

ORIGINAL INVESTIGATION

Affective and Cognitive Mediators of the Impact of Cigarette Warning Labels

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ABSTRACT

Introduction: Research conducted by the U.S. Food and Drug Administration to select graphic warning labels for cigarette packs has been challenged as inadequate for demonstrating effects on smokers' beliefs about smoking. The present study tested the prediction that warnings alter risk perceptions and thoughts of quitting indirectly through a cognitive pathway (warning believability) and an affective pathway (worry about health), both of which are important for encouraging smokers to consider quitting.

Methods: Using a national Internet panel, individuals who smoke were randomly assigned to view 1 of 3 types of warning labels: basic text only, graphic image with basic text, and graphic image with both basic and additional text elaborating on the reason for the health risk. Analyses were conducted to determine whether cognitive and affective reactions mediated effects on smoking-related outcomes.

Results: Images influenced perceived risk, immediate desire to smoke, and feelings toward quitting indirectly through affective reactions; elaborated text influenced these outcomes through cognitive believability, with little evidence of direct effects. Believability also enhanced positive feelings toward quitting among smokers who were less worried about health risks due to smoking.

Conclusions: The findings indicate that (a) many effects of warnings on smokers' beliefs are mediated rather than direct, (b) both cognitive and affective responses are important mediators, and (c) elaborated text can help to increase effects of images through a cognitive pathway. Warning labels should be designed to maximize effects on these mediators in order to influence smoking outcomes.

INTRODUCTION

Tobacco is the leading cause of preventable death worldwide, killing one person every 6 s (Centers for Disease Control and Prevention, 2012; World Health Organization, 2012). To combat this epidemic, some countries have implemented health warnings on the front and back of cigarette packages that include basic statements of health risks (e.g., “smoking kills”), large images illustrating the risks, and further text elaborating on the basis for these risks (e.g., “more people die from smoking per year than from car accidents or drug overdoses”). In contrast to basic text-only warnings, which are forgettable and ineffective (Bansal-Travers, Hammond, Smith, & Cummings, 2011; Borland et al., 2009; Hammond et al., 2007; Moodie, MacKintosh, & Hammond, 2009), graphic pictorial warnings create negative affect toward smoking (Peters et al., 2007) and encourage smokers with those reactions to think about quitting (Hammond, 2011; White, Webster, & Wakefield, 2008). Nevertheless, in the United States, some courts have rejected

pictorial warning labels for cigarettes because “the images do not convey *any* warning information at all ... [and] are unabashed attempts to evoke emotion (and perhaps embarrassment) and browbeat consumers into quitting” (R. J. Reynolds Tobacco Co. v. Food and Drug Admin., 2012, p. 9; emphasis in original).

The failure of the courts to perceive educational value in the images proposed by the Food and Drug Administration (FDA) may stem from FDA's selection of images on the basis of their emotional impact rather than ability to enhance risk perceptions or increase thoughts of quitting. In FDA's tests of its labels, there was little evidence that the selected labels increased either of these outcomes (FDA, 2010b). However, theory and research (Damasio, 1994; Hammond, 2011; Peters et al., 2007) suggest that graphic images may alter risk perception and thoughts of quitting indirectly through their emotional and cognitive impacts on those outcomes. This study examines whether warning labels do convey health information that can communicate the hazards of the habit through indirect routes mediated by affective and cognitive responses.

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Research on determinants of risk appraisal reveals that affective reactions are powerful sources of information (Loewenstein, Weber, Hsee, & Welch, 2001; Slovic, 2001a). Warning images that evoke affective reactions to smoking, such as worry about the personal health cost of the habit, should engage the use of this affect heuristic to influence evaluations of the objective risks of smoking (Loewenstein et al., 2001; Slovic, 2001a) and elicit thoughts of quitting (Diefenbach, Miller, & Daly, 1999; Romer & Jamieson, 2001). However, such effects are predicted to be mediated rather than direct. That is, their influence on risk perceptions and beliefs about the hazards of smoking will depend on proximal emotional responses that vary across smokers.

Despite the importance of images in cigarette warnings, text is necessary for interpreting the meaning of images (Rayner, Rotello, Stewart, Keir, & Duffy, 2001). Smokers pay more attention to graphic cigarette warnings with text than to those without (Brown, Reidy, Weighall, & Arden, 2013), and text that elaborates on basic warning statements may enhance persuasion by engaging the cognitive pathway hypothesized to influence decision making in dual-process models. According to dual-process theories of decision making and behavior (Chaiken & Trope, 1999; Epstein, 1994; Gawronski & Bodenhausen, 2006; Petty & Cacioppo, 1981), relatively automatic processes, such as the experience of affect, are not the only way to influence decision making. Text can provide arguments that support and enhance the believability of the warning. Despite the use of elaborative text in Canada, FDA's decision not to include it may have represented a lost opportunity to enhance the impact of their warning labels. Nevertheless, little research has examined the separate influence of elaborated text on warning label impact.

One potential impact of enhanced believability is in influencing smokers who fail to experience affective reactions to warnings. Although message believability may matter less for people who are worried about their health, it could overcome resistance to changing smoking habits among those who are less concerned about the health consequences of smoking. Thus, this study also assessed the potentially greater effects of believability of warnings among less worried smokers.

Present Study

Despite the growing literature supporting the effectiveness of graphic warning labels (see Hammond, 2011, for a review), the extant research has not examined the importance of assessing affective and cognitive processes as mediators of warning-label effects. The potential benefits of including elaborated text to enhance warning effects have also not been examined. In order to assess the potential additive effects of images and elaborative text, this study presented smokers with a basic text warning, the same basic text warning with an image illustrating the risk, or the basic text warning with an image and elaborated text. Compared with basic text, both images and elaborative text were expected to influence appraisals of objective health risks of smoking, as well as thoughts of quitting smoking (assessed through immediate desire to smoke and feelings toward quitting). It was hypothesized that (H1) images would produce these outcomes by enhancing affective responses to warnings (worry about health risks), whereas (H2) elaborated text would influence outcomes by enhancing cognitive responses (evaluation of the believability of warnings). Finally, (H3) individual

differences in participants' perceptions of the believability of the warning were expected to moderate the effects on smoking outcomes of individual differences in participants' feelings of worry such that believability would make a greater difference among individuals who worry less about smoking's health consequences.

METHOD

Participants and Design

An Internet survey panel sponsored by Research Now that FDA used to test candidate warning images (FDA, 2010a) provided an initial sample of 5,306 participants (43.7% male, 56.3% female; Annenberg Public Policy Center, 2011; see Romer, Peters, Strasser, & Langleben, 2013, for additional details regarding this dataset). The survey was designed to test variations in images and messages using FDA's warnings as a template. After excluding participants in conditions not relevant to the present hypotheses, 2,648 participants were included in the present analyses. Individuals were eligible to participate if they had not previously participated in the FDA study, if they had smoked at least 100 cigarettes in their lives, and if they smoked every day or some days. The average age was 33.77 ($SD = 14.73$), and the median education level was "some college" with 13.3% having a high-school degree or less and 42.8% having completed more than some college. The majority of participants identified as non-Hispanic White (75.2%); 11.6% identified as Hispanic, 4.8% as non-Hispanic Black, and 7.4% as non-Hispanic Asian.

The study employed a between-subjects design, with approximately 300 participants randomly assigned to one of eight different warning-label conditions (described below), stratified between ages 18–24 and 25+. Participants viewed the warnings on a hypothetical unbranded pack of cigarettes that was used in the FDA test. Two warning statements mandated by Congress were tested: "Smoking during pregnancy can harm your baby" and "Cigarettes are addictive." There were four variations of each of these warnings: basic text only, basic text plus image, and two versions of basic text, image, plus two versions of elaborated text (see [Supplementary Material](#)). We collapsed the variations across the two statements to create a final set of three conditions (basic text only; basic text plus image; and the basic text, image, plus elaborated text). Participants did not differ between conditions on demographics, smoking frequency, or intention to quit prior to viewing the warning labels.

Materials and Procedure

In the basic text-only condition, participants saw a pack of cigarettes on its side with the warning-label text on the side of the pack in the same location currently used in the United States. In the basic text plus image condition, participants saw a label that covered the top half of the pack with an image and one of the same short statements as in the text-only condition (see [Supplementary Material](#)). The addiction image used a picture that was tested but not selected by FDA for its final set. A baby image was taken from the proposed FDA warning labels (FDA, 2011a, 2011b). For example, participants who received the pregnancy message viewed a pack with an image of a

cartoon baby accompanied by the statement, “smoking during pregnancy can harm your baby” (see [Supplementary Material](#)).

In the elaborated text condition, participants saw a pack with one of the images described above covering the top half of the pack and basic, as well as explanatory, text below the image. The elaborated text described the risks of smoking during pregnancy or the difficulty of quitting (see [Supplementary Material](#)). There were two versions of the elaborated statement for the addiction warning. A second picture taken from the Canadian warnings that showed an actual baby in intensive care was also tested in the elaborated text condition. Results of the mediational analyses for each statement or image did not differ, so all analyses collapsed across the different messages, images, and versions of elaborated text. Analyses also collapsed across age, education, and income groups, as none of them were significant moderators in the model.

Participants completed the study online. After beginning the study, participants learned that the researchers were investigating responses to new cigarette packaging. Participants saw one of the packs and could look at it for as long as they wanted. However, they could not return to the pack once they started the rest of the survey. Each participant only saw one pack with one of the warning messages. Unless otherwise noted, all measures were adapted from the FDA study (FDA, 2010b). Upon study completion, respondents received compensation from the firm that hosted the Internet panel. The Institutional Review Board of the University of Pennsylvania approved the study.

Cognitive Measure of Believability

Participants reported the extent to which they believed that the information on the warning label was true (“The pack is believable”), assessed on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

Affective Measures

Participants evaluated whether they were concerned about their health as a result of smoking (“How concerned are you that your smoking has affected your health?” on a 4-point scale (1 = *not at all concerned*, 4 = *very concerned*). They also indicated the extent to which the warning label made them feel “worried” on a 5-point scale (1 = *not at all*, 5 = *completely*). These items were significantly correlated ($r = .36, p < .001$). After being standardized, they were combined to create a composite measure of worry.

Smoking-Outcome Measures

Perceived Risk

Eight items assessed the extent to which participants perceived health risks from smoking (e.g., “How likely do you think it is that a regular smoker would get cancer?”). They rated a number of health risks for a regular smoker, including lung disease, addiction, heart disease, and harm to her baby if the smoker were pregnant on a 5-point scale (1 = *not at all likely*, 5 = *extremely likely*). This scale showed good reliability ($\alpha = .91$).

Immediate Desire to Smoke

Participants reported how much they wanted to smoke after viewing the warning labels (“I want a cigarette right now”), assessed on a 5-point Likert scale (1 = *strongly disagree*,

5 = *strongly agree*), and how they would feel if they were to smoke now (“How good or bad would you feel if you were to smoke a cigarette right now?”; Slovic, 2001b), evaluated on a 4-point scale (1 = *very good*, 4 = *very bad*). This second item was reverse scored. These items were significantly correlated ($r = .35, p < .001$); after being standardized, they were combined to create a composite measure of feelings about the immediate desire to smoke.

Feelings Toward Quitting

Participants indicated how they would feel if they quit smoking (“How good or bad do you think you would feel if you quit smoking in the next year?”). This item was created for this study and was assessed on a 4-point scale (1 = *very good*, 4 = *very bad*). Prior to data analysis, the item was reverse scored.

Analysis

Two orthogonal contrasts tested the contributions of each warning-label component to the two proposed mediators and three smoking outcomes. The first contrast evaluated the contribution of image compared with text-only labels: the elaborated text and image-only conditions were contrast coded as 1, and the text-only condition was coded as -2 . The second contrast evaluated the effects of elaborated text: The elaborated text condition was contrast coded as 1, image only as -1 , and text only as 0. Given the large sample size and the desire to reduce Type I errors, only effects significant at $p < .01$ were considered for interpretation.

Multiple mediation analyses were conducted using INDIRECT macro for SPSS by Preacher and Hayes (2008); all analyses with the first contrast included the second as a covariate, and vice versa, so that both contrasts could be included in the same model (Preacher & Hayes, 2008). The analyses used bootstrapping with 5,000 resamples to test whether believability or worry about health concerns mediated the effects of each label component on smoking outcomes. Mediation was considered significant if the 99% CI did not include 0, and both mediators were entered into the model simultaneously.

RESULTS

Associations Between Smoking Outcomes

The three smoking-outcome variables were somewhat correlated with each other. Greater desire to smoke was associated with lower risk perceptions ($r = -.22, p < .001$) and less positive affect toward quitting ($r = -.23, p < .001$). Greater risk perceptions were associated with more positive affect toward quitting ($r = .30, p < .001$). Nevertheless, the variables were sufficiently independent to allow separate analyses of each outcome. We also performed additional analyses on the believability and the feelings toward quitting items. In support of the believability item’s sensitivity to the information contained in the warning rather than to other aspects of its appearance, the item correlated strongly with a separate item that assessed whether “the pack is informative” ($r = .57, p < .001$). In support of the feeling toward quitting item’s sensitivity as a measure of motivation to quit, the item was positively correlated with a separate item that assessed

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likelihood of trying “to quit smoking in the next 30 days” ($r = .30, p < .001$).

As expected, there were no direct effects of either warning component on any smoking outcome other than the effect of image on the immediate desire to smoke ($t = -4.90, p < .001$). Nevertheless, there were effects of each warning component on the mediators, with image influencing worry ($t = 8.39, p < .001$) and elaborated text influencing believability ($t = 2.84, p < .001$) (see Figure 1).

Indirect Effects of Warning-Label Components

Risk Perception

Worry about smoking mediated the effect of image compared with basic text on increased risk perception (99% CI = .030, .058), whereas believability did not (99% CI = -.004, .004). Believability, however, mediated the effect of elaborated text (compared with image) on risk perception (99% CI = .0007, .015) but worry did not (99% CI = -.023, .021), $F(4,2643) = 171.93, R^2$ for the model = .207, $p < .001$. Thus, the image increased worry, which was associated with greater risk perception, whereas elaborated text enhanced believability, which was associated with increased risk perception (Figure 1).

Desire to Smoke

Greater worry mediated the effect of image (compared with text) on desire to smoke (99% CI = -.041, -.020) but believability did not (99% CI = -.003, .003). Moreover, believability mediated the effects of elaborated text (compared with image only) on desire to smoke (99% CI = -.012, -.0006) but worry did not (99% CI = -.015, .015); $F(4,2643) = 89.44, R^2$ for the model = .119, $p < .001$. The image caused greater worry, which was associated with decreased desire to smoke; the elaborated

text increased believability, which was associated with less desire to smoke (Figure 1).

Feeling Toward Quitting

The presence of the image increased worry, which mediated the effect of the image on feelings toward quitting (99% CI = .019, .038). However, the image did not influence feelings toward quitting through believability (99% CI = -.003, .002). Conversely, believability mediated the effect of elaborated text on feelings toward quitting (99% CI = .0004, .009) but worry did not (99% CI = -.014, .014); $F(4,2640) = 96.70, R^2$ for the model = .128, $p < .001$. Thus, the image increased worry, which was associated with more positive feelings toward quitting, whereas the text augmented believability, which was associated with positive feelings about quitting (Figure 1).

Does Believability Moderate the Effects of Worry?

Hypothesis 3 posited that believability might enhance warning effects when worry about health is weak. After being standardized, worry, believability, and their interaction were entered into regression models for each outcome, collapsing across experimental conditions. Believability ($\beta = .072, p < .001$) and worry ($\beta = .325, p < .001$) had significant main effects on feelings toward quitting; moreover, the interaction was significant ($\beta = -.068, p < .001$; see Figure 2), $F(3,2641) = 131.34, R^2 = .130, p < .001$. Individuals with higher levels of worry expressed more positive feelings toward quitting, regardless of level of belief in the warnings. However, individuals with low levels of worry expressed more positive feelings toward quitting when they believed in the warnings compared with when they did not (Figure 2). The interaction between believability and worry was not observed for risk

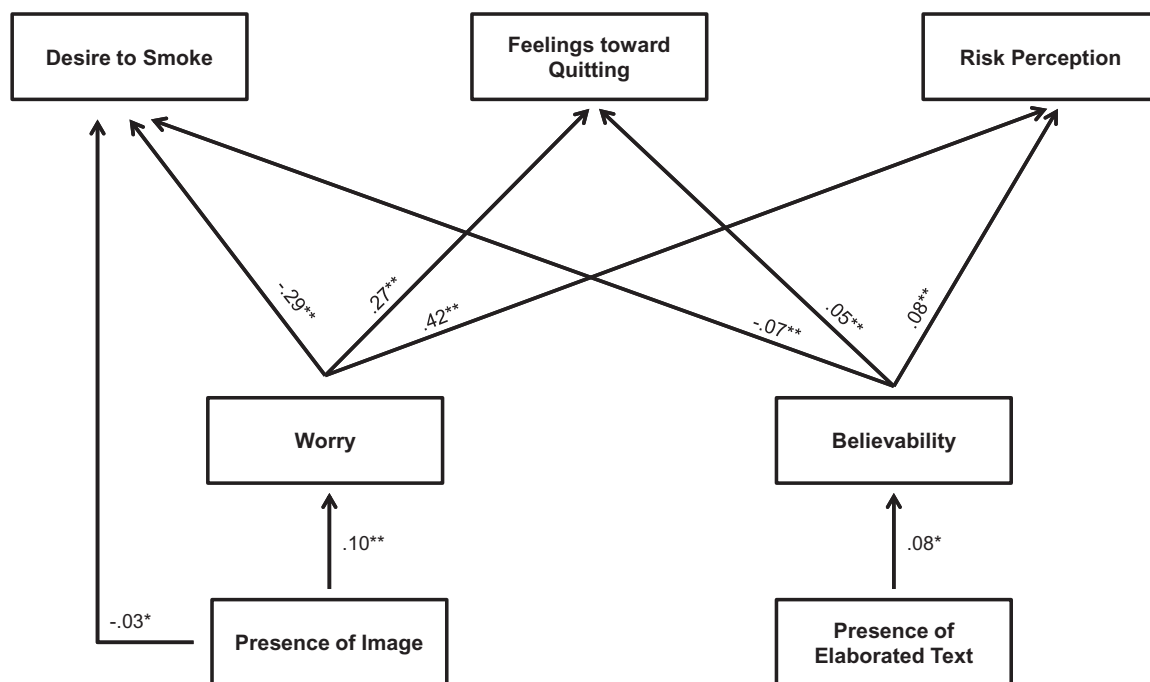


Figure 1. Presence of image and presence of elaborated text influencing desire to smoke, feelings toward quitting, and risk perception, mediated by worry and believability. Only significant pathways are shown. $^{**}p < .001$; $^*p < .01$. All betas are unstandardized.

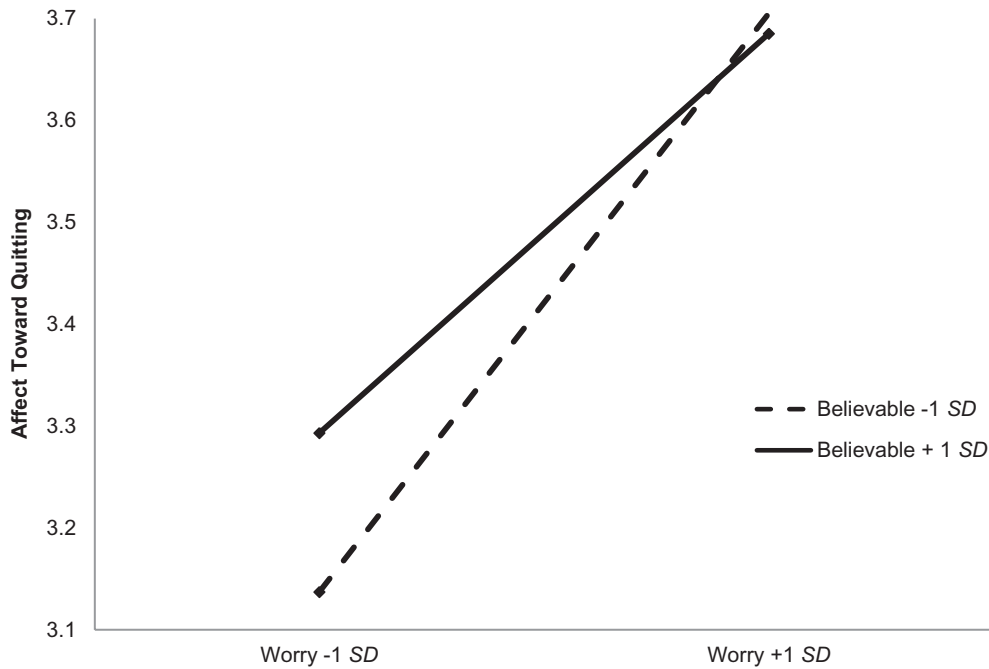


Figure 2. Interaction between believability and worry predicting feelings toward quitting.

perception ($\beta = -.025$, nonsignificant [*ns*]) or immediate desire to smoke ($\beta = .014$, *ns*).

DISCUSSION

Despite accumulating evidence suggesting the effectiveness of graphic warning labels on cigarette packs (see Hammond, 2011, for a review), many countries, including the United States, have not adopted these stronger warning labels (World Health Organization, 2012). Although FDA (2010b) found that its proposed labels evoke emotional reactions in smokers, there was little evidence that the labels had direct effects on either risk perceptions or thoughts of quitting. The present research demonstrated that images on warning labels do influence both outcomes but only through the indirect pathway of increasing worry about health risks of smoking. The study revealed that adding elaborated text that explains the basis for the warning also enhanced smoking-related outcomes through the indirect pathway of the believability of the warning. Both images and elaborated text provided health information that influenced important smoking-related outcomes, but these effects were indirect and mediated by affective and cognitive processes. Using a mediational model to investigate warning-label components enables researchers to determine how best to translate both of these processes into outcomes that matter for communicating smoking risks. Showing only that graphic images increase emotional reactions leaves the further question of their impact on smoking outcomes untested.

This study is the first to examine the distinct contribution of elaborated text to graphic warning labels. The findings suggest that FDA lost a crucial opportunity to enhance its proposed warning labels by not including elaborated text (FDA, 2012), which other countries, such as Canada, have adopted (Health Canada, 2011). Although individuals who expressed

greater worry about health effects of smoking felt positively about quitting regardless of belief in the labels, the perceived believability of the labels enhanced their impact on feelings toward quitting among individuals who reported lower levels of worry. Although this finding did not emerge for risk perceptions or immediate desires to smoke, both affect and cognition can play a role in promoting positive feelings toward quitting. Especially when individuals are less concerned about their health, elaborated text appears to be an important component of warning labels. Believability can enhance feelings about quitting, which should lead to greater effectiveness for the ultimate aim of warnings: the cessation of cigarette use.

The findings have implications for both designing and demonstrating the effects of cigarette warnings in the United States. Previous research has established that graphic warning labels are more visible and impactful than are text-only labels in increasing thoughts of quitting among those who notice them (Bansal-Travers et al., 2011; Borland et al., 2009; Hammond et al., 2007). However, to the best of our knowledge, this study is the first to examine experimentally the processes underlying their impact on risk perception and thoughts of quitting. Little previous research has examined elaborated text (see Thrasher et al., 2012, for an exception), and no studies have investigated the processes underlying elaborated text that may add to the effectiveness of graphic warnings. The finding that elaborated text enhances believability suggests the importance of having both a powerful image and a powerful message.

Strengths, Limitations, and Future Directions

A methodological strength of this study lies in its experimental design. However, due to its cross-sectional nature, this study cannot determine whether warning labels have long-term effects. One-time exposure to labels with images and elaborated text may not change smoking behavior. Furthermore, in an analysis of intentions to quit smoking based on exposure to

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the warnings in this study, self-efficacy for quitting moderated message effects (Romer et al., 2013). Nevertheless, this study shows that both image and elaborated text on warning labels can have unique effects on smoking-related beliefs that may build over repeated exposures.

Another limitation is that the text-only labels were presented differently from the graphic labels: the pack with the text-only labels was shown on its side. However, the text was prominently displayed on the pack. The text-only label was presented this way to reflect smokers' actual experiences of the current text-only labels, which are on the side of the pack, a procedure that replicated the protocol used by FDA in its tests of new warnings (FDA, 2010a). Although greater consistency in presentation would have been ideal from an experimental standpoint, it would have been an unrealistic simulation for participants accustomed to seeing text labels on the side of the pack.

The study's testing of only two warning-label messages is a potential limitation. Future research should attempt to replicate this study with the other seven messages mandated by Congress. The effects observed in this study might be stronger with more graphic images: previous research has found that participants attributed higher levels of credibility, relevance, and effectiveness to warnings using images of unhealthy organs compared with images of people suffering (Thrasher et al., 2012), and images of real people are more effective than cartoons (Hammond, Reid, Driezen, & Boudreau, 2013). More research is needed to determine whether the results of this study are generalizable to other types of images and messages.

In addition to these limitations, the item regarding feelings toward quitting did not delineate how smokers would feel if they actually quit rather than just made an attempt to do so. Future research could benefit from more precisely distinguishing between these alternatives (e.g., adding "if you successfully quit") to more accurately measure this construct.

Future studies should examine the effects of different message content in elaborated text. A basic text-only label might say that smoking causes lung cancer, but which facts about the effects of smoking on lung cancer are most persuasive? Previous research has found that didactic text, citing facts or statistics, is more persuasive than testimonial text on graphic warning labels (Thrasher et al., 2012), but different forms of didactic content may have different effects. Individuals low in education might be less persuaded by text featuring statistics than more educated individuals. Finally, although we suspect that elaborated text has a greater impact in the presence of a graphic warning label (compared with its absence), no known research has examined this question.

CONCLUSIONS

Understanding how to create persuasive cigarette warning labels is a crucial step toward stemming the epidemic of disease and death due to tobacco use (World Health Organization, 2012). Based on the current results, it appears that a combination of graphic images and elaborated text is important for transmitting health information. The research suggests the necessity of considering processes underlying the association between warning labels and smoking outcomes, as their effects on smoking outcomes are largely mediated rather than direct, and the importance of studying each component of the

warning labels. Impactful warning labels could play an important role in encouraging people to quit smoking, and by combining images and elaborated text, these labels can both raise health concerns and convince people that those health risks are real.

SUPPLEMENTARY MATERIAL

Supplementary Material can be found online at <http://www.ntr.oxfordjournals.org>.

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DECLARATION OF INTERESTS

None declared.

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