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## Psychological Distress and Responses to Comparative Risk Messages about Electronic and Combusted Cigarettes

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### Abstract

**Background:** People with mental illness suffer disproportionately high health burdens of smoking. Communicating to these smokers that electronic cigarettes (e-cigarettes) are a less harmful alternative to combusted cigarettes might help them reduce their health risks by encouraging completely switching to e-cigarettes. However, such messages might also cause unintended consequences (e.g., dual use of both combusted and e-cigarettes). Our study examined how smokers with vs. without serious psychological distress (SPD) responded to messages communicating reduced harm of e-cigarettes in relation to cigarettes.

**Method:** In an online experiment, 1,400 U.S. adult smokers with and without SPD viewed 1 of 6 messages about reduced harm of e-cigarettes compared to cigarettes or a control message. Then participants reported e-cigarette- and cigarette-related beliefs, and behavioral intentions.

**Results:** Message type (comparative risk messages vs. control) did not interact with SPD status to produce differential impacts on smokers with and without SPD. Regardless of being exposed to a comparative risk message or a control message, smokers with SPD reported greater perceived absolute risk of e-cigarettes and cigarettes, greater support for tobacco control, greater intentions to switch to e-cigarettes completely and seek help with quitting, and were less likely to report e-cigarettes were less harmful than cigarettes compared to smokers without SPD.

**Discussion:** Smokers with SPD had greater intentions to switch to e-cigarettes completely and seek help quitting compared to smokers without SPD, which indicates that smokers with SPD may be optimistic about e-cigarettes to help them quit smoking.

### Keywords

psychological distress; e-cigarettes; comparative risk messages; mental health; cigarettes

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Cigarette smoking is the leading cause of preventable mortality in the U.S. (U.S. Department of Health and Human Services [USDHHS], 2014). While smoking rates have declined in the general adult population, the downward trend is much less prominent among people with mental illness (Lê Cook et al., 2014). In 2016, 35.8% of U.S. adults with mental illness reported past-month cigarette use whereas the rate was 14.7% among people without mental illness (Center for Behavioral Health Statistics and Quality, 2017). In 2012–2013, people meeting criteria for at least one psychiatric disorder made up 36.4% of the U.S. adult population but accounted for more than 50% of cigarette consumption in the country (Chou et al., 2016). Disproportionate concentration of smoking among people with mental illness leads to greater smoking-related health burdens for this population, resulting in shorter life expectancy (Tam, Warner, & Meza, 2016).

Although mental healthcare providers often assume that their patients do not want to quit (Chen et al., 2017), cumulative evidence suggests that people with mental health issues are concerned about smoking harms and are as interested in quitting as the general population (Chen et al., 2017; Lucksted, Dixon, & Sembly, 2000; Prochaska, 2011; Siru, Hulse, & Tait, 2009). U.S. adult smokers with serious, moderate or no serious psychological distress (SPD) showed similar increasing trends in past-month smoking quit attempts from 1997 to 2015 (Kulik & Glantz, 2017).

Although a large proportion of smokers with mental illness are motivated to quit, many report difficulties quitting (Forman–Hoffman, Hedden, Glasheen, Davies, & Colpe, 2016). Even for those who initially succeed in quitting, rates of relapse are high (Ziedonis et al., 2008). Several factors may contribute to lower quit rates among smokers with mental illness, such as the tobacco industry's concentrated marketing efforts directed at them, difficulty coping with stress and withdrawal symptoms during smoking cessation, higher nicotine dependence, and limited access to smoking cessation resources (for a review, see Schroeder & Morris, 2010). To help reduce smoking-related health disparities among people with mental illness, it is important to identify more innovative smoking harm reduction and cessation strategies.

The use of electronic cigarettes (e-cigarettes) has increased rapidly in the past decade. Ever use of e-cigarettes in the US increased from 12.6% in 2014 to 15.3% in 2016 (Bao, Xu, Lu, Snetselaar, & Wallace, 2018). E-cigarettes heat a liquid typically containing nicotine, flavoring and other chemicals into aerosols for users to inhale, simulating the experience of cigarette smoking. E-cigarettes do not burn tobacco and, as a result, expose users to lower levels of toxic chemicals than combusted cigarettes (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018). Therefore, complete switching to e-cigarettes might help reduce harms among smokers who have mental illness and are unable to quit smoking otherwise. While U.S. Food and Drug Administration (FDA)-approved smoking cessation medications (e.g., nicotine replacement therapy [NRT]) are recommended for all adult smokers interested in quitting (Das & Prochaska, 2017; Stead & Lancaster, 2012), e-cigarettes could potentially offer an alternative or a supplementary tool to smokers who have not been able or willing to use NRT or to consider quitting. Some research suggests that e-cigarettes are perceived as more pleasant than the NRT inhaler (Bullen et al., 2010). However, the efficacy of e-cigarettes for smoking cessation has not been established in

general population (Lancaster, Stead, Silagy, & Sowden, 2000; Malas et al., 2016) and more research is needed to examine their effects specifically among smokers with mental illness (Gentry, Forouhi, & Notley, 2018).

Despite the relative dearth of research on e-cigarette use and perceptions among people with mental illness, recent studies suggest that this population may have more favorable beliefs about e-cigarettes than those without mental illness. For instance, smokers with SPD reported more positive expectancies about effects of e-cigarettes on weight control and socialization than those without SPD (Miller, Tidey, Rohsenow, & Higgins, 2017). Similarly, current smokers with vs. without mental health conditions reported more thoughts about the potential of e-cigarettes to improve their health (Spears, Jones, Weaver, Pechacek, & Eriksen, 2018) and adults with mental health conditions were more likely to use e-cigarettes (Cummins, Zhu, Tedeschi, Gamst, & Myers, 2014; Park, Lee, Shearston, & Weitzman, 2017; Spears, Jones, Weaver, Pechacek, & Eriksen, 2017).

People with mental illness often report using e-cigarettes to quit or reduce smoking (Chen et al., 2017; Cummins et al., 2014; Hefner et al., 2016; Hefner, Valentine, & Sofuoglu, 2017; Spears et al., 2018). Limited pilot studies indicated that some smokers with serious mental illness reduced their daily smoking and sometimes successfully quit smoking after being provided with e-cigarettes (e.g., Caponnetto, Auditore, Russo, Cappello, & Polosa, 2013; Pratt, Sargent, Daniels, Santos, & Brunette, 2016). However, other studies found no evidence that e-cigarettes might help reduce or quit smoking in smokers with serious mental illness. In a clinical trial conducted among smokers with serious mental illness (Prochaska & Grana, 2014), e-cigarette use increased over time but was not associated with changes in cigarette use or quitting. In another study (Hefner et al., 2016), although 36.2% of smokers with mental illness indicated using e-cigarettes to quit smoking, less than 5% reported succeeding.

Given the growing popularity of e-cigarettes, including among people with mental illness, it is important to examine the effects of various communication strategies about e-cigarettes. With the emergence of various novel tobacco products, there is an increasing call for clear communication about the risk differential between various tobacco products (Kozlowski & Sweanor, 2018; Levy, 2018; Ramström, 2018). In some countries, policies have already been developed to communicate comparative risks of different tobacco products. For instance, in the U.K., high nicotine-containing e-cigarettes could be licensed as medical products and make positive health appeals (Action on Smoking and Health, 2016). In the U.S., the FDA regulates e-cigarettes as tobacco products, although the deadlines for the regulations have been postponed (U.S. Food and Drug Administration, July 28, 2017) and several public health groups subsequently challenged the FDA's delay (Raymond & Mincer, 2018). The FDA has a regulatory mechanism in place, called modified risk tobacco product application, which, upon the agency's approval, would allow companies to market e-cigarettes as being less harmful than other tobacco products currently on the market (U.S. Food and Drug Administration, 2012). In evaluating whether to allow marketing of a tobacco product with modified risk claims, FDA must consider the population-level impact of modified risk messages. On one hand, if smokers otherwise not willing to quit switched completely to e-cigarettes as a result of these messages, they may benefit. On the other hand, such

communication might also cause unintended consequences, such as delayed smoking cessation or dual use of both e-cigarettes and cigarettes among smokers (Benowitz & Goniewicz, 2013; Kalkhoran & Glantz, 2015), relapse among former smokers, and increased initiation among non-smokers, particularly youth, who might then progress to smoking (Soneji et al., 2017). This communication challenge needs to be evaluated in the population as a whole, and it might be of critical importance among people with mental illness, who experience profound tobacco-related health disparities and might have much to gain or lose from comparative risk messages. To further mitigate negative outcomes of these messages, it has been proposed that they should only be delivered to adult current smokers or e-cigarette users, for example, in adult-only tobacco retail outlets, as inserts in cigarette packs, or as direct mail to smokers rather than as general advertisements or public education campaigns (Lindblom, 2018; Lindblom, Berman, & Thrasher, 2017).

Recent studies have begun to examine the effects of comparative risk messages about e-cigarettes (Banerjee, Greene, Li, & Ostroff, 2016; Barnes, Bono, Lester, Eissenberg, & Cobb, 2017; Berry, Burton, & Howlett, 2017; Pepper, Byron, Ribisl, & Brewer, 2017; Wackowski, Hammond, O'Connor, Strasser, & Delnevo, 2016), but to our knowledge none have evaluated comparative risk messages by comparing people with and without mental illness. The present study aims to fill this gap by testing comparative risk messages among smokers with and without serious psychological distress (SPD), as determined by a screening instrument for serious mental illness.

## Method

### Participants

This study was a part of a larger project examining the effects of different types of messages communicating comparative risk of e-cigarettes and cigarettes on risk perceptions and tobacco use intentions. Participants were 1,400 U.S. adult (18+ years old) current smokers (smoked at least 100 cigarettes in their lifetime and currently smoking cigarettes every day or some days) or recently former smokers (quit smoking in the past 2 years). Participants were recruited by a survey market research company Toluna, using a variety of online recruitment strategies (e.g., web banners and pay-per-click). The Georgia State University IRB approved this study and all participants completed informed consent.

### Procedure

The study began by asking participants about their general tobacco use behaviors, beliefs, and demographics. Patients were then randomized to view one of the 6 messages on comparative risk of e-cigarettes and cigarettes or a control message (a bottled water advertisement). Participants examined their message without a time limit and were then asked questions regarding e-cigarette- and cigarette-related beliefs and behavioral intentions. At the conclusion of the study, all participants were presented with a debriefing message indicating that the comparative risk messages they saw were designed for research only and the healthiest choice is not to use any tobacco products at all.

## Comparative Risk Messages

Detailed description of the messages and their development process is provided elsewhere (Yang, Owusu, & Popova, 2018). Briefly, after reviewing the latest research studies and existing e-cigarette campaigns, we created 12 initial message concepts, executed as full-color pictures and text, and evaluated them in 12 focus groups. Based on focus group discussion, 6 of the original 12 messages were further developed into the final 6 messages.

All messages asserted that smokers who are not ready to quit smoking should switch to e-cigarettes completely to reduce their health risks (see Appendix for messages) but utilized two different approaches. Three messages (“comparative risk” [CR] messages) focused on the benefits of switching to e-cigarettes to reduce health risks and used more positive imagery. The other three messages emphasized the serious health consequences of smoking and used more negative imagery to portray e-cigarettes as a less harmful alternative to cigarettes (“negative comparative risk” [CR-] messages).

## Key Measures

Details on all measures are shown in Table 1. Serious psychological distress was assessed through the Kessler-6 (K6) scale (Furukawa, Kessler, Slade, & Andrews, 2003; Kessler et al., 2003), which measures non-specific psychological distress in the past 30 days and has been clinically validated as a screening tool for serious mental illness. Based on prior studies (Hagman, Delnevo, Hrywna, & Williams, 2008; Kessler et al., 2003; Sung, Prochaska, Ong, Shi, & Max, 2011), people with scores 13–24 were coded as having serious psychological distress (SPD).

Based on the anti-smoking message impact framework (Noar et al., 2015), we organized our outcome variables into two sets: e-cigarette- and cigarette-related beliefs and behavioral intentions. E-cigarette- and cigarette-related beliefs included perceived absolute e-cigarettes and cigarettes risks and benefits (Chaffee et al., 2015), perceived comparative risk of cigarettes, self-efficacy to quit smoking (The International Agency for Research on Cancer, 2009), and support for tobacco control (Ling, Neilands, & Glantz, 2007). Behavioral intentions included intentions to smoke, intentions to switch completely to e-cigarettes (Mays, Moran, Levy, & Niaura, 2015), and dual use intentions (intentions to use both e-cigarettes and combusted cigarettes). Among current smokers, we also assessed quit intentions (Carpenter, Hughes, Solomon, & Callas, 2004) and other relevant intentions (Wong & Cappella, 2009).

## Analysis Plan

The study aims to evaluate comparative risk messages by comparing smokers with and without SPD. Our prior paper reported the main effects of message type (two types of comparative risk messages and the control message) (Yang et al., 2018). In the current paper, we present 1) the interaction effect between type of message and SPD status and 2) main effect of SPD. Multivariable logistic regression analyses were conducted for categorical variables (dual use intentions and comparative risk perceptions) and multivariable linear regressions were run for continuous variables (all other outcomes). Similar to the analyses reported in our previous paper (Yang et al., 2018), we created two message impact dummy

variables using orthogonal coding (dummy 1= CR + CR- messages vs. control message; dummy 2=CR vs. CR- messages). We ran multivariable linear and logistic regressions to examine the interaction of the two message dummy variables with SPD status and the main effect of the SPD status controlling for sex, age, race, education level, perceived comparative risk of e-cigarettes and cigarettes, self-efficacy at pretest, daily cigarette use (yes vs. no), e-cigarettes use (never vs. ever vs. current), quit intentions at pretest (former smokers vs. current smokers who never plan to quit vs. current smokers plan to quit in the future), and smoking identity. SPSS v.24 was utilized for all analyses. The significance level was specified at  $p < .05$ .

## Results

### Sample Characteristics

The overall sample was 53% female, 81.6% White, and 63.7% college graduates. Daily smokers comprised 61%; 9.4% were recent former smokers, and 33.6% reported using e-cigarettes in the past 30 days (Table 2). Young adults (18–29) were the smallest age group (17.7%), but constituted the largest group among people with SPD (32.9%). Among smokers with SPD, 62.2% attempted to quit in the past 12 months (vs. 45.9% of smokers without SPD,  $p < .001$ ). Participants with SPD were more likely to be current e-cigarette users (43.9% vs. 30.5%,  $p < .001$ ) and current dual users of both e-cigarettes and cigarettes (42.4% vs. 27.9%,  $p < .001$ ). However, those with SPD were less likely to be daily smokers than those without SPD (47% vs. 63.4%,  $p < .001$ ) (Table 2).

### Message Impacts among Smokers with and without SPD

Table 3. provides the mean scores and percentages for each outcome for smokers with and without SPD in the treatment and control conditions. To examine whether the impacts of comparative risk messages were different among smokers with and without SPD, we assessed the interactions between the two dummy message variables and SPD status. None of the interactions between message type and SPD status were significant (Table 4)

### Association of SPD with Outcome Variables

According to Table 4, in both treatment and control conditions, smokers with SPD reported greater perceived absolute risk of e-cigarettes and cigarettes, greater support for tobacco control, and greater intentions to switch to e-cigarettes completely and seek help with quitting compared to smokers without SPD. Also, smokers with SPD were less likely than those without SPD to report e-cigarettes were less harmful than cigarettes.

## Discussion

Although far from being harmless, e-cigarettes expose users to lower levels of toxic substances than combusted cigarettes (NASEM, 2018). Communicating about the relative risks of e-cigarettes versus combusted cigarettes could encourage smokers with mental illness to switch to e-cigarettes, which could help reduce tobacco-related disparities for this population. However, promoting e-cigarettes as a less harmful option might also result in unintended outcomes, including delayed smoking cessation or dual use, which might worsen

existing differences in smoking-related mortality and morbidity between people with and without mental illness. In this context, our study aims to provide preliminary evidence about comparative risk communication about e-cigarettes among smokers with and without SPD.

Overall, our findings suggest that messages communicating lower risk of e-cigarettes had the same positive and the lack of evidence for negative impacts among smokers with and without SPD (Yang et al., 2018). Furthermore, we found that smokers with SPD reported greater perceived absolute risks of e-cigarettes and cigarettes, greater support for tobacco control, and greater intentions to switch to e-cigarettes completely and seek help with quitting and lower odds of e-cigarettes being less harmful than smokers without SPD, regardless of whether they were exposed to comparative risk messages or the control message. To our knowledge, no studies have examined the impact of comparative risk messages on e-cigarette- and cigarette-related beliefs and intentions by comparing people with vs. without mental health conditions. Our findings are consistent with past research suggesting that smokers with mental health conditions typically have high motivation to quit smoking (Chen et al., 2017; Lucksted et al., 2000; Prochaska, 2011; Prochaska, Das, & Young-Wolff, 2017; Siru et al., 2009). Given that smokers with SPD reported greater intentions to switch to e-cigarettes completely, this population may be optimistic about the use of e-cigarettes to help them quit smoking. This is consistent with a recent study finding that smokers with vs. without mental health conditions indicated thinking more about how e-cigarettes might improve their health (Spears et al., 2018). Given that this population has had particular difficulties quitting (Forman-Hoffman et al., 2016), novel products like e-cigarettes may be viewed as a source of hope to help them quit. However, smokers with vs. without SPD also reported higher absolute e-cigarette risk perceptions and were less likely to indicate that e-cigarettes are less harmful than cigarettes. Although more research is needed, it is possible that higher perceived absolute risk of e-cigarettes would predict lower chance of prolonged e-cigarette use among people with SPD. Future studies should continue to examine this issue.

In our study, smokers with and without SPD did not differ in terms of intentions for dual use. It would be concerning if comparative risk messages led people with mental illness to plan to use both e-cigarettes and combusted cigarettes, which has clear health risks. However, it is important to note that our study did not measure people's actual behaviors or the long-term effects of comparative risk messages. Given that people with mental health conditions tend to have higher nicotine dependence (Schroeder & Morris, 2010), they could be at risk for dual use of e-cigarettes and cigarettes and/or prolonged use of tobacco over time (Prochaska & Grana, 2014). Hence, to better understand the effects of comparative risk messages on people with and without SPD, studies using longitudinal designs and measuring people's actual behaviors are needed. Also, our study did not probe participants' cognitive beliefs about e-cigarettes as a smoking cessation aid after they viewed the comparative risk messages. Prior studies suggested that many people with mental illness may believe e-cigarettes could help them quit smoking (Chen et al., 2017; Hefner et al., 2016; Hefner et al., 2017; Spears et al., 2018). However, existing evidence on the efficacy of e-cigarettes as a smoking cessation aid is mixed, with studies of population-level e-cigarette use indicating that e-cigarettes might suppress cessation (Farsalinos, 2018; Glantz & Bareham, 2018; Kalkhoran & Glantz, 2016; Rahman, Hann, Wilson, Mnatzaganian, & Worrall-Carter, 2015).

We urge future studies to conduct more in-depth exploration of how people with mental health conditions interpret and understand messages communicating lower risk of e-cigarettes than cigarettes, and in particular how they view e-cigarettes as a smoking cessation tool.

Limitations include outcomes assessed based on a single forced exposure, which might limit the external validity of findings. A non-probability-based sample does not allow for generalization to the entire U.S. population. Our finding that participants with SPD are more likely to smoke and use e-cigarettes is consistent with past literature in U.S. nationally representative samples (Park et al., 2017; Phillips et al., 2017). However, smokers with SPD in our study were less likely to be daily smokers than those without SPD. This was unexpected, and large studies with representative samples are needed for continued surveillance of smoking frequency by SPD. We measured immediate behavioral intentions instead of people's long-term actual behaviors. In addition, given the lack of established dual use intention measures, we developed our own question. Hence, findings about the association between SPD and dual use intentions should be interpreted with caution. The K6 scale assesses general psychological distress rather than specific clinical diagnoses. Use of e-cigarettes may differ across diagnostic categories (Spears et al., 2017). Future research might assess how people with various diagnosed mental illnesses respond to messages about comparative risk of e-cigarettes. Our study only focused on adult smokers. Future studies should assess how comparative risk messages influence non-smokers and former smokers with SPD. Also, mental health problems are prevalent among adolescents (USDHHS, 2017), a population vulnerable to e-cigarette use (USDHHS, 2016). Future studies might also assess how adolescents with vs. without SPD respond to comparative risk messages.

Despite these limitations, our study is novel in examining the association between SPD and smokers' responses to messages communicating comparative risk of e-cigarettes and cigarettes. Understanding the effects of various communication strategies among smokers with mental illness is particularly important given the striking tobacco-related disparities experienced by this population. Our results indicate that smokers with SPD reported more favorable responses (including greater intentions to switch to e-cigarettes completely and seek help quitting) compared to smokers without SPD. Smokers with SPD may be optimistic about e-cigarettes to help them quit smoking, and more research is needed to optimize messages about e-cigarettes and cigarettes for smokers with SPD.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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### Highlights

- An online experiment exposed smokers to comparative risk messages about combusted and electronic cigarettes.
- Message responses were compared between smokers with and without SPD.
- Smokers with SPD reported higher self-efficacy to quit smoking, greater support for tobacco control, lower intentions to smoke and greater intentions to seek quit help than smokers without SPD.
- Smokers with and without SPD did not differ in dual use intentions.

**Table 1.**

**Key Measures**

Measures	Response options	Reliability (for scale)
<b>Psychological distress</b>		
In the PAST 30 DAYS, how often did you feel... - So sad that nothing could cheer you up? - Nervous? - Restless or fidgety? - Hopeless? - That everything was an effort? - Worthless?	1 (all of the time) – 5 (none of the time) <sup>a</sup>	$\alpha = .93$
<b>E-cigarette- and cigarette-related beliefs</b>		
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? <b>Perceived risks:</b> - Lung cancer - Lung disease other than lung cancer (such as COPD and emphysema) - Heart disease - Become addicted - Early/Premature death  <b>Perceived benefits:</b> - Look cool - Feel more relaxed - Have better concentration - Be more popular	0 (no chance) – 6 (very good chance) + I don't know <sup>b</sup>	E-cigarettes $\alpha = .94$ ; Cigarettes $\alpha = .91$ ;  E-cigarettes $\alpha = .87$ ; Cigarettes $\alpha = .79$ ;
<b>Perceived comparative risk:</b> Is using electronic cigarettes (vapes) less harmful, about the same, or more harmful than smoking regular cigarettes?	Three options + I don't know <sup>c</sup>	
<b>Self-efficacy:</b> - 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) <sup>d</sup>	Pretest $\alpha = .83$ , Posttest $\alpha = .86$
<b>Support for tobacco control:</b> - 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)	$\alpha = .91$
<b>Behavioral intentions</b>		
<b>Intentions to smoke cigarettes:</b> What is the chance that you will smoke a cigarette sometime over the next 6 months?	1 (definitely will) – 4 (definitely will not) <sup>e</sup>	
<b>Intentions to switch completely to e-cigarettes:</b> 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)	
<b>Dual use intentions:</b> Which of the following are you most likely to do in the next month? (Pick one) <sup>f</sup> 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	
<b>Intentions to quit:</b> <sup>g</sup>	0 (very definitely no) – 10 (very definitely yes)	

Measures	Response options	Reliability (for scale)
How much do you intend to quit in the next 6 months?		
<b>Other intentions:<sup>g</sup></b> <ul style="list-style-type: none"> <li>- How likely is it that in the next 6 months you will reduce the number of cigarettes you smoke in a day?</li> <li>- How likely is it that in the next 6 months you will seek counseling/support to help you quit smoking?</li> <li>- 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)?</li> </ul>	1 (definitely will not) – 4 (definitely will)	Analyzed separately
<b>Covariate</b>		
<b>Smoking identity:</b> <ul style="list-style-type: none"> <li>- Smoking is part of my self-image.</li> <li>- Smoking is part of “who I am.”</li> <li>- Smoking is a part of my personality.</li> <li>- Smoking is a large part of my daily life.</li> <li>- Others view smoking as part of my personality.</li> </ul>	1 (strongly disagree) – 10 (strongly agree)	$\alpha = .92$

Notes.

<sup>a</sup>The scale was converted to a 0–4 scale and was then reverse coded. Each individual’s psychological distress score was then calculated as the sum of their responses to the six items. Those with total scores between 13–24 was coded as individuals with serious psychological distress.

<sup>b</sup>The response category “I don’t know” was treated as missing value in the data analysis.

<sup>c</sup>The response category “more harmful, same, and I don’t know” were grouped together and compared with the response category “less harmful”

<sup>d</sup>The measurement scale for option 2 was 1 (not at all sure) — 9 (completely sure)

<sup>e</sup>Reverse coded in data analysis.

<sup>f</sup>The response category 7 was treated as missing value. The response categories 2, 3, and 4 were grouped together (dual use) and compared with the response categories 5 (exclusive e-cigarette use) and 6 (cessation), which indicate intended outcomes.

<sup>g</sup>Measured only among current smokers.

**Table 2.**

Demographic and Tobacco Use Characteristics by Past-Month Serious Psychological Distress

	Overall (n = 1400) %	Serious psychological distress (n=328) %	No serious psychological Distress (n=1,072) %	SPD vs. No SPD $\chi^2$ (df), p-value
<b>Sex</b>				0.05(1), <i>p</i> =.82
Male	47.0	47.6	46.8	
Female	53.0	52.4	53.2	
<b>Age</b> ***				<b>104.47(3), <i>p</i>&lt;.001</b>
18–29	17.7	32.9	13.1	
30–44	25.6	30.5	24.1	
45–59	31.1	26.8	32.5	
60+	25.6	9.80	30.4	
<b>Race</b>				5.70(4), <i>p</i> =.23
White	81.6	79.6	82.2	
Black or African American	8.3	7.0	8.7	
Hispanic	4.0	5.2	3.6	
Asian	1.2	4.9	3.5	
Other	1.1	3.4	2.1	
<b>Education</b>				2.12(3), <i>p</i> =.55
Less than high school	1.8	1.8	1.8	
High school	34.4	36.6	33.8	
Some college	33.1	29.9	34.1	
Bachelor's degree or higher	30.6	31.7	30.3	
<b>Daily smoker</b> ***				<b>11.38 (1), <i>p</i>&lt;.001</b>
Yes	61.0	47.0	63.4	
No	39.0	53.0	36.6	
<b>E-cigarette use</b> ***				<b>22.76(2), <i>p</i>&lt;.001</b>
Current	33.6	43.9	30.5	
Ever but not current	22.8	22.3	22.9	
Never	43.6	33.8	46.5	
<b>Current cigarette use</b>				3.97(2), <i>p</i> =.14
Yes, but expect to quit	82.6	86.3	81.5	
Yes, and never expect to quit	7.9	6.4	8.4	
No, former smoker	9.4	7.3	10.1	
<b>Current dual user of e-cigarettes and cigarettes</b> ***				<b>24.52(1), <i>p</i>&lt;.001</b>
Yes	31.3	42.4	27.9	
No	68.7	57.6	72.1	
<b>Tried to quit in the past 12 months</b> ***				<b>26.69(1), <i>p</i>&lt;.001</b>
Yes	49.7	62.2	45.9	
No	50.3	37.8	54.1	

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*Notes:* SPD – Serious Psychological Distress. Current e-cigarette use is defined as past 30-day e-cigarette use.

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 $p < .001$ .

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**Table 3.**

Mean Scores or Percentages for Comparative Risk Messages and Control Condition for Each Outcome for Smokers with and without Serious Psychological Distress

Outcome	SPD group	Comparative risk messages, M (SD) or %	Control condition, M (SD) or %
<b>E-cigarette- and cigarette-related beliefs</b>			
Perceived absolute risks of e-cigarettes	SPD	4.01 (1.64)	4.46 (1.38)
	No SPD	3.64 (1.69)	3.74 (1.72)
Perceived absolute benefits of e-cigarettes	SPD	2.91 (1.91)	3.38 (2.07)
	No SPD	2.27 (1.72)	2.37 (1.65)
Perceived absolute risk of cigarettes	SPD	5.27 (1.05)	5.35 (0.77)
	No SPD	5.10 (1.10)	5.17 (1.12)
Perceived absolute benefits of cigarettes	SPD	3.08 (1.68)	3.55 (1.66)
	No SPD	2.57 (1.49)	2.67 (1.47)
Self-efficacy at posttest	SPD	5.22 (2.38)	5.19 (2.03)
	No SPD	4.86 (2.19)	5.01 (2.13)
Support for tobacco control	SPD	4.61 (1.85)	4.89 (1.66)
	No SPD	3.94 (1.85)	3.69 (1.85)
<b>Behavioral intentions</b>			
Intentions to smoke cigarettes	SPD	3.26 (0.95)	3.54 (0.62)
	No SPD	3.36 (0.93)	3.42 (0.81)
Intentions to switch to e-cigarettes completely	SPD	5.26 (2.90)	4.81 (2.72)
	No SPD	4.24 (2.80)	3.81 (2.85)
<b>Behavioral intentions (only current smokers)</b>			
Intentions to quit	SPD	7.07 (2.95)	6.82 (2.97)
	No SPD	6.14 (3.23)	6.36 (3.19)
Intentions to reduce the number of cigarettes	SPD	3.21 (0.79)	2.98 (0.76)
	No SPD	3.15 (0.83)	3.18 (0.85)
Intentions to seek quit help	SPD	2.49 (1.05)	2.68 (0.93)
	No SPD	2.10 (0.98)	2.20 (0.90)
Intentions to use nicotine replacement therapy	SPD	2.72 (1.03)	2.75 (0.92)
	No SPD	2.43 (1.04)	2.46 (0.98)
<b>Perceived comparative risk</b>	SPD	44.3% (vs. 55.7%)	22.9 (vs. 77.1)
	No SPD	49.6% (vs. 50.4%)	46.7 (vs. 53.3)
<b>Dual use intentions</b>			
Exclusive e-cigarette use (vs. dual use intentions)	SPD	12.2% (vs. 45.3%)	4.3% (vs. 57.4%)
	No SPD	9.4% (vs. 39.0%)	8.1% (vs. 34.5%)
Cessation (vs. dual use intentions)	SPD	14.0% (vs. 45.3%)	12.8% (vs. 57.4%)
	No SPD	13.9% (vs. 39.0%)	13.5% (vs. 34.5%)

Notes.M – mean. SD – standard deviation. SPD – serious psychological distress.

**Table 4.**

Interactions Between SPD and Comparative Risk Messages and Main Effect of SPD

Outcome variables	Interaction: CR- and CR messages vs. control x SPD	Interaction: CR vs. CR-messages x SPD	Main effect of SPD (SPD vs. no SPD)
Multivariable Linear Regression Unstandardized <i>b</i> (95% CI)			
<b>E-cigarette- and cigarette-related beliefs</b>			
Perceived absolute risks of e-cigarettes	-0.08 (-0.26, 0.11)	0.09 (-0.12, 0.30)	0.35 (0.12, 0.59) **
Perceived absolute benefits of e-cigarettes	-0.09 (-0.28, 0.10)	0.03 (-0.19, 0.24)	0.23 (-0.01, 0.47)
Perceived absolute risks of cigarettes	-0.03 (-0.16, 0.09)	0.11 (-0.03, 0.26)	0.21 (-0.05, 0.37) *
Perceived absolute benefits of cigarettes	-0.05 (-0.22, 0.11)	-0.03 (-0.22, 0.16)	0.17 (-0.03, 0.38)
Self-efficacy at posttest	0.06 (-0.08, 0.20)	0.09 (-0.07, 0.25)	0.18 (-0.00, 0.35)
Support for tobacco control	-0.18 (-0.39, 0.02)	0.19 (-0.04, 0.43)	0.56 (0.31, 0.82) ***
<b>Behavioral intentions</b>			
Intentions to smoke cigarettes	-0.07 (-0.15, 0.01)	-0.05 (-0.14, 0.05)	-0.03 (-0.13, 0.08)
Intentions to switch to e-cigarettes completely	-0.05 (-0.32, 0.21)	0.04 (-0.27, 0.34)	0.34 (0.004, 0.68) *
<b>Behavioral intentions (only current smokers)</b>			
Intentions to quit	0.02 (-0.32, 0.37)	0.03 (-0.36, 0.42)	0.42 (-0.01, 0.86)
Intentions to reduce the number of cigarettes	0.04 (-0.05, 0.14)	-0.01 (-0.12, 0.10)	-0.03 (-0.15, 0.08)
Intentions to seek quit help	-0.02 (-0.13, 0.10)	0.03 (-0.10, 0.16)	0.19 (0.05, 0.33) **
Intentions to use nicotine replacement therapy	-0.02 (-0.14, 0.10)	0.02 (-0.12, 0.16)	0.14 (-0.01, 0.29)
Multivariable Logistic Regression Adjusted OR (95% CI)			
<b>Perceived comparative risk</b>			
Less harmful (v. equally or more harmful + I don't know)	1.34 (0.95, 1.89)	1.01 (0.71, 1.43)	0.63 (0.42, 0.96) *
<b>Dual use intentions</b>			
Exclusive e-cigarette use intentions (vs. dual use intentions)	1.54 (0.87, 2.74)	0.94 (0.59, 1.51)	0.98 (0.51, 1.89)
Cessation (vs. dual use intentions)	1.05 (0.67, 1.66)	1.06 (0.63, 1.81)	1.51 (0.84, 2.69)

Notes. Regression models controlled for sex, age, race, education level, perceived comparative risk of e-cigarettes and cigarettes, self-efficacy at pretest, daily cigarette use (yes vs no), e-cigarette use (never vs. ever vs. current), quit intentions at pretest (former smokers vs. current smokers who never plan to quit vs. current smokers who plan to quit in the future), and smoking identity.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .