Published in final edited form as:
J Am Coll Health. 2013 April ; 61(3): 149–155. doi:10.1080/07448481.2013.776052.

Use and Perception of Electronic Cigarettes Among College Students

Craig W. Trumbo, PhD[1] and **Raquel Harper, PhD**[2]

[1]Department of Journalism and Technical Communication, Colorado State University, Fort Collins, Colorado [2]School of English and Media Studies, Massey University–Albany Campus, Auckland, New Zealand

Abstract

Objective—This study provides insight into how electronic cigarettes may affect the social normative environment for tobacco use among college students.

Participants—244 freshman and sophomore students.

Methods—Students completed an online self-report survey in April 2011.

Results—There is a higher acceptance rate of e-cigarette smoking in public than traditional tobacco. For intention to use an e-cigarette the strongest predictor is current tobacco use, followed by a positive orientation toward public use of e-cigarettes. Positive orientation toward public use of e-cigarettes is significantly predicted by the use of alternate tobacco, intention to use or try e-cigarettes, positive orientation toward public use of tobacco, positive attitude toward e-cigarettes, positive perception of social norms for use of e-cigarettes, and favorable orientation toward e-cigarettes as an innovation.

Conclusions—These models suggest attitudinal, social normative, innovation, and behavioral factors may combine to bring the electronic cigarette into wider use among college students.

Keywords

attitudes; diffusion of innovations; electronic cigarettes; smoking laws; social norms

INTRODUCTION

Since the Surgeon General's report of 1964 tobacco companies have been increasingly motivated to market products labeled as "safer" than regular cigarettes. The product development and marketing effort that led to "low-tar" and "light" cigarettes is well documented.[1, 2] This strategy has resulted in a class of "reduced harm" products being developed and advertised by a number of tobacco companies. These products have appeared during the last 10 years as tobacco control programs have made headway and clean indoor air laws have progressively eliminated places to smoke. These products include cigarettes

For comments and further information, address correspondence to Craig W. Trumbo, Department of Journalism and Technical Communications, Colorado State University, 1785 Campus Delivery, Fort Collins, CO 80523-1785, USA (ctrumbo@mac.com).

made with modified tobacco that manufacturers claim have lower levels of toxicity (e.g., Omni, Quest) and smokeless products designed to be chewed like gum or a mint (e.g., Revel, Exalt).[3]

Most recently devices have been introduced in which a nicotine-containing liquid is vaporized in an Electronic Nicotine Delivery System (ENDS), or electronic cigarette (herein e-cigarette). E-cigarettes look very similar to traditional cigarettes, except they consist of a plastic tube, a battery-powered electronic heating device, and a liquid nicotine cartridge. When the e-cigarette is activated, the electronic element heats the liquid nicotine. Steam from the liquid nicotine is absorbed orally, but no “smoke” is released into the air – only water vapor. They do not contain tobacco; however, the nicotine is derived from tobacco.[4, 5]

The device has become increasingly popular. Ayers and colleagues discovered online searches for e-cigarettes have become significantly greater than searches for other alternative smoking devices in the U.S., Australia, Canada, and the U.K.[4] They assessed the number of online searches for e-cigarettes, snus, and nicotine replacement therapies between January 2008 and September 2010 and found that by the end of the study, e-cigarette queries in the U.S. were 550% greater than snus and 300% greater than nicotine replacement therapy. Caponnetto et al. state that "The electronic cigarette is an emerging phenomenon that is becoming increasingly popular with smokers worldwide," and that "The need for novel and more effective approaches to tobacco control is unquestionable."[20] McMillen et al. surveyed 3,200 Americans and reported that young, more educated males are trying and using electronic cigarettes (and other new nicotine delivery products) at significantly high rates and state that "Use of these products raises concerns about nonsmokers being at risk for nicotine dependence and current smokers maintaining their dependence. Greater awareness of emerging tobacco product prevalence and the high risk demographic user groups might inform efforts to determine appropriate public health policy and regulatory action."[21] Other population sample surveys and interview studies with "vapers" support these conclusions.[22, 23]

The purpose of this study was to provide insight into the manner in which college students view e-cigarettes. There are two specific aims. First, describe the degree to which college students have become aware of and are using e-cigarettes. Second, using the Theory of Reasoned Action and Diffusion of Innovations, model how attitudes and social norms affect students' interest in trying e-cigarettes and their tolerance for others' use of e-cigarettes in public places.

Here we turn to a discussion of the theoretical frameworks that supported the study. For over 50 years researchers in a wide variety of disciplines have used Diffusion as a framework in which to study the spread of new ideas. [24] Diffusion has been used to investigate the spread of innovations as wide ranging as snowmobiling, hybrid seed corn, new medicines and new math. In summary: “The main elements in the diffusion of new ideas are: (1) an innovation, (2) that is communicated through certain channels, (3) over time, (4) among the members of a social system. An *innovation* is an idea, practice or object perceived as new by an individual or other unit of adoption. The characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption. Five attributes of innovations

are: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability."[24]

As an innovation, e-cigarettes can be seen to be fairly favorable in terms of the characteristics of relative advantage (might be able to use it in places where smoking is restricted), compatibility (similar pharmacological profile), complexity (not much new to learn for use), and trialability (easy to obtain via the Web). Addressing the effects of observability is a key aspect of this study.

An important goal of this project is to examine behavioral intention to try ENDS. To do so, we employ the Theory of Reasoned Action (TRA).[25] Its history has been recounted in numerous places. [e.g.,26, p. 168–218] The TRA has a parsimonious form: behavior that is under volitional control is best predicted by behavioral intention, which in turn is best predicted by the individual's attitude toward the act and the individual's perception of social norms involving the act.

We incorporate the TRA because it is widely acknowledged tobacco use is socially embedded. The inclusion of normative effects addresses this condition. Attitudes toward ENDS can be related to the other components of our design, especially those surrounding restrictions on public smoking. And the model integrates well with Diffusion Theory as it also conceptualized adoption as a social process. Taken together, Diffusion and the TRA offer models predicting intention to use ENDS and orientation toward public use.

METHODS

Participants

Subsequent to approval from the Institutional Review Board, a survey was presented as an extra credit activity in a freshman-sophomore large lecture class An alternate extra credit activity was provided, which no students undertook. The class was a 100-level Mass Media in Society course that serves an academically diverse cross-section of students on campus. Of the 342 students registered for the course, 244 completed the survey (71%). Given the high participation rate we held little concern regarding participation bias. The online service Question Pro was used for survey implementation.

Measures

The measure smoking in public was based on the Tobacco Use Supplement of the U.S. Census Current Population Survey.[34] This provides an estimate of social norms against tobacco smoking in public places.[35] It asks respondents to state if smoking should be allowed in all areas, in some areas, or not at all in five locations: restaurants, indoor work areas, bars and cocktail lounges, indoor sporting events, and indoor shopping malls. To this set we added airports, indoor concerts, outdoor sporting events, college dorms, and college student centers. This item set was repeated for the variable e-cigarettes in public. Both measures were scored 1–3 on each of the 10 items (*1 = allowed in all areas, 2 = allowed in designated areas, 3 = not allowed at all*). Summing across the items yielded a 10–30 scale with high values indicating unacceptability (Chronbach's alpha .86 for tobacco and .96 for e-cigarettes).

Behavioral intention to use e-cigarettes was measured using best practice recommendations provided by Ajzen.[36] The item asks "How likely do you think it is that you would use an e-cigarette in the not-too distant future, say in the next six months?" Response options were on a 7-point scale: *absolutely not, very unlikely, unlikely, maybe yes maybe no, likely, very likely, absolutely yes*. Other items from the Theory of Reasoned action were also constructed using recommendations by Ajzen. Attitude included three items with 5-point responses (*strongly agree to strongly disagree*): use of e-cigarettes should be legal for adults, e-cigarettes are a big step forward, and belief that e-cigarettes are a more modern way of using tobacco. This measure is summed across the three items (a = .76). Norms consisted of three pairs of items: it would be acceptable to my closest friends (most people I know, closest family members) if I used e-cigarettes; when it comes to things like e-cigarettes it is important for me to follow the wishes of my closest friends (most people I know, closest family members). This was computed as the sum of the product of the paired statements.

Measures for the innovation characteristics of e-cigarettes were based on the widely-cited measurement study by Moore and the extensive work of Rogers.[24, 37] An item pool set was developed and refined through peer feedback and informal pre-testing. Two items were developed for each of the five elements of an innovation, with 5-point scales from *strongly agree to strongly disagree*. Relative advantage was indicated by "I think e-cigarettes are safer in terms of 'second-hand' smoke compared to tobacco cigarettes" and "I think e-cigarettes are not as harmful to users as tobacco cigarettes." Compatibility was indicated by "I think e-cigarette users can easily make use of existing smoking areas" and "I believe using e-cigarettes would fit in well with the lifestyle of most smokers." Complexity was indicated by "I believe it will not be difficult for smokers to learn how to use e-cigarettes" and "Overall, e-cigarettes are no more complicated to use than ordinary tobacco cigarettes." Triability was indicated by "I think it will be easy for people to purchase e-cigarettes" and "Smokers could easily give e-cigarettes a try to see if they like them better than tobacco." Observability was indicated by "It would be easy to tell whether a person was using an e-cigarette versus smoking tobacco" and "The e-cigarette has a distinctive and attractive appearance, setting it apart from tobacco cigarettes." The final measure was the sum of the 10 indicators.

Awareness of e-cigarettes and use of e-cigarettes was assessed through three items, which made use of a standard tobacco use skip pattern: Have you ever heard of these devices (*yes/no*), Have you ever tried one of these products (*yes/no*), and Do you now use e-cigarettes *every day, some days, or not at all*.

Finally, smoking status was assessed using measures from the Behavioral Risk Factor Surveillance System.[38] These included (with standard skip pattern) having smoked 100 cigarettes in lifetime (*yes/no*), now smoking every day, some days, or not at all. This variable was collapsed to never smokers and all others. Alternate tobacco use for five activities (hookah, pipe, cigar, snuff, chewing tobacco) was also measured (*1–4 never, tried, some days, every day*) and summed with higher values indicating more use (a = .68).

Procedure

The questionnaire was designed for online administration. Question order started with current tobacco use items, attitude toward public use of tobacco, and then awareness and use of e-cigarettes. At that point in the online questionnaire we provided some general information about e-cigarettes. This information was placed at this point in the questionnaire so as to not influence the previous awareness items. Information on e-cigarettes was provided so that individuals who were unaware of e-cigarettes would base their opinions on a description of the products rather than provide what is often termed as a pseudo opinion.[39] The information section contained a text and graphic section describing the manner in which the e-cigarette functions, based on material available from science.howstuffworks.com, http://www.my7s.com (an e-cigarette trade organization) and Wikipedia. The text was crafted so as to not promote the e-cigarette but to clinically describe the way it works. This was followed by a video clip linked from YouTube showing actress Katherine Heigl smoking an electronic cigarette on the Late Show with David Letterman.[35]

The questionnaire continued with intention to use an e-cigarette, attitude toward public use of e-cigarettes, the Reasoned Action measures for attitude and social norms, and finally the perceived innovation characteristics of e-cigarettes. Where appropriate item response sets were randomly rotated (e.g., innovation characteristics, list of public places).

Analysis

The first specific aim was met through the use of descriptive analyses of the variables reporting e-cigarette use among the study participants. To meet the second aim, two linear regressions were run. The first modeled participants' intention to use e-cigarettes, the second modeled participants' reported acceptability for the use of e-cigarettes in public places. Independent variables included: age, sex, smoking status, use of other alternate tobacco products, awareness of e-cigarettes, acceptance of public tobacco use, attitude towards e-cigarettes, perceived social normative pressure regarding e-cigarettes, and perception of e-cigarettes as an innovation. And for each model the alternate model's dependent variable was also included. SPSS v. 20 was used for all analyses.

RESULTS

To describe the degree to which college students have become aware of and are using e-cigarettes descriptive analyses (means, standard deviations, and correlation coefficients) were used (Table 1). About 55% of the students were female, and students were between 19 and 22 years old (on average sophomore). These characteristics match the averages for the 2010–2011 university admission report. As the student population is about 80% white we did not assess race.

In general, mean levels indicate that students felt tobacco cigarettes shouldn’t be allowed in public at all; that they were more accepting of e-cigarette use in public; that most students had little intention of using an e-cigarette within the next six months; that students tended to have a somewhat negative attitude toward the use of e-cigarettes; that the introduction of e-cigarettes may have some strong spreading characteristics as a new innovative tool; and that

there may be some social normative acceptability and pressure to use e-cigarettes. Nearly 84% of the students have never smoked (3% former, 9% some days, 5% every day), 71% have heard of e-cigarettes, and only 13% have tried e-cigarettes.

A number of interesting correlations were found among the set of independent variables. While most students were never-smokers, being a current or former smoker was positively associated with alternate tobacco use, awareness of e-cigarettes, and perception of stronger norms against smoking. Never-smokers were less accepting of tobacco smoking in public. Use of alternate tobacco products followed the same pattern. Awareness of e-cigarettes was associated with greater acceptance of tobacco smoking in public, more positive attitude toward e-cigarettes, perception of less normative pressure against e-cigarettes, and stronger perception of e-cigarettes as a favorable innovation. The three theoretically based predictors were appropriately correlated.

We were able to see if college students had a higher overall acceptance of e-cigarette smoking in public places (such as restaurants, shopping malls, college dorms, and indoor work areas) than acceptance of traditional tobacco smoking in public places. The results showed that acceptance of public smoking had a mean score of 26.14, while acceptance of e-cigarette smoking had a mean score of 19.94 (on a scale of *10 = smoking allowed in all areas, to 30 = no smoking allowed at all*). This represents an effect size (*d*) of 1.89, meaning that the two types of smoking differed by almost two standard deviations. A paired samples *t* test was used to compare the two smoking types. The test shows that there was a significantly higher acceptance rate of e-cigarette smoking in public than traditional tobacco smoking (t (243) = 16.67, p = .000). The results were similar regardless of smoking status or sex, although the largest effect sizes in acceptance of e-cigarette smoking in public (versus traditional tobacco) were with students who currently smoke: d = 6.61 and d = 4.49 for occasional smokers and daily smokers, respectively.

To predict the students' interests in trying e-cigarettes and tolerance for others' use of e-cigarettes in public places two linear regression models were developed (Table 2). The outcome variables "interest in trying e-cigarettes" and "tolerance of others' use of e-cigarettes" were regressed onto the independent variables. Models were blocked by concept and all independent variables were entered simultaneously. Results of the regression analyses show that for individual intention to use or try an e-cigarette the strongest predictor is smoking status, with alternate tobacco use and greater acceptability of public use of e-cigarettes also significant. The second model shows that greater acceptance of public use of e-cigarettes (lower values) is significantly predicted by the use of alternate tobacco, intention to use or try e-cigarettes, greater acceptance of tobacco smoking in public, positive attitude toward e-cigarettes, perception of lower normative pressure against e-cigarettes, and favorable orientation toward e-cigarettes as an innovation.

COMMENT

The purpose of this study was to provide insight into the manner in which college students view e-cigarettes. The first specific aim sought to describe the degree to which college students have become aware of and are using e-cigarettes. Without question, marketing

efforts to promote e-cigarettes have succeeded in the college student population, with a very strong majority of this study's participants being aware of the devices. Given the relatively recent introduction of e-cigarettes and the overall strong norms against tobacco use, the fact that over 1 in 10 students in this study had at least tried an e-cigarette may be of concern. This climate of strong awareness and trial certainly argues that e-cigarette uptake in the college student population should be an ongoing concern.

The second specific aim sought to provide a more nuanced and theoretical view of the factors potentially driving the introduction of e-cigarettes into the college student population. The analyses show that the social factors of attitudinal orientation and perceived normative pressure, in concert with the behavioral factors of alternate tobacco product use and intention to try electronic cigarettes have a strong predictive association for the acceptability of the use of e-cigarettes in public. Further, the favorable perception of the electronic cigarette as an innovation suggests that elements of its design and use are amenable to proven marketing techniques. The two theoretical vehicles used to motivate this study provide a strong framework to examine the introduction and spread of e-cigarettes.

Specifically with reference to the theories employed here we raise three potential consequences suggested by this work. First since innovation significantly predicted the acceptability of the use of e-cigarettes in public, it’s likely that there will be a significantly rapid rate of adoption of the e-cigarette, according to the Diffusion of Innovation Theory. Second, because college students are perhaps already seeing the “positive” results of this e-cigarette innovation – the fact that they might be able to use them in public places (like on college campuses) – this is also shown to have an effect on the rapid rate of adoption (according to the Diffusion of Innovation Theory). And third, attitudes and social norms are also both significant predictors of acceptability of e-cigarette use in public – which we could say might have an impact on behavioral intentions in the future (fusion of TRA and Diffusion).

Another important finding shows that favorable orientation toward public use is also a significant predictor of intent to try e-cigarettes. This suggests that attitudinal, social normative, innovation, and behavioral factors may combine to facilitate efforts to bring the electronic cigarette into wider use.

Limitations

This study relied on a limited sample of students from a single college campus. As such it has limited generalizability to the entire population of college students. This particular campus also features relatively low levels of racial and ethnic diversity, which further hampers the broader interpretation of the results and misses what may be important subgroup effects in these population segments. College students also do not exist in a vacuum, and the e-cigarette is certainly also an issue in the broader non-college population of young people. A larger study to diversify the population sample might address these limitations.

Conclusions

The broader picture presented by this study suggests that the use of e-cigarettes by college students is most likely to be constrained to those who already use some manner of tobacco product, at least initially. The overall ethic of non-smoking has become dominant on campuses. But there is a wider context within which e-cigarettes fall, which is the expanding use of alternate tobacco products. In this context e-cigarettes provide current tobacco users an added option for continuing use.

Of far greater concern is the potential integration of e-cigarettes into the portfolio of substances accepted by college students. Hookah bars are now fairly common and are likely accepted by college students because users don't affect non-users. Exclusion of cigarette smoking from social situations is also common. But, as the results of this study show, there is capacity for a higher level of acceptance of the use of e-cigarettes in social situations given the minimal impact on non-users. Widespread awareness of the e-cigarette clearly indicates that marketing efforts have been successful in introducing the device to the vocabulary of college students.

Without question college health professionals should be aware of the potential for e-cigarette use by students, and their potential for open use on campuses. Current non-smoking policies could be expanded to include e-cigarettes. And counter-marketing awareness campaigns should be implemented, at least to include e-cigarettes in any broader tobacco education materials.

Finally, it is worth returning to the broader picture of the electronic nicotine delivery system, beyond the context of the college population. These devices have made a fairly quick and successful introduction into the market since first sales in 2005.[6, 7] They have not yet appeared in the U.S. in main-stream retail outlets, but are typically sold online.[5] Sales may have broken $100 million as early as 2009 and investors have taken notice.[6, 8] E-cigarettes pose a challenge for regulators, with the FDA having been barred from regulating the devices as drug delivery systems. [9] The health effects of e-cigarettes are as yet unknown, as are their potential as cessation aids.[10–11–13]

The advent of e-cigarettes has presented a complication to the theoretical understanding of tobacco use. In fact, e-cigarettes represent a potentially fundamental shift from the use of tobacco to the use of nicotine *per se*, a behavior which has been to this point largely constrained to nicotine replacement therapies such as the patch or nicotine gum. While those modes of nicotine uptake have certainly been abused, their use in public offers little or no normative impact on others' perceptions or behavior. The acceptance of electronic cigarette use in public may pose a challenge for maintaining the strong normative pressure against smoking that has been achieved.

Acknowledgments

Research reported in this publication was supported in part by the National Institute on Drug Abuse and FDA Center for Tobacco Products (CTP). The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH or the Food and Drug Administration. Support was also provided by Colorado State University's Center for Research on Communication and Technology.

REFERENCES

1. Fairchild A, Colgrove J. Out of the ashes: the life, death, and rebirth of the "safer" cigarette in the United States. Am J Public Health. 2004 Feb; 94(2):192–204. [PubMed: 14759927]
2. Pollay RW, Dewhirst T. The dark side of marketing seemingly "Light" cigarettes: successful images and failed fact. Tob Control. 2002 Mar; 11(Suppl 1):I18–I31. [PubMed: 11893811]
3. Hickman N, Klonoff EA, Landrine H, et al. Preliminary investigation of the advertising and availability of PREPs, the new"safe" tobacco products. J Behav Med. 2004 Aug; 27(4):413–424. [PubMed: 15559736]
4. Ayers JW, Ribisl KM, Brownstein JS. Tracking the rise in popularity of electronic nicotine delivery systems (electronic cigarettes) using search query surveillance. Am J Prev Med. 2011 Apr; 40(4): 448–453. [PubMed: 21406279]
5. Cahn Z, Siegel M. Electronic cigarettes as a harm reduction strategy for tobacco control: a step forward or a repeat of past mistakes? J Public Health Policy. 2010 Feb; 32(1):16–31. [PubMed: 21150942]
6. Dugan T. Debates flare over electronic cigarettes Smokeless devices ignite policy battle. Arkansas Democrat-Gazette. 2010 Aug 1.A1
7. Noel JK, Rees VW, Connolly GN. Electronic cigarettes: a new 'tobacco' industry? Tob Control. 2010 Jan.20(1):81. [PubMed: 20930060]
8. Herzog, B.; Metrano, B.; Gerberi, J. Tobacco Talk Survey -- E-Cigarettes A Promising Opportunity. 2012. (available at http://www.stevevape.com/wp-content/uploads/2012/05/E-Cigs-A-Promising-Opportunity.pdf)
9. FDA. [Accessed 7/1, 2012] Regulation of E-Cigarettes and Other Tobacco Products. (available at http://www.fda.gov/newsevents/publichealthfocus/ucm252360.htm).
10. Wollscheid KA, Kremzner ME. Electronic cigarettes: safety concerns and regulatory issues. Am J Health Syst Pharm. 2009 Oct 1; 66(19):1740–1742. [PubMed: 19767381]
11. Bullen C, McRobbie H, Thornley S, Glover M, Lin R, Laugesen M. Effect of an electronic nicotine delivery device (e cigarette) on desire to smoke and withdrawal, user preferences and nicotine delivery: randomised cross-over trial. Tob Control. 2010 Apr; 19(2):98–103. [PubMed: 20378585]
12. Siegel MB, Tanwar KL, Wood KS. Electronic cigarettes as a smoking-cessation tool results from an online survey. Am J Prev Med. 2011 Apr; 40(4):472–475. [PubMed: 21406283]
13. Vansickel AR, Cobb CO, Weaver MF, Eissenberg TE. A clinical laboratory model for evaluating the acute effects of electronic "cigarettes": nicotine delivery profile and cardiovascular and subjective effects. Cancer Epidemiol Biomarkers Prev. 2010 Aug; 19(8):1945–1953. [PubMed: 20647410]
14. Cobb N, Byron M, Abrams D, Shields P. Novel nicotine delivery systems and public health: The rise of the "E-Cigarette". American Journal of Public Health. 2010; 100:2340–2342. [PubMed: 21068414]
15. Freiberg M. Options for state and local governments to regulate non-cigarette tobacco products. Ann Health Law. 2012 Winter;21(2):407–445. [PubMed: 22606921]
16. Etter JF, Bullen C, Flouris AD, Laugesen M, Eissenberg T. Electronic nicotine delivery systems: a research agenda. Tob Control. 2011 Mar; 20(3):243–248. [PubMed: 21415064]
17. Alesci NL, Forster JL, Blaine T. Smoking visibility, perceived acceptability, and frequency in various locations among youth and adults. Prev Med. 2003 Mar; 36(3):272–281. [PubMed: 12634018]
18. Trotter L, Wakefield M, Borland R. Socially cued smoking in bars, nightclubs, and gaming venues: a case for introducing smoke-free policies. Tob Control. 2002 Dec; 11(4):300–304. [PubMed: 12432155]
19. Kim SH, Shanahan J. Stigmatizing smokers: public sentiment toward cigarette smoking and its relationship to smoking behaviors. J Health Commun. 2003 Jul-Aug;8(4):343–367. [PubMed: 12907400]
20. Caponnetto P, Campagna D, Papale G, Russo C, Polosa R. The emerging phenomenon of electronic cigarettes. Expert Rev Respir Med. 2012 Feb; 6(1):63–74. [PubMed: 22283580]

21. McMillen R, Maduka J, Winickoff J. Use of emerging tobacco products in the United States. J Environ Public Health. 2012; 2012:989474. [PubMed: 22654922]
22. Regan AK, Promoff G, Dube SR, Arrazola R. Electronic nicotine delivery systems: adult use and awareness of the 'e-cigarette' in the USA. Tob Control. 2011 Nov 28.
23. McQueen A, Tower S, Sumner W. Interviews with "vapers": implications for future research with electronic cigarettes. Nicotine Tob Res. 2011 Sep; 13(9):860–867. [PubMed: 21571692]
24. Rogers, E. The Diffusion of Innovations. Vol. Vol 4. New York: Free Press; 1995.
25. Fishbein, I. Readings in Attitude Theory and Measurement. New York: John Wiley and Sons; 1967.
26. Eagly, A.; Chaiken, S. The Psychology of Attitudes. Ft. Worth: Harcourt Brace Jovanovich; 1993.
27. Crano W, Prislin R. Attitudes and persuasion. Annual Review of Psychology. 2006; 57:345–375.
28. Singh K, Leong S, Tan C, Wong K. A theory of reasoned action perspective of voting behavior: Model and empirical test. Psychology and Marketing. 1995; 12(1):37–51.
29. Pancer S, George M, Gebotys R. Understanding and predicting attitudes towards computers. Computers in Human Behavior. 1992; 8(2/3):211–222.
30. Monge P, Cozzens M, Contractor N. Communication and motivational predictors of the dynamics of organizational innovation. Organization Science. 1992; 3(2):250–274.
31. Trumbo C, O'Keefe G. Intention to conserve water: Environmental values, planned behavior, and information effects. A comparison of three communities sharing a watershed. Society and Natural Resources. 2001; 14(10):891–901.
32. Trumbo C, O'Keefe G. Communication and reasoned action toward water conservation: demonstration of an augmented model. Environmental Communication Yearbook. 2004; 1(1): 189–204.
33. Trumbo C, O'Keefe G. Intention to conserve water: Environmental values, reasoned action, and information effects across time. Society and Natural Resources. 2005; 18(6):573–585.
34. US Census. [accessed Jan 2011] 2002 Tobacco Use Supplement. at http://riskfactor.cancer.gov/studies/tus-cps/
35. Annon. [accessed Jan 2011] Letterman Electronic Cigarette Debut on the Late Show Guest Katherine Heigl. at http://www.youtube.com/watch?v=9obAKcKiQMs
36. Ajzen, I. Constructing a TpB Questionnaire: Conceptual and Methodological Considerations. Amherst, MA: University of Massachusetts; 2011. from http://www-unix.oit.umass.edu/~aizen/tpb.html [accessed 1/15/11]
37. Moore G, Benbasat I. Development of an instrument to measure the perceptions of adopting an information technology innovation. Information Systems Research. 1991; 2(3):192–222.
38. CDC. [accessed Jan 2011] Behavioral Risk Factor Surveillance System Survey Questionnaire. 2009. at http://www.cdc.gov/brfss
39. Converse, P. The nature of belief systems in mass publics. In: Apter, D., editor. Ideology and Discontent. New York: Free Press; 1964.

Table 1

Descriptive statistics: correlations above diagonal, covariances below, M(SD) on diagonal (n = 244).

	1	2	3	4	5	6	7	8	9	10	11
1. Behavioral intention How likely to use e-cig, 1–6 high values more likely to use	2.1 (1.3)	−.39**	.04	.01	.46**	.33**	.16*	−.21**	.06	.30**	.05
2. E-cigarettes in public Should e-cigs be allowed in public, 10–30, higher less acceptable	1.70	19.9 (6.6)	−.06	.04	−.27**	−.37**	−.16*	.49**	−.38**	−.40**	−.30**
3. Age 19–22 in years	−3.34	44.45	19.6 (0.8)	.04	.04	−.01	−.03	.05	.11	−.03	−.02
4. Sex 1 = male	.01	.13	.02	.45 (.45)	.10	.06	−.01	−.07	−.15*	.06	−.04
5. Smoking Status 0 = never 1 = former, somedays, or daily	.52	−1.58	.03	.04	.16 (.37)	.26**	.17*	−.22**	.05	.22**	.08
6. Alternate Tobacco Use frequency (1–4) for 5 types, 5–14 with higher more frequent use	.89	−5.02	−.02	.06	.36	7.5 (2.0)	.13*	−.35**	.08	.24**	.05
7. Aware of e-cigarettes Having ever heard of e-cigs, 1 = yes	.09	−.50	−.01	−.01	.06	.12	.70 (.45)	−.16*	.18**	.21**	.18**
8. Smoking in public Acceptability of smoking in public, 11–30, higher less acceptable.	−.91	11.08	.14	−.12	−.75	−2.45	−.25	26.1 (3.4)	−.05	−.18**	.03
9. Attitude 1–5 agree on 3 items, 3–15 with higher more positive toward e-cigs	.19	−5.88	.22	−.17	.10	.36	.19	−.41	11.5 (2.3)	.18**	.46**
10. Norms 3 pairs (belief X motivation) 3–75 higher less pressure against	4.86	−32.48	−.29	.39	2.84	5.90	1.19	−7.55	5.16	24.6 (12.3)	.20**
11. Innovation 10 items 1–5 agree, 22–50 higher more positive as innovation	.32	−9.39	−.06	−.09	.30	.48	.39	.42	5.06	11.48	36.0 (4.7)

* $p < .05$

** $p < .01$

Reporting *eta* for binary variables.

Table 2

Linear regression models predicting (a) behavioral intention to try e-cigarettes, and (b) acceptance of e-cigarette use in public (n = 244).

Behavioral intention	**β**	**block ΔR^2**	**E-cigarettes in public**	**β**	**block ΔR^2**
Age	.02		Age	.05	
Sex	−.03	.01	Sex	.05	.01
Smoking status	.34**		Smoking status	−.01	
Alternate tobacco use	.15**		Alternate tobacco use	−.11*	
Aware of e-cigarettes	.05	.30**	Aware of e-cigarettes	.05	.19**
E-cigarettes in public	−.26**	.04**	Behavioral intention	−.19**	.05**
Smoking in public	.08	.01	Smoking in public	.38**	.12**
Attitude	.07		Attitude	−.23**	
Norms	.12		Norms	−.18**	
Innovation	.06	.01	Innovation	−.16**	.15**
Full Model Adjusted R^2		.30**	Full Model Adjusted R^2		.49**

* $p < .05$

** $p < .01$

beta coefficients from full model, simultaneous entry, independent variables grouped by block