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Testing Messages About Comparative Risk of Electronic Cigarettes and Combusted Cigarettes

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Abstract

Introduction: Health agencies are grappling with communicating risks of electronic cigarettes (e-cigarettes) compared to combusted cigarettes. This study examined smokers' responses to two types of comparative risks messages with one type incorporating more negative anti-smoking elements in the design.

Methods: In an online experiment, 1,400 U.S. adult (18+) current smokers and recent quitters were randomized to view one of three comparative risk messages about e-cigarettes (CR messages), one of three comparative risk messages that included more negative anti-smoking elements in the design (CR- messages), or a control message. Selection of outcomes was guided by the anti-smoking message impact framework. Multivariate analyses of covariance and logistic regression models analyzed effects of messages on message evaluations, e-cigarettes- and cigarettes-related beliefs, and behavioral intentions.

Results: Both CR and CR- messages decreased smokers' intentions to smoke cigarettes, increased intentions to switch to e-cigarettes completely, and increased perceptions that e-cigarettes are less harmful than combusted cigarettes. Neither message type increased dual use intentions relative to exclusive e-cigarettes use or smoking cessation. CR messages decreased perceived absolute risks of e-cigarettes and self-exempting beliefs about smoking while CR- vs. CR messages produced higher self-efficacy to quit smoking.

Conclusion: Comparative risk communication might encourage smokers to switch to lower-harm tobacco products. Comparative risk messages with more negative anti-smoking elements in the design might be particularly effective, because they led to higher self-efficacy to quit smoking. Regulatory agencies may consider using comparative risk messages with more negative anti-smoking elements to educate the public about lower risk of e-cigarettes.

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Contributions of Authors

LP and DO planned the study with contributions from BY. BY analyzed the data, wrote the first draft and submitted the manuscript. LP conceived the study, supervised data collection, analysis, interpretation, and writing. All authors contributed to writing, revision, and approval of the final version.

Competing Interest

None.

Ethical Approval

IRB at Georgia State University

Keywords

harm reduction; e-cigarettes; advertising and promotion

Tobacco smoking carries significant economic and health burdens.[1] Some argue that alternative tobacco products such as electronic cigarettes (e-cigarettes) that effectively deliver nicotine with lower levels of harmful chemicals than combusted tobacco may reduce the overall harm of tobacco use by attracting smokers not willing to quit.[2–4]

Some countries began communicating about lower risk of e-cigarettes. In the U.K., high nicotine e-cigarettes can be licensed as medicinal products and make health claims.[5] “Tobacco Control Plan for England” discusses e-cigarettes as one of the strategies to reach a “smoke-free generation.”[4] Canada recently passed a bill to regulate e-cigarettes to achieve both smoking prevention and harm reduction.[6] The U.S. Food and Drug Administration (FDA) has been urged to communicate to the public about relative risks of different tobacco products.[2,3,7] The FDA can also authorize marketing of products with modified risk claims—statements that a certain tobacco product is less harmful than other tobacco products currently on the market.[8]

The challenge with comparative risk communication (including modified risk claims) is to develop messages that would motivate smokers who are unwilling to quit smoking to switch completely to less harmful products, but would not result in unintended consequences, such as lower cessation and increased dual use among smokers, initiation among non-users, or relapse in former smokers. Few studies outside tobacco industry examined communication strategies for comparative risks of novel tobacco products,[9–14] particularly e-cigarettes, and more research is needed.

Greater risk perceptions make people less likely to engage in harmful behavior (e.g., smoking).[15] Past studies predominantly focused on perceived risk of a single product, such as cigarettes or e-cigarettes.[16–18] Communicating comparative risks of two products, such as electronic and combusted cigarettes, raises additional issues. Because public health education resulted in engrained opinions about risks of cigarettes, comparative risk messages may only influence e-cigarette risk perceptions. Alternatively, telling people that one risky behavior is better than another might reduce perceived risk of both behaviors. To our knowledge, no study examined how claims comparing risks of e-cigarettes and cigarettes influence the perceived risks of each product.

Consistent with theories on risk perception, qualitative and quantitative research,[19,20] longitudinal and cross-sectional observations,[21,22] and research conducted among youth and adults[23,24] found that lower perceived risk of e-cigarettes as compared to cigarettes was associated with greater likelihood of e-cigarette initiation. Also, former and current smokers named lower harm of e-cigarettes as one of the most important reasons for e-cigarette use.[20,25] Hence, for e-cigarettes to be promoted as a harm reduction tool, smokers should be able to recognize that e-cigarettes present lower risks than cigarettes.

Most people perceive e-cigarettes as less harmful than combusted cigarettes,[26,27] particularly the young, highly educated, and ever e-cigarette users.[28,29] However, beliefs that e-cigarettes are less harmful have been declining.[27,28] This might stem from the changing tobacco regulatory environment or negative media coverage of e-cigarettes.[30–32]

The few studies[9,12,33–37] on comparative risk messages about e-cigarettes and cigarettes typically used an explicit statement that e-cigarettes are less harmful than cigarettes, similar to e-cigarette advertisements and tobacco companies' modified risk statements (e.g., "Switching completely from conventional cigarettes to the iQOS system can reduce the risks of tobacco-related diseases"[38]). However, it is unclear whether this way of communicating comparative risk about e-cigarettes is the most effective. Research on different approaches to communicating lower risk of e-cigarettes on risk perceptions and intentions surrounding use of e-cigarettes and cigarettes is lacking. To our knowledge, only one study examined effect of different comparative risk messages on smokers' dual use interest, finding that messages emphasizing cigarettes had more harmful chemicals than e-cigarettes (10 times more, 100 times more; and harmful chemicals only contained in cigarettes) evoked higher dual use interest than the message that e-cigarettes and cigarettes had same amount of harmful chemicals.[9]

To evaluate different approaches to communicating comparative risk of e-cigarettes and cigarettes, we developed and tested two types of comparative risk messages based on two knowledge frameworks. One type was developed from the knowledge about comparative risk messages from prior studies[9,12,33–37] where comparative risk messages were similar to e-cigarettes advertisements and tobacco companies' modified risk claims. These messages emphasized the benefits of e-cigarettes compared with cigarettes (labeled "CR messages"). The other type was developed from the knowledge about effective anti-smoking messages. Prior studies have identified several elements that enhance anti-smoking communication effectiveness,[18,39–42] such as a strong smoking risk message and graphic visuals emphasizing severe health problems caused by smoking. We incorporated these elements to create messages that emphasized the harms of continued smoking while presenting e-cigarettes as a safer alternative (labeled "CR- messages"). Given that comparative risk messages might have unintended effects, such as delayed cessation or increased dual use, we evaluated whether comparative risk messages developed from the effective anti-smoking message framework that included many anti-smoking elements in the design would have smaller unintended effects than the messages tested in prior studies and that were similar to e-cigarettes advertisement appeals. We assessed message effects on multiple outcomes, guided by the anti-smoking message impact framework.[43]

METHODS

Materials

We combined a top-down deductive and an empirical inductive approach to develop the messages. In collaboration with a research company John Snow, Inc. (JSI), we reviewed existing e-cigarette messages from public health agencies (such as California's Still Blowing Smoke campaign[44]), and the extant literature on e-cigarette health effects and comparative risks. This review combined with the team's expertise in communication, public health, and

tobacco control informed the development of 12 initial message concepts, executed as full-color pictures and text. These initial message concepts were tested with 12 focus groups comprising 72 adult (18+) current or recently former (quit in the past 2 years) smokers in Atlanta, GA. Each group viewed 8 out of 12 messages. We evaluated which message concepts participants liked and perceived as effective and which messages generated the most engaged discussion that were relevant to e-cigarettes and dual use. Of the 12 initial concepts, 6 were selected and further revised into the final 6 messages (Appendix).

In developing the messages, we aimed to evaluate two different ways to deliver comparative risk information about e-cigarettes. One (CR messages) followed the way messages in prior comparative risk communication studies, most e-cigarette advertisements and tobacco companies' modified risk claims have been constructed. The other (CR- messages) capitalizes on knowledge of what makes an effective anti-smoking appeal. The two ways of delivering comparative risk messages are different and incorporate different visual and textual elements. As a result, the two types of our messages were different not only in inclusion of anti-smoking appeal, but also in other features.

All 6 messages stated that if smokers are not ready to quit, switching to e-cigarettes completely can reduce their health risks (Appendix). Because comparative risk information likely appeals to positive emotions (e.g., hope), based on focus group discussion, more positive images and lighter colors were used in the 3 CR messages. In contrast, the 3 CR- messages were designed to arouse negative thoughts about smoking and motivate smoking cessation. CR- messages included a strong smoking risk message, used darker colors and graphic images. As CR messages emphasized that switching to e-cigarettes can reduce health risks and utilized more positive images and CR- messages highlighted dangers of smoking and used threat-based images, respectively, CR and CR- messages resemble gain-framed (emphasizing benefits of staying away from smoking) and loss-framed (emphasizing costs of smoking) anti-smoking messages. Loss-framed anti-smoking messages were found more effective in encouraging smoking cessation than gain-framed ones.[39,45,46] For instance, current smokers rated loss-framed graphic warning labels more effective in motivating people to stay away from smoking than gain-framed graphic warning labels.[46] Based on prior studies, CR- messages might have greater intended effects of comparative risk communication. The 3 CR messages and 3 CR- messages were paired up by three themes: taking control, e-cigarettes having lower amount of toxic chemicals, and smoking effects on lifespan.

Participants

Participants were 1,400 adult (18+) current smokers (smoked at least 100 cigarettes in their life and were currently smoking cigarettes every day or some days) or recent former smokers (quit smoking within the past two years). Toluna, a survey market research company, recruited participants through different online recruitment strategies (e.g., web banners, website referrals, affiliate marketing, pay-per-click). All participants completed electronic informed consent. All protocols were approved by the Georgia State University IRB.

Procedure

We conducted a pilot test with 100 participants recruited by Toluna to examine feasibility and refine the questionnaire. In the main study, participants began by answering questions about demographics, past tobacco use, efficacy to quit smoking, perceived comparative risk of e-cigarettes and combusted cigarettes, and smoking identity. Participants were then randomized to view one of the six messages (groups 1-6) or a control message (a bottled water advertisement; group 7). Randomization was stratified on the current vs. former smoker status, and on intentions to quit smoking (never planning to quit; planning to quit in the future, but not in the next 6 months; and planning to quit in the next 6 months or sooner). Participants viewed the message without time constraint. After seeing the message, participants were asked questions about their emotional responses and perception of the messages. Then, their risk perceptions and use intentions about e-cigarettes and cigarettes were assessed, followed by other belief questions (e.g., self-efficacy in quitting smoking).

At the end, all participants saw a debriefing page stating that the messages were used for research only and that stopping smoking completely is the best thing they can do for health. All participants were given a quit-line telephone number and referred to smoking cessation websites.

Outcome Measures

The selection of the outcome measures was based on the anti-smoking message impact framework[43] and included:

- (1) message reactions and perceived effectiveness (negative emotions,[47,48] positive emotions,[49,50] reactance,[51] message novelty, and perceived message effectiveness in arousing health concerns[52] and in motivating switching to e-cigarettes).
- (2) e-cigarettes- and cigarettes-related beliefs (perceived risks and benefits of e-cigarettes and cigarettes,[53] perceived comparative risk of e-cigarettes to cigarettes, response efficacy,[54] self-efficacy,[54] self-exempting beliefs about smoking,[55] and support for tobacco control[56]).
- (3) behavioral intentions (intentions to smoke cigarettes, intentions to switch to e-cigarettes,[14] dual use intentions, and for current smokers only: intentions to quit[57] or to engage in various cessation-related behaviors[18]).

Detailed measures are shown in Table 1. Variables measured by multiple items were averaged to create composite scores.

Covariates

Covariates included demographics (sex, age, race, and education level), perceived comparative risk of e-cigarettes and cigarettes, response efficacy and self-efficacy at pre-test, daily cigarette use (yes vs. no), e-cigarettes use (never vs. ever but not current vs. current), last year quit attempt (yes vs. no), and smoking identity[46] (Table 1). Current e-cigarettes use was defined as past 30 days use.

Analysis Plan

We first examined whether the effects of message type varied across message theme.[58] Univariate analyses of variances did not identify significant interaction effects between message type and message theme on the outcome variables. Based on prior practice,[59,60] we collapsed 3 messages within each type of comparative risk messages.

We performed multivariate analyses of covariance (MANCOVAs) on each block of outcome variables with experimental condition as the independent variable. For the MANCOVA on message reactions and perceived effectiveness, we excluded the control group because reactions to the control message (water bottle advertisement) were not relevant. For other MANCOVAs, we included the control condition. Significant multivariate effects of message condition were followed by univariate analyses of the condition effect on each dependent variable.

We performed binomial logistic regression for perceived comparative risk of e-cigarettes and cigarettes (comparing e-cigarettes being “less harmful” to all other answers—”about the same”, “more harmful” and “don’t know,” which represented potentially incorrect beliefs or lack of knowledge). Multinomial logistic regression examined whether exclusive e-cigarette use and cessation (more desirable outcomes) versus dual use (undesirable outcome) differed across conditions. For both binomial and multinomial logistic regressions, we created two message dummy variables using orthogonal coding. One variable compared CR and CR-with control. The other dummy variable compared CR with CR- messages.

All analyses used the same covariates detailed previously. Significance level was $p < .05$. Multiple pairwise comparisons involving three groups employed Bonferroni procedure. We used SPSS v24.

RESULTS

The sample was 53% female, 81.6% White, 63.7% college graduates, 61% daily smokers, 9.4% former smokers, 33.6% current e-cigarette users, and 31.3% current dual users averagely aged 47 (Table 2).

Message reactions and perceived effectiveness.

Condition was significant at the multivariate level, $F(6, 1183) = 52.93, p < .001$, Wilks' $\lambda = .79$. Follow-up univariate analyses found that CR messages evoked less negative emotions, more positive emotions, were rated more novel, more effective in motivating switching to e-cigarettes, but less effective in increasing health concerns than CR- messages. Reactance was low and not significantly different between conditions (Table 3).

E-cigarettes- and cigarettes-related beliefs.

Condition was significant at the multivariate level, $F(16, 2418) = 2.23, p < .01$, Wilks' $\lambda = .97$. Follow-up univariate analyses found that CR messages reduced self-exempting beliefs and perceived risks of e-cigarettes compared to other conditions. CR- messages led to greater self-efficacy compared to CR messages. Differences in perceived benefits of cigarettes and e-cigarettes and perceived cigarettes risks were not significant (Table 4).

Perceived comparative risk of e-cigarettes and cigarettes.

Compared to control, CR and CR- messages increased perceptions that e-cigarettes are less harmful than cigarettes (OR = 1.29, 95% CI [1.12, 1.48]). However, CR and CR- messages did not differ in comparative risk perceptions (Table 5).

Dual use intentions.

Compared to control, CR and CR- messages did not significantly increase dual use intentions relative to exclusive e-cigarette use or smoking cessation. Also, CR and CR- messages did not differ in dual use intentions (Table 5).

Smoking and switching intentions.

Condition was significant at the multivariate level, $F(4, 2768) = 5.32, p < .001$, Wilks' $\lambda = .99$. Compared to control, both CR and CR- messages reduced intentions to smoke cigarettes and increased intentions to switch to e-cigarettes. CR and CR- messages did not differ from each other for both intentions (Table 6).

Current smokers' intentions to quit.

Message condition was not significant at the multivariate level, $F(8, 2500) = 1.21, p = .29$, Wilks' $\lambda = .99$ or at the univariate level (Table 6).

DISCUSSION

Despite the increasing calls to inform the public of comparative risks of various tobacco products,[2] few studies examined comparative risk communication strategies.[9–14] We developed and tested two types of comparative risk messages: one emphasized the benefits of switching to e-cigarettes (CR messages) and the other incorporated more negative anti-smoking elements, such as graphic images highlighting dangers of smoking (CR- messages). Compared with the control, both types of messages decreased intentions to smoke, increased intentions to completely switch to e-cigarettes, and made smokers more likely to report that e-cigarettes are less harmful than combusted cigarettes. CR messages reduced e-cigarettes risk perceptions and self-exempting beliefs about smoking. CR- messages led to higher self-efficacy to quit smoking than the CR messages. While the difference in self-efficacy was small (Cohen's $d = 0.10$ or $r = .05$, a small effect size), it is comparable with other effect sizes in communication research.[61] For example, in media campaigns for smoking prevention and cessation, an average effect size is $r = .03$.[62] However, these small effects are important considering a large number of people who would view the messages and be influenced by them.[63]

Compared to CR messages, CR- messages evoked more negative emotions, less positive emotions, were perceived as less novel and less likely to encourage complete switching to e-cigarettes but more likely to arouse health concerns in smokers. Hence CR and CR- messages might influence behavior through different mechanisms.

This study begins to answer some important questions about comparative risk communication around tobacco products and identifies areas of future research:

- 1) Can comparative risk communication have a positive impact on consumers? We did not find unintended effects of comparative risk messages and found some positive effects on comparative risk perceptions and smoking and switching intentions; thus, the answer is a tentative yes. However, our results differed from Pepper et al.'s finding[9] where smokers exposed to comparative risk claims about e-cigarettes reported more dual use interest. One explanation for the discrepancy might be the use of different measures to assess dual use tendencies. We assessed dual use intentions in a direct way. Participants picked one most likely future action among smoking cessation, exclusive e-cigarette or cigarette use, or dual use. In contrast, Pepper et al. assessed dual use interest, with a measure similar to perceived message effectiveness (participants reported whether the message would make them do a particular thing). They assessed dual use interest indirectly by asking smokers' interest in using e-cigarettes and cigarettes separately. Participants who indicated intentions to increase, decrease or continue smoking and also to initiate or increase e-cigarettes use were classified as having dual use interest. Indirect and direct measures might have led to the observed difference, similar to how indirect and direct comparative risk measures resulted in different findings in other studies.[64–66] Also, different control messages (bottled water advertisement in our study vs. message that e-cigarettes and cigarettes had the same amount of harmful chemicals in Pepper et al.) might explain the difference. Additional research is needed to evaluate effects of comparative risk communication on dual use intentions.
- 2) Which way of communicating about comparative risks would have the most positive effect? CR and CR- messages generally produced similar effects (or lack thereof) with three exceptions: CR messages lowered perceived risks of e-cigarettes and reduced self-exempting beliefs about smoking while CR- messages increased smokers' self-efficacy to quit smoking. Meta-analyses[67–70] of fear appeal studies found that perceived efficacy has a greater impact on positive outcomes (such as intentions to quit smoking) than perceived risk (or threat). Furthermore, higher self-efficacy facilitates smoking cessation.[71] Thus, we recommend CR- messages. However, other types of messages need to be explored. For example, few studies directly compared messages about absolute and comparative risk of different tobacco products.[72] It is possible that the same intentions to switch to e-cigarettes might be more effectively motivated by traditional messages communicating absolute risk of tobacco products, such as the anti-smoking messages from the Tips from Former Smokers campaign.[73]
- 3) How do comparative risk communications affect risk perceptions? Both CR and CR- messages produced greater perceptions that e-cigarettes are less harmful than cigarettes and reduced absolute perceptions of e-cigarette risks, although the difference was only significant for CR messages. CR- messages did not significantly reduce perceived risk of e-cigarettes possibly because CR- messages emphasized harms of cigarettes, making tobacco product risk perceptions salient. For instance, seeing messages about smoking risks increased

perceived risks of e-cigarettes in young adults.[74] Both CR and CR- messages did not change perceived cigarettes risks, potentially due to a uniformly high awareness of cigarettes risk. Messages on comparative risk of two products with lower perceived harms (e.g., different alcohol products) might find different results.

Limitations include participants viewing messages without distraction, possibly amplifying our effect sizes. Our non-probability sample contained more Whites and higher educated participants than the US census figures, limiting the generalizability of our findings. Only adult smokers were included; future studies should include nonsmokers, adolescent smokers, and long-term former smokers. We analyzed self-reported data and did not measure actual behaviors. Lacking a validated measure of dual use intentions, we created our own measure, which might explain the lack of differences among conditions on the measure. Using measures from other studies resulted in varying referents (self vs. others vs. no referent); consistently treating respondents as referents might provide more useful information.[75] While measuring people's efficacy beliefs and comparative risk perceptions before exposure and controlling for them increased statistical power, estimates' precision and internal validity,[76] pre-test might have interacted with the messages to produce outcomes not generalizable to contexts without pre-test. Finally, we compared two formats of comparative risk messages: one based on the knowledge about effective anti-smoking communication and one based on the knowledge about e-cigarettes advertisements, modified risk claims, and prior comparative risk communication studies. Because of the differences in the two knowledge frameworks, there were many differences across the two types of messages (e.g., different health risks highlighted, images used, size of image, portrayal of persons, font sizes, color, etc.), which might be responsible for the differences we found. Future studies should evaluate individual anti-smoking message features to uncover the mechanisms of effective comparative risk communication.

Strengths of our study include comparing two types of comparative risks messages and assessing multiple messages in each message type, which reduces case-category confounding[77] and increases ecological validity. Evaluating message effects on multiple outcomes provided a comprehensive understanding of how comparative risks messages influence smokers.

In conclusion, comparative risk communication might motivate smokers to switch to reduced risk products. Comparative risk messages with many negative anti-smoking elements in the design may be particularly effective by increasing smokers' self-efficacy. While further research is needed, our results indicate that public health agencies may consider comparative risk messages with negative anti-smoking elements to increase population-level benefits.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What this paper adds:

- Messages that frame e-cigarettes as a less harmful option to combusted cigarettes could be beneficial if smokers who are unwilling to quit switch to e-cigarettes completely; however, comparative risk communication about e-cigarettes might have unintended effects on smokers, such as delayed smoking cessation or increased dual use.
- This study evaluated two types of comparative risk messages with one type of messages incorporating more negative elements in the design.
- Regardless of message type, we found some positive effects and no evidence of unintended effects of messages communicating lower risk of e-cigarettes than cigarettes. Furthermore, comparative risk messages incorporating more negative anti-smoking elements in the design increased smokers' self-efficacy to quit smoking—a critical factor contributing to the success of smoking cessation.

Table 1.

Key Measures

Measures	Response options	Reliability (for scale)
Message reactions and perceived effectiveness		
While looking at the message, I felt: Negative emotions: sad, angry, afraid, guilty, disgusted, worried, ashamed confused Positive emotions: amused, hopeful, inspired, alert, interested, determined, happy	1 (not at all) – 9 (extremely)	$\alpha = .93$
Reactance: - This message is trying to manipulate me. - This message annoys me. - The health effects on this message are overblown.	1 (strongly disagree) – 5 (strongly agree)	$\alpha = .83$
Message novelty: This message was...	1 (usual) – 7 (unusual)	
Perceived message effectiveness in arousing health concerns: - This message will make people more concerned about the health risk of smoking.	1 (not at all) – 9 (extremely)	
Perceived message effectiveness in motivating switching to e-cigarettes: - This message will motivate smokers to switch to e-cigarettes.	1 (not at all) – 9 (extremely)	
E-cigarettes and cigarettes-related beliefs		
Imagine that you just began vaping e-cigarettes (smoking cigarettes) every day. What do you think your chances are of having each of the following happen to you if you continue to vape e-cigarettes (smoke cigarettes) every day? Perceived risks: - Lung cancer - Lung disease other than lung cancer (such as COPD and emphysema) - Heart disease - Become addicted - Early/Premature death Perceived benefits: - Look cool - Feel more relaxed - Have better concentration - Be more popular	0 (no chance) – 6 (very good chance) + I don't know ^a	E-cigarettes $\alpha = .94$; Cigarettes $\alpha = .91$;
Perceived comparative risk: Is using electronic cigarettes (vapes) less harmful, about the same, or more harmful than smoking regular cigarettes?	Three options + I don't know ^b	E-cigarettes $\alpha = .87$; Cigarettes $\alpha = .79$;
Response efficacy: - Staying away from smoking is effective at preventing cancer. - If I do not smoke, I am less likely to get a serious disease. - How much do you think you would benefit from health and other gains if you were to quit smoking permanently in the next 6 months?	1 (not at all) – 9 (extremely)	Pre-test $\alpha = .80$, Post-test $\alpha = .81$
Self-efficacy: - It is easy for me to stay away from smoking. - How sure are you that, if you really wanted to, you could say no to a cigarette offer if a very close friend offers it? - If you decided to give up smoking completely in the next 6 months, how sure are you that you would succeed?	1 (not at all) – 9 (extremely) ^c	Pre-test $\alpha = .83$, Post-test $\alpha = .86$
Self-exempting beliefs: - Smoking cannot be all that bad for you because many people who smoke live long lives.	1 (strongly disagree) – 7 (strongly agree)	$\alpha = .73$

Measures	Response options	Reliability (for scale)
<ul style="list-style-type: none"> - You can overcome the harms of smoking by doing things like eating healthy food and exercising regularly. - You have got to die of something, so why not enjoy yourself and smoke. - Everything causes cancer these days. - I have made an informed choice to smoke in full knowledge of the risks I am taking. 		
Support for tobacco control: <ul style="list-style-type: none"> - I want to be involved in efforts to get rid of cigarettes smoking. - I would like to see the cigarette companies go out of business. - Taking a stand against smoking is important to me. 	1 (strongly disagree) – 7 (strongly agree)	$\alpha = .91$
Behavioral intentions		
Intentions to smoke cigarettes: What is the chance that you will smoke a cigarette sometime over the next 6 months?	1 (definitely will) – 4 (definitely will not) ^d	
Intentions to switch completely to e-cigarettes: How likely are you to switch completely from using regular cigarettes to electronic cigarettes in the next 6 months?	1 (not at all) – 9 (extremely)	
Dual use intentions: Which of the following are you most likely to do in the next month? (Pick one) ^e <ol style="list-style-type: none"> 1. Only smoke cigarettes 2. Mostly smoke cigarettes and occasionally use e-cigarettes 3. Smoke cigarettes and use e-cigarettes about the same amount 4. Occasionally smoke cigarettes and mostly use e-cigarettes 5. Only use e-cigarettes 6. Not smoke cigarettes and not use e-cigarettes 7. Other: (please write your answer) _____ 	Pick one option	
Intentions to quit: ^f How much do you intend to quit in the next 6 months?	0 (very definitely no) – 10 (very definitely yes)	
Other intentions: ^f <ul style="list-style-type: none"> - How likely is it that in the next 6 months you will reduce the number of cigarettes you smoke in a day? - How likely is it that in the next 6 months you will seek counseling/support to help you quit smoking? - How likely is it that in the next 6 months you will use nicotine gum, nicotine patch, or other form of nicotine replacement therapy (NRT)? 	1 (definitely will not) – 4 (definitely will)	Analyzed separately
Covariate		
Smoking identity: <ul style="list-style-type: none"> - Smoking is part of my self-image. - Smoking is part of “who I am.” - Smoking is a part of my personality. - Smoking is a large part of my daily life. - Others view smoking as part of my personality. 	1 (strongly disagree) – 10 (strongly agree)	$\alpha = .92$

Notes.

^aThe response category “I don’t know” was treated as missing value in the data analysis.

^bThe response category “more harmful, same, and I don’t know” were grouped together and compared with the response category “less harmful.”

^cThe measurement scale for option 2 was 1 (not at all sure) — 9 (completely sure)

^dReverse coded in data analysis.

^eThe response category 7 was treated as missing value. The response category 2, 3, and 4 were grouped together (dual use) and compared with the response category 5 (exclusive e-cigarette use) and 6 (cessation).

^f Measured only among current smokers.

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Table 2.

Participant Characteristics Overall and by Experimental Condition

	Overall (n = 1400) %	Comparative risk messages (n = 600) %	Negative comparative risk messages (n = 602) %	Control (n = 198) %
Gender				
Male	47	45.5	47.2	51
Female	53	54.5	52.8	49
Age				
18-29	17.7	16	19.1	18.7
30-44	25.6	25.7	24.9	27.3
45-59	31.1	29	32.9	32.3
60+	25.6	29.3	23.1	21.7
Race				
White	81.6	83	81.7	76.8
Black or African American	8.3	8.3	7.8	9.6
Hispanic	4.0	3.3	4.2	5.6
American Indian or Alaska Native	1.2	1.3	1.2	1.0
Asian	3.8	2.5	4.7	5.1
Other	1.1	1.5	0.5	2.0
Education				
Less than high school	1.8	1.8	1.8	1.5
High school	34.4	34	35.2	33.3
Some college	33.1	34.3	31.1	35.9
Bachelor's degree or higher	30.6	29.8	31.9	29.3
Daily smoker				
Yes	61	62.3	61.0	57.1
No	39	37.7	39.0	42.9
E-Cigarette use				
Current	33.6	33.8	32.7	35.9
Ever not current	22.8	23.0	22.1	24.2
Never	43.6	43.2	45.2	39.9
Current cigarette use				
Yes, but expect to quit	82.6	82.7	82.7	82.3
Yes, and never expect to quit	7.9	7.8	8.0	8.1
No, former smoker	9.4	9.5	9.3	9.6
Current dual user of e-cigarettes and cigarettes				
Yes	31.3	31.7	30.6	32.3
No	68.7	68.3	69.4	67.7
Try to quit in the past 12 months				
Yes	49.7	47.3	50.7	54
No	50.3	52.7	49.3	46

	Overall (n = 1400) %	Comparative risk messages (n = 600) %	Negative comparative risk messages (n = 602) %	Control (n = 198) %
Perceived comparative risk of e-cigarettes to cigarettes at pre-test				
Less harmful	38.3	39	36.5	41.4
Equally harmful	38.6	38.8	37.4	41.4
More harmful	7.4	6.5	8.5	7.1
I don't know	15.7	15.7	17.6	10.1

Notes. No significant differences were found between conditions on participant characteristics.

Table 3.

Means, Standard Errors, and Univariate F Statistics of Each Treatment Condition on Message Reactions and Perceived Effectiveness

	Comparative risk messages	Negative comparative risk messages	Univariate <i>F</i> statistics
	M (SE)	M (SE)	
Negative emotions ***	2.85 (0.07) ^a	4.37 (0.07) ^b	$F(1, 1188) = 209.44, p = .00, \eta_p^2 = .15$
Positive emotions ***	4.74 (0.07) ^a	4.28 (0.07) ^b	$F(1, 1188) = 21.40, p = .00, \eta_p^2 = .02$
Reactance	2.37 (0.04)	2.49 (0.04)	$F(1, 1188) = 3.45, p = .06, \eta_p^2 = .00$
Message novelty **	4.16 (0.08) ^a	3.81 (0.08) ^b	$F(1, 1188) = 9.96, p = .00, \eta_p^2 = .01$
Perceived message effectiveness in arousing health concerns *	6.39 (0.08) ^a	6.66 (0.08) ^b	$F(1, 1188) = 5.76, p = .02, \eta_p^2 = .01$
Perceived message effectiveness in motivating switching to e-cigarettes ***	6.09 (0.08) ^a	5.69 (0.08) ^b	$F(1, 1188) = 12.35, p = .00, \eta_p^2 = .01$

Notes. M: mean; SE: standard errors. Different letters indicate significant difference at $p < .05$.

*
 $p < .05$.

**
 $p < .01$.

 $p < .001$.

Table 4.

Means, Standard Errors, and Univariate F Statistics of Each Message Condition on E-Cigarettes- and Cigarettes-Related Beliefs

	Comparative risk messages	Negative comparative risk messages	Control	Univariate <i>F</i> statistics
	M (SE)	M (SE)	M (SE)	
Perceived risks of e-cigarettes ^{**}	3.59 (0.07) ^a	3.83 (0.07) ^b	3.95 (0.11) ^b	$F(2, 1216) = 5.61, p = .00, \eta_p^2 = .01$
Perceived benefits of e-cigarettes	2.54 (0.07)	2.42 (0.07)	2.68 (0.12)	$F(2, 1216) = 2.09, p = .12, \eta_p^2 = .00$
Perceived risks of cigarettes	5.14 (0.04)	5.13 (0.04)	5.19 (0.07)	$F(2, 1216) = 0.31, p = .74, \eta_p^2 = .00$
Perceived benefits of cigarettes	2.76 (0.06)	2.68 (0.06)	2.90 (0.10)	$F(2, 1216) = 1.67, p = .19, \eta_p^2 = .00$
Response efficacy at post-test	6.90 (0.05)	6.90 (0.05)	6.94 (0.09)	$F(2, 1216) = 0.07, p = .93, \eta_p^2 = .00$
Self-efficacy at post-test [*]	4.94 (0.05) ^a	5.14 (0.05) ^b	4.95 (0.09) ^{ab}	$F(2, 1216) = 4.32, p = .01, \eta_p^2 = .01$
Self-exempting beliefs [*]	3.85 (0.05) ^a	3.90 (0.05) ^b	4.13 (0.09) ^b	$F(2, 1216) = 4.13, p = .02, \eta_p^2 = .01$
Support for tobacco control	4.19 (0.07)	4.20 (0.07)	3.98 (0.12)	$F(2, 1216) = 1.37, p = .26, \eta_p^2 = .00$

Notes. M: mean; SE: standard errors. Different letters indicate significant difference at $p < .05$.

^{*}
 $p < .05$.

^{**}
 $p < .01$.

Table 5. Logistic Regressions Predicting Perceived Comparative Risk of E-Cigarettes to Cigarettes at Post-Test and Dual Use Intentions

Predictors	Perceived comparative risk of e-cigarettes to cigarettes at post-test		Dual use intentions	
	Less harmful (vs. more or equally harmful or I don't know)	Exclusive e-cigarettes use (vs. dual use)	Cessation (vs. dual use)	
	OR (95% CI)	OR (95% CI)	OR (95% CI)	
Female (vs. male)	0.78 (0.58, 1.05)	1.23 (0.80-1.88)	1.55 (0.99-2.44)	
Age in years	1.01 (1.00, 1.02)	1.02 (1.01-1.03)**	1.02 (1.00-1.03)*	
White (vs. non-White)	0.83 (0.57, 1.21)	1.03 (0.63-1.70)	1.04 (0.61-1.76)	
Less than college (vs. college or higher)	1.28 (0.95, 1.74)	1.46 (0.94-2.28)	1.48 (0.95-2.31)	
Daily smoking (vs. no)	0.95 (0.66, 1.36)	0.55 (0.34-0.88)*	0.66 (0.40-1.11)	
Ever but not current e-cigarettes use (vs. never)	1.40 (0.98, 2.01)	0.99 (0.50-1.96)	0.52 (0.30-0.88)*	
Current e-cigarettes use (vs. never)	1.62 (1.14, 2.30)**	1.55 (0.91-2.65)	0.13 (0.07-0.22)***	
Tried to quit in the past 12 months (vs. no)	0.85 (0.61, 1.16)	0.68 (0.44-1.07)	0.29 (0.17-0.48)***	
Perceived comparative risk of e-cigarettes to cigarettes at pre-test (less harmful vs. others)	24.59 (17.79, 33.99)***	1.84 (1.21-2.79)**	0.46 (0.29-0.73)**	
Response efficacy at pre-test	1.13 (1.04, 1.24)**	1.12 (0.97-1.29)	1.06 (0.92-1.22)	
Self-efficacy at pre-test	0.89 (0.82, 0.96)**	1.24 (1.11-1.38)***	1.60 (1.42-1.81)***	
Smoking identity	0.98 (0.92, 1.03)	0.90 (0.83-0.98)*	0.73 (0.67-0.80)***	
Comparative risk messages and negative comparative risk messages (vs. control)	1.29 (1.12, 1.48)***	1.18 (0.96-1.46)	1.02 (0.84-1.25)	
Comparative risk messages (vs. negative comparative risk messages)	1.13 (0.97, 1.31)	1.03 (0.83-1.27)	0.92 (0.74-1.16)	

Notes. Perceived comparative risk of e-cigarettes to cigarettes at post-test: less harmful = 47.3% and others = 52.5%. Dual use intentions: dual use = 40.4%, exclusive e-cigarettes use = 9.6%, and cessation = 13.9%.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 6:

Means, Standard Errors, and Univariate F Statistics of Each Message Condition on Behavioral Intentions

	Comparative risk messages	Negative comparative risk messages	Control	Univariate <i>F</i> statistics
	M (SE)	M (SE)	M (SE)	
Full sample (current smokers and recent former smokers, <i>N</i> = 1,400)ⁱ				
Intentions to smoke cigarettes *	3.34 (0.03) ^a	3.32 (0.03) ^a	3.50 (0.06) ^b	$F(2, 1385) = 4.42, p = .01, \eta_p^2 = .01$
Intentions to switch to e-cigarettes completely **	4.59 (0.09) ^a	4.41 (0.09) ^a	3.94 (0.16) ^b	$F(2, 1385) = 6.25, p = .00, \eta_p^2 = .01$
Current smokers only (<i>N</i> = 1,268)				
Intentions to quit	6.46 (0.11)	6.32 (0.11)	6.32 (0.19)	$F(2, 1253) = 0.48, p = .62, \eta_p^2 = .00$
Intentions to reduce the number of cigarettes	3.18 (0.03)	3.15 (0.03)	3.10 (0.06)	$F(2, 1253) = 0.89, p = .41, \eta_p^2 = .00$
Intentions to seek support	2.17 (0.04)	2.23 (0.04)	2.31 (0.07)	$F(2, 1253) = 1.97, p = .14, \eta_p^2 = .00$
Intentions to use nicotine replacement therapy	2.51 (0.04)	2.51 (0.04)	2.51(0.07)	$F(2, 1253) = 0.00, p = 1.00, \eta_p^2 = .00$

Notes. M: mean; SE: standard errors. Different letters indicate significant difference at $p < .05$.

ⁱ Among current smokers only, message type on intentions to smoke cigarettes became marginally significant, $F(2, 1253) = 2.61, p = .07, \eta_p^2 = .004$; message type on intentions to switch to e-cigarettes completely remained significant, $F(2, 1253) = 5.66, p = .004, \eta_p^2 = .01$.

* $p < .05$.

** $p < .01$