources differed for current, former, and never-smokers. Former and current smokers were more likely to have heard about e-cigarettes from e-cigarette users than were never-smokers. Adults age 30 years or younger were more likely than adults older than 30 years to have heard about e-cigarettes online.

Conclusions: Nearly all U.S. adults had heard of e-cigarettes in 2013. By focusing on the most common channels of information, public health campaigns can more efficiently communicate information about e-cigarette safety and consider necessary regulations should companies use these channels for marketing that targets youth, non-tobacco users, and other at-risk groups.

INTRODUCTION

Electronic cigarettes, also called e-cigarettes or electronic nicotine delivery systems, are battery-operated devices that produce vapor by heating a cartridge containing nicotine, flavoring, and humectants. Many researchers and public health advocates are concerned about e-cigarettes' safety (Bahl et al., 2012; U.S. Food and Drug Administration, 2009), possible use as a gateway to future smoking (Centers for Disease Control and Prevention, 2013; Grana, 2013), and potential to prevent smokers from trying proven cessation tools. Evidence of e-cigarettes' ability to help smokers quit is suggestive but not definitive (Bullen et al., 2013; Pepper & Brewer, 2013). The federal government does not currently regulate e-cigarettes but intends to do so through the Food and Drug Administration (U.S. Food and Drug Administration, 2011).

E-cigarette awareness among U.S. adults has increased from 16% in 2009 (Regan, Promoff, Dube, & Arrazola, 2013) to 75% in 2012 (Zhu et al., 2013). Ever use has also increased from 1% of U.S. adults in 2009 (Regan et al., 2013) to 8% in

2012 (Zhu et al., 2013). Current and former smokers are more likely to be aware of and use e-cigarettes than never-smokers (King, Alam, Promoff, Arrazola, & Dube, 2013; Pearson, Richardson, Niaura, Vallone, & Abrams, 2012; Regan et al., 2013; Zhu et al., 2013).

Our study expands on past research by documenting how adults learn about e-cigarettes, describing how those channels might be used for public health communication, and discussing the potential need to regulate marketing on those channels. We tested three predictions. First, we predicted that hearing about e-cigarettes from a person who uses them would be more common among smokers than non-smokers, given that smokers have higher rates of e-cigarette use than non-smokers, and smokers gather together in social and family groups (i.e., homophily; Christakis & Fowler, 2008). Second, we predicted that hearing about e-cigarettes from a person who uses them would be more common among e-cigarette users than non-users because e-cigarette users gather with other users (homophily) and exchange information about the product (Barbeau, Burda, & Siegel, 2013; Etter, 2010; Foulds, Veldheer, & Berg, 2011).

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Third, we predicted that young adults would be more likely to hear about e-cigarettes through online sources because young adults are more likely than older adults to use the Internet and social media (Smith, 2011; Zickuhr & Smith, 2012).

METHODS

Sample

This study relied on data collected from U.S. adults (age ≥ 18 years) in a March 2013 online survey as part of the Tobacco Control in a Rapidly Changing Media Environment study that examined the relationship between recall of receiving and sharing tobacco-related information and smoking attitudes, beliefs, and behavior. Most respondents (75%) were members of KnowledgePanel, a nationally representative online survey panel constructed using random digit dialing supplemented by address-based sampling (GfK Knowledge Networks, 2014). To recruit the rest of the sample, the survey company screened people who clicked on online ads and quota matched them to the probability sample based on demographic and tobacco use characteristics. The survey company also screened names and addresses and removed duplicates before inviting them to complete the survey. Non-responders received up to four reminders, and all participants provided consent online before taking the survey. Sixty-one percent of invited KnowledgePanel members completed the screening, and 97% of eligible respondents completed the survey. Response rates for the convenience sample cannot be calculated because there is no known sampling frame. The study received institutional review board approval.

Measures

The survey described e-cigarettes while displaying generic images of the product: "An e-cigarette looks like a regular cigarette, but it runs on a battery and produces vapor instead of smoke. There are many types of e-cigarettes. Some common brands are Smoking Everywhere, NJOY, Blu, and Vapor King." Next, one item assessed awareness of e-cigarettes: "Before today, had you ever heard of e-cigarettes?" (yes/no).

Respondents who had heard of e-cigarettes received a question about the sources of their awareness, "From which of the following sources have you ever heard about e-cigarettes?": another person, online, an ad on TV, an ad in a newspaper or magazine, a news story on TV or in a newspaper or magazine, and seeing them for sale in stores, including gas stations. Respondents who had heard about e-cigarettes from another person received the question, "Who did you hear about e-cigarettes from?": a friend or family member who uses e-cigarettes, a friend or family member who does not use e-cigarettes, someone else who uses e-cigarettes, and someone else who does not use e-cigarettes. Respondents who had heard about e-cigarettes online received the question, "Where did you hear about e-cigarettes online?"; response options were Twitter, an ad or user on Facebook, an ad or user on YouTube, an ad on some other Web site, a Web site that sells e-cigarettes, and an online news source.

The survey assessed demographics and smoking status. Current smokers received questions about intentions to quit ("Do you plan to quit smoking for good ...?": in the next seven days, in the next 30 days, in the next six months, in the next

year, more than one year from now, or I do not plan to quit smoking for good) and previous quit attempts ("During the past year, have you stopped smoking for one day or longer because you were trying to quit smoking for good?": yes/no). We conducted cognitive interviews with 16 participants during survey item development and pre-tested the revised items with 160 respondents.

Data Analysis

Analyses used Stata Version 12 (svy commands to account for the complex survey design), two-tailed statistical tests, and a critical alpha of .01. We examined bivariate associations between respondent characteristics and awareness of e-cigarettes using logistic regression and included statistically significant correlates in a multivariate model. To address our predictions, we conducted three multivariate logistic regressions, each adjusted for significant bivariate correlates and using source of awareness as the outcome. The regressions assessed whether (a) current smokers (smoke every day or some days) and former smokers (smoked more than 100 cigarettes in their lifetime but not currently smoking) were more likely than never-smokers (smoked fewer than 100 cigarettes) to have heard about e-cigarettes from someone who uses them (a combination of the responses "a friend or family member who uses e-cigarettes" and "someone else who uses e-cigarettes"); (b) e-cigarette users were more likely than non-users to hear about e-cigarettes from someone who uses them; and (c) respondents aged 30 and younger were more likely than those over age 30 to hear about e-cigarettes online.

Frequencies are unweighted, and percentages and analyses are weighted. Poststratification sample weights accounted for study design, including the combination of the probability and nonprobability samples, and representativeness of the sample compared with the U.S. population.

RESULTS

More than half of respondents (52%) were never-smokers, 28% were former smokers, and 21% smoked everyday or some days (Supplementary Table 1). Among current smokers, 54% intended to quit smoking in the next year. Most respondents were non-Hispanic White (68%) and had at least some college education (57%). The mean age was 47 years (SD 27). Eighty-six percent of U.S. adults had heard of e-cigarettes in 2013. Among those who were aware of e-cigarettes, 83% had never tried them, 11% were former users, and 6% were current users.

Correlates of Awareness

In multivariate analysis, former smokers (90% aware) and current smokers (95%) were more likely to have heard of e-cigarettes than never-smokers (81%, both $p < .001$; Supplementary Table 2). Greater awareness was associated with male gender (89% of males vs. 84% of females, $p < .01$), higher education (88% of those with some college education and 87% of those with college or more vs. 78% of those with less than a high school education, both $p < .001$), and race (80% of non-Hispanic Black, 77% of non-Hispanic other race, and 80% of Hispanic adults vs. 89% of non-Hispanic White adults; all $p < .001$). Awareness decreased with age ($p < .001$).

How U.S. adults learn about e-cigarettes

Sources of Awareness

The most frequent way that adults had heard of e-cigarettes was through another person (34% of never, 39% of former, and 48% of current smokers; Figure 1), by seeing them for sale in stores (22% of never, 27% of former, and 47% of current smokers), and by seeing them advertised on television (31% of never, 35% of former, and 40% of current smokers). Fewer respondents endorsed the Internet (12% of never, 12% of former, and 28% of current smokers) as a source of awareness.

As predicted, current smokers (83% aware) were more likely to have heard about e-cigarettes from an e-cigarette user than former smokers (78%, $p < .01$) or never-smokers (72%, $p < .001$). Consistent with our second prediction, 85% of ever e-cigarette users who heard about e-cigarettes from another person said that person used e-cigarettes, compared with 74% of those who had never used e-cigarettes ($p < .001$). Finally, as predicted, respondents over age 30 were less likely to have heard about e-cigarettes through the Internet than those aged 30 and younger (14% vs. 23%, $p < .001$).

DISCUSSION

Most U.S. adults (86%) had heard of e-cigarettes by 2013, continuing the increasing trend from 2009 (Figure 2). Demographic groups with higher smoking rates in the general population (e.g., men, non-Hispanic Whites; Centers for Disease Control and Prevention, 2011) were often more likely to be aware of e-cigarettes in our study, although this pattern was not consistent for education. This discrepancy may reflect exposure to outlets selling e-cigarettes, which are more widely available in high socioeconomic status neighborhoods (Rose et al., 2014).

Interpersonal communication was an important source of information among current and former smokers. Because of homophily (Christakis & Fowler, 2008), smokers often

associate with other smokers, who appear to be important sources of information about e-cigarettes. Similarly, e-cigarette users often congregate with other users (Barbeau et al., 2013; Etter, 2010; Foulds et al., 2011), so product information likely spreads through those connections.

E-cigarettes have a strong online presence (Cobb, Brookover, & Cobb, 2013; Yamin, Bitton, & Bates, 2010), which helps to explain why more than one-quarter of smokers learned about e-cigarettes online. The Internet may play an important role by reinforcing word-of-mouth messages, providing additional information as follow-up to personal conversations, or priming people to participate in conversations about e-cigarettes. Our results were consistent with our prediction that online sources were more common for adults age 30 and younger, who are more likely than those older than 30 to use the Internet and social media (Smith, 2011; Zickuhr & Smith, 2012).

These results have important implications for public health communication. First, interpersonal discussion is a key source of information, so future efforts should consider including grassroots word-of-mouth strategies. Televised advertising, a frequent source of information, could be used to communicate public health messages. Given that seeing e-cigarettes for sale in stores was a common source of awareness and point-of-sale cigarette marketing is already known to influence smoking behavior (Paynter & Edwards, 2009), warning labels should be clearly displayed on the products and their advertising at the point of sale, as is currently done for cigarettes and smokeless tobacco products. Based on our findings, web-based communications could be helpful to reach young adults aged 18–30 years. Finally, because these same routes of communication also serve as marketing channels, the public health community should closely track them and, as necessary, consider regulation to prevent targeted marketing to youth, non-tobacco users, and other at-risk groups. For example, if youth frequently learn about e-cigarettes from televised advertising or such advertising renormalizes the image of smoking, the Food and Drug Administration

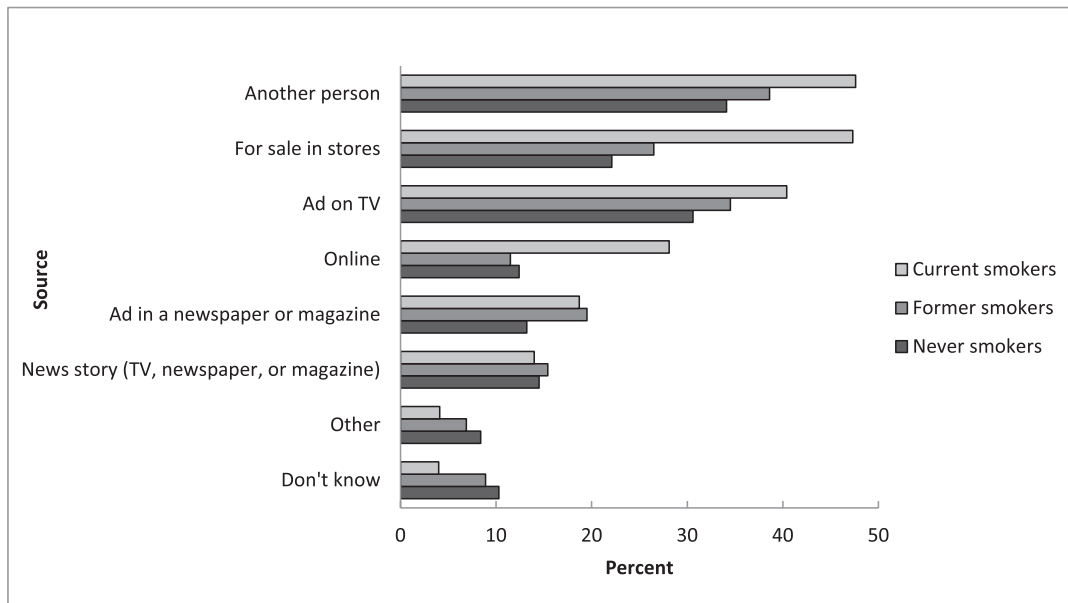


Figure 1. Channels of awareness of e-cigarettes among current smokers ($n = 6,311$), former smokers ($n = 3,709$), and never-smokers ($n = 5,551$) who have heard of e-cigarettes.

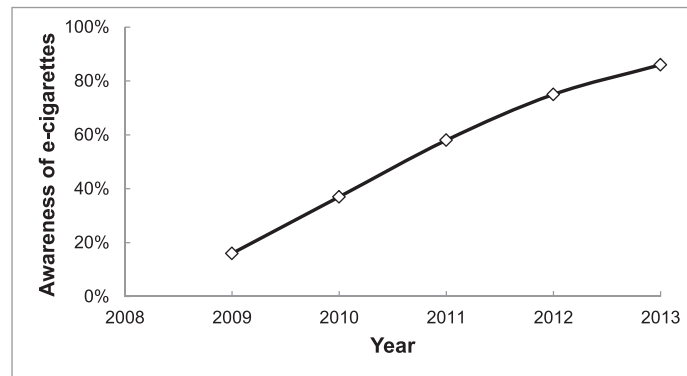


Figure 2. Increase in awareness of e-cigarettes among U.S. adults: 16% in 2009 (Regan et al., 2013), 37% (mean) in 2010 (King et al., 2013; Pearson et al., 2012; Regan et al., 2013), 58% in 2011 (King et al., 2013), 75% in 2012 (Zhu et al., 2013), and 86% in 2013.

might promulgate regulations to restrict or ban such ads on television.

Limitations include the study's cross-sectional design that precluded examining whether different sources of awareness predicted initiation or changes in e-cigarette use. We did not study first source of awareness, the content of the information people received, or their perceptions of its validity. Future studies will also need to establish the generalizability of our findings to youth and to newer types of e-cigarettes, including tank models. Although we recruited a supplementary convenience sample, we quota matched them to the probability sample on demographic and tobacco use characteristics.

In sum, awareness of e-cigarettes has increased rapidly in recent years, but we do not know whether the information that people are receiving is accurate or appropriate. Our results suggest that some channels (e.g., word of mouth, television, point-of-sale displays) may be more useful for spreading timely, accurate information about e-cigarettes than others.

SUPPLEMENTARY MATERIAL

Supplementary Tables 1 and 2 can be found online at <http://www.ntr.oxfordjournals.org>

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DECLARATION OF INTERESTS

None declared.

REFERENCES

Bahl, V., Lin, S., Xu, N., Davis, B., Wang, Y. H., & Talbot, P. (2012). Comparison of electronic cigarette refill fluid cytotoxicity using embryonic and adult models.

Reproductive Toxicology, 34, 529–537. doi:10.1016/j.reprotox.2012.08.001

Barbeau, A. M., Burda, J., & Siegel, M. (2013). Perceived efficacy of e-cigarettes versus nicotine replacement therapy among successful e-cigarette users: A qualitative approach. *Addiction Science & Clinical Practice*, 8, 5. doi:10.1186/1940-0640-8-5

Bullen, C., Howe, C., Laugesen, M., McRobbie, H., Parag, V., Williman, J., & Walker, N. (2013). Electronic cigarettes for smoking cessation: A randomised controlled trial. *Lancet*, 382, 1629–1637. doi:10.1016/S0140-6736(13)61842-5

Centers for Disease Control and Prevention. (2011). Vital signs: Current cigarette smoking among adults aged ≥18 years — United States, 2005–2010. *Morbidity and Mortality Weekly Report*, 60, 1207–1212.

Centers for Disease Control and Prevention. (2013). Notes from the field: Electronic cigarette use among middle and high school students - United States, 2011–2012. *Morbidity and Mortality Weekly Report*, 62, 729–730.

Christakis, N. A., & Fowler, J. H. (2008). The collective dynamics of smoking in a large social network. *The New England Journal of Medicine*, 358, 2249–2258. doi:10.1056/NEJMs0706154

Cobb, N. K., Brookover, J., & Cobb, C. O. (2013). Forensic analysis of online marketing for electronic nicotine delivery systems. *Tobacco Control*. Advance online publication. doi:10.1136/tobaccocontrol-2013-051185

Etter, J. F. (2010). Electronic cigarettes: A survey of users. *BMC Public Health*, 10, 231. doi:10.1186/1471-2458-10-231

Foulds, J., Veldheer, S., & Berg, A. (2011). Electronic cigarettes (e-cigs): Views of aficionados and clinical/public health perspectives. *International Journal of Clinical Practice*, 65, 1037–1042. doi:10.1111/j.1742-1241.2011.02751.x

GfK Knowledge Networks. (2014). Knowledge Panel overview. Retrieved from <http://www.gfk.com/us/Solutions/consumer-panels/Pages/GfK-KnowledgePanel.aspx>. Last accessed March 31, 2014.

Grana, R. A. (2013). Electronic cigarettes: A new nicotine gateway? *The Journal of Adolescent Health*, 52, 135–136. doi:10.1016/j.jadohealth.2012.11.007

King, B. A., Alam, S., Promoff, G., Arrazola, R., & Dube, S. R. (2013). Awareness and ever use of electronic cigarettes among U.S. adults, 2010–2011. *Nicotine & Tobacco Research*, 15, 1623–1627. doi:10.1093/ntr/ntt013

Paynter, J., & Edwards, R. (2009). The impact of tobacco promotion at the point of sale: A systematic review. *Nicotine & Tobacco Research*, 11, 25–35. doi:10.1093/ntr/ntn002

Pearson, J. L., Richardson, A., Niaura, R. S., Vallone, D. M., & Abrams, D. B. (2012). E-cigarette awareness, use, and

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- harm perceptions in US adults. *American Journal of Public Health*, 102, 1758–1766. doi:10.2105/ajph.2011.300526
- Pepper, J. K., & Brewer, N. T. (2013). Electronic nicotine delivery system (electronic cigarette) awareness, use, reactions, and beliefs: A systematic review. *Tobacco Control*. Advance online publication. doi:10.1136/tobaccocontrol-2013-051122
- Regan, A. K., Promoff, G., Dube, S. R., & Arrazola, R. (2013). Electronic nicotine delivery systems: Adult use and awareness of the 'e-cigarette' in the USA. *Tobacco Control*, 22, 19–23. doi:10.1136/tobaccocontrol-2011-050044
- Rose, S. W., Barker, D., D'Angelo, H., Khan, T. A., Huang, J., Chaloupka, F., & Ribisl, K. M. (2014). *The availability of electronic cigarettes in US retail outlets, 2012: Results of two national studies*. *Tobacco Control*. doi:10.1136/tobaccocontrol-2013-051461
- Smith, A. (2011). Twitter update 2011. Washington, DC: Pew Internet & American Life Project.
- U.S. Food and Drug Administration. (2009). Evaluation of e-cigarettes. St. Louis, MO: Center for Drug Evaluation and Research.
- U.S. Food and Drug Administration. (2011, April 25). Regulation of e-cigarettes and other tobacco products. Retrieved from www.fda.gov/NewsEvents/PublicHealthFocus/ucm252360.htm. Last accessed March 31, 2014.
- Yamin, C. K., Bitton, A., & Bates, D. W. (2010). E-cigarettes: A rapidly growing Internet phenomenon. *Annals of Internal Medicine*, 153, 607–609. doi:10.7326/0003-4819-153-9-201011020-00011
- Zhu, S. H., Gamst, A., Lee, M., Cummins, S., Yin, L., & Zoref, L. (2013). The use and perception of electronic cigarettes and snus among the U.S. population. *PLoS One*, 8, e79332. doi:10.1371/journal.pone.0079332
- Zickuhr, K., & Smith, A. (2012). Digital differences. Washington, DC: Pew Internet & American Life Project.