

Understanding How Graphic Pictorial Warnings Work on Cigarette Packaging

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The 2009 Family Smoking Prevention and Tobacco Control Act requires cigarette packages to contain stronger warnings in the form of color, graphic pictures depicting the negative health consequences of smoking. The authors present results from a between-subjects experiment with more than 500 smokers that test (1) the effectiveness of pictorial warnings that vary in their graphic depiction of the warning and (2) an underlying mechanism proposed to drive potential effects of the manipulation of the graphic depiction. The findings indicate that more graphic pictorial warning depictions strengthen smokers' intentions to quit smoking. Recall of warning message statements is reduced by moderately or highly graphic pictures compared with a no-picture control or less graphic pictures. The results also show that the graphic warnings affect evoked fear, and in turn, fear mediates the effects of the graphic warning depiction on intentions to quit for the sample of smokers. This pattern of results indicates that though highly graphic pictures may reduce specific message recall and limit the direct effect of recall on intentions to quit, highly graphic pictures increase intentions to quit smoking through evoked fear (i.e., fear fully mediates the effect of the graphic depiction level). The authors discuss implications for consumer health and policy decisions.

Keywords: graphic pictorial warnings, intentions to quit smoking, fear, Family Smoking Prevention and Tobacco Control Act, cigarette warning labels

The use of tobacco is the foremost preventable cause of premature death, causing approximately 5.4 million deaths worldwide (World Health Organization 2009). In the United States alone, smoking results in some 443,000 premature deaths each year and \$190 billion in total tobacco-related disease costs (Centers for Disease Control and Prevention [CDC] 2009). Given the level of costs in both human and financial terms, it is not surprising that advertising and marketing communication efforts aimed at reducing smoking rates are viewed as critical (Fiore et al. 2002).

Cigarette warning labels are a key element in most countries' integrated public health campaigns designed to inform and persuade consumers about the negative consequences

associated with smoking. Despite the documented shortcomings of warning labels (e.g., Bushman 2006; Ringold 2002; Stewart, Folkes, and Martin 2001), warnings can be an important communications tool (Bettman, Payne, and Staelin 1986), and for smokers, warnings can result in countless opportunities to be viewed at the point of sale and/or use (Hammond et al. 2003).

In the United States, the Family Smoking Prevention and Tobacco Control Act (110 U.S.C. §§ 900-302) was signed into law on June 22, 2009. This legislation gives the U.S. Food and Drug Administration (FDA) the authority to regulate the manufacturing, advertising, and promotion of tobacco products to protect public health. Section 201 (part d) of the legislation covering tobacco product warnings and disclosures states that regulations will require "color graphics depicting the negative health consequences of smoking" to accompany cigarette label message statements. These stronger package warnings will cover 50% of the front and rear of cigarette packages. The law also requires that the Secretary of Health and Human Services issue a rule requiring graphic pictorial warning labels on packages by July 2011. This new law is expected to bring the United States more in line with Canada, Australia, and many European countries that currently use strong text messages and, in most cases, graphic pictorial warning labels.

Similarly, to address the global problem of smoking, a groundbreaking public health treaty, the Framework Con-

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vention on Tobacco Control (FCTC), was ratified by the World Health Organization in an effort to control tobacco supply and consumption (see <http://www.fctc.org/>). An important aspect of the FCTC is a “package labeling” provision that requires health warning communications to cover at least 30% of the principal display area on tobacco packaging. These package warnings may be in the form of message text, pictures, or a combination of both text and pictures. As of April 2010, the FCTC had been ratified by 168 countries throughout the world, representing billions of global consumers.

As initiatives such as the FCTC and the Family Smoking Prevention and Tobacco Control Act move forward, it is important to understand what types of warnings are most effective and the underlying mechanisms as to why such warnings might work. Many countries have opted to use a variety of pictorial warnings, which often include highly graphic depictions of the health consequences of smoking. For the purposes of our study, we conceptualize a “graphic” warning as a stimulus depiction (i.e., pictorial warning) that is “marked by clear lifelike or vividly realistic description” and is “vividly or plainly shown or described” (see <http://www.merriam-webster.com/dictionary/graphic>). The more vivid and powerful the picture used to depict the consequence of smoking, the more graphic is the warning. As exemplified by the many different warnings used around the world, there is substantial flexibility regarding what types of pictorial warnings could be used in the United States and how graphic these pictures should be. For example, some warnings use a highly graphic depiction (e.g., a vivid picture of advanced mouth cancer), whereas others are less graphic (e.g., a picture of stained teeth caused by nicotine) (Physicians for a Smoke-Free Canada 2010).

From the myriad options, research examining effects of the graphic level of the warning depiction will be useful to many marketing communication specialists, public health officials, and global policymakers as they consider the best choices for persuading smokers to consider quitting. Therefore, to address these research gaps, we conduct a between-subjects experiment with more than 500 U.S. and Canadian smokers to examine (1) the effects of varying levels of graphic pictorial warning depictions (i.e., low, moderate, and high) and (2) the role of a hypothesized underlying mechanism (i.e., evoked fear) that might account for any differences in the effectiveness of these graphic pictures.¹

Background: Pictorial Stimuli and Persuasive Communications

Some recent preliminary qualitative studies in the United States suggest favorable effects for graphic pictorial warnings. A CDC-sponsored study using 11 small focus groups of smokers and nonsmokers in the United States finds that participants who view Canadian pictorial warnings consider these warnings more informative and potentially more effective than the current U.S. warnings (O’Hegarty et al.

2007). O’Hegarty and colleagues (2007) conclude that across both smokers and nonsmokers, warnings that combine strong, graphic pictures with compelling verbal information (e.g., “Cigarettes Cause Lung Cancer”) are perceived as the most helpful. In one of the few experimental studies of pictorial cigarette warning effectiveness, Kees and colleagues (2006) find that adding a pictorial warning to a verbal warning currently used in the United States can decrease the perceived attractiveness of the cigarette package and increase smokers’ intentions to quit smoking more so than simply using the verbal warning. In addition, in an examination of current U.S. cigarette warning labels versus current Canadian labels (combined text and pictures), Peters and colleagues (2007) show that Canadian labels produce a greater negative response for both U.S. smokers and nonsmokers without any signs of defensive reactions from smokers. Despite this recent research on pictorial warnings, a major unanswered question pertains to the specific mechanisms at work that might account for the pictorial warning effectiveness and how effectiveness might be improved. For example, Kees and colleagues demonstrate that pictorial warnings may increase effectiveness, but they do not identify why (i.e., possible underlying mechanisms). Peters and colleagues examined general affective responses (negative/positive) to various warning labels in use in Canada, but they do not examine the relative effectiveness of any of the warnings they used in the study.

Conceptualization and Hypotheses

Brief Summary of the Fear Appeals Literature

Many of the pictorial cigarette warnings use graphic visuals that may evoke fear related to the consequences of smoking (Physicians for a Smoke-Free Canada 2010). Although some researchers argue that gruesome pictorial warnings on packages denigrate and shame adult consumers, which may reduce warning effectiveness (Wilson et al. 2009), public health messages have long used negative-consequence themes in the form of fear appeals to generate attention and motivate action in attempts to persuade users to change destructive behaviors (e.g., Hornik 2002; Worden and Slater 2004). Moreover, such strong counterpersuasion attempts can be important in overcoming biased and entrenched initial opinions and knowledge about quitting that smokers are likely to hold (Petty and Cacioppo 1986; Slovic 2001). In addition, there is considerable evidence in the literature that suggests a positive linear relationship between message acceptance and fear-arousing conditions (Berkowitz and Cottingham 1960; Janis and Leventhal 1968; Leventhal 1970; Leventhal and Niles 1965; Sutton 1982). In a meta-analysis of more than 100 articles on fear appeals and an evaluation of many different fear appeal conceptualizations, Witte and Allen (2000, p. 601) conclude that “the stronger the fear aroused by a fear appeal, the more persuasive it is.” The findings from this meta-analysis suggest that stronger fear appeals result in greater attitude, intention, and behavior changes.

Witte and Allen (2000) note the importance of examining specific message characteristics that may help explain why some fear appeals work better than others. To maximize the

¹Because a pictorial warning has been included on packages in Canada since 2000, the use of U.S. and Canadian smokers enables us to assess the effect of the pictorial warning variations for consumers who have and have not been exposed to pictures on packaging.

chances for a desired response or protective action (e.g., attitude change, behavioral change), it is important for the fear appeal to affect perceptions of severity and susceptibility (Rogers 1975, 1983) and not to evoke a defensive response to fear. For example, a pictorial warning on a package of cigarettes should make the threat of disease “real” to smokers’ and also make them believe that they are at risk of contracting the disease if they do not cease the (harmful) behavior of smoking. It is also important for fear appeals to communicate that behavioral change will reduce the threat the fear appeal emphasizes (i.e., response efficacy) and to give a person confidence that he or she can successfully implement the behavioral change (i.e., self-efficacy) (Rogers 1975, 1983). Smokers need to feel confident that they can overcome their habit and actually quit smoking and that, by quitting, their risk for disease will be significantly reduced.

Depending on the nature of the fear appeal, one of two competing responses is expected, either fear control or danger control (Leventhal 1970). Danger control is the desired response because it is more likely to lead to changes in attitudes, intentions, and behaviors. Fear control responses (e.g., defensive avoidance, heightened anxiety, reactance, denial) are unlikely to result in behavioral change. Strong fear appeals may generate both danger control and fear control responses, but appeals that are effective at communicating the efficacy of the response and/or that the person is capable of performing the desired response should produce a higher likelihood of behavior change (Rogers and Mewborn 1976; Witte and Allen 2000). Alternatively, if a person feels a high level of threat from a fear appeal but believes that behavioral change will not reduce the threat or that he or she will be unable to change the behavior, the response may be defensive rather than instrumental.

In Witte and Allen’s (2000) meta-analysis, the message characteristic that produced the strongest effects on attitudes and intentions was severity. Although Witte and Allen are unable to determine what specifically accounts for the strong effects of severity, they speculate that it could be due to the “vivid and often gruesome pictures” (pp. 602–603) included as components of more recent manipulations. Consistent with Witte and Allen, we view graphic pictures of health consequences as being closely related to consumer perceptions of severity. Gruesome pictures have the potential to be more novel and attended to more carefully than other features of the message, and this may enhance desired effects. Thus, the focus of our study is to determine whether varying the depiction of graphic warning levels on cigarette packages affects evoked fear and, in turn, whether this increases smokers’ quitting intentions.²

Beyond the classic theoretical explanations of how fear operates (e.g., Leventhal 1970; Rogers 1975) and Witte and Allen’s (2000) meta-analysis, it is important to discuss some specific findings from the fear literature that are relevant to our study. In one of the few studies that test the persuasiveness of low versus high levels of fear appeals, Keller and Block (1996) find that arousal and elaboration are key

moderators to consider. They demonstrate that high-fear appeals are likely to be less effective when consumers elaborate on the problem, which results in defensive tendencies, such as message avoidance. Referencing others in the message and encouraging objective processing of the message may be effective at reducing problem elaboration (and subsequent problem avoidance), rendering the high-fear appeal more effective. In another study, Das, De Wit, and Stroebe (2003) use fear appeals to induce vulnerability. In turn, the vulnerability the fear appeal induced had positive linear effects on attitudes and intentions, even in conditions in which the argument quality was poor and the threat was not severe. Keller (1999) suggests that fear-arousing messages are more effective for those who are already persuaded (versus the “unconverted”). However, Keller tests only a low versus moderate level of fear arousal. In another meta-analysis, Keller and Lehmann (2008) note that most existing studies examining the role of fear in preventive health behaviors do not arouse high levels of fear. Thus, Keller and Lehmann conclude that moderate-fear appeals seem to be more effective than low-fear appeals (across all levels of involvement), but they are unable to test the impact of high-fear appeals in the meta-analysis.

On the basis of our literature review, we predict that smokers’ intentions to quit smoking will increase as the depiction of the pictorial warning becomes more graphic (H_1). Recall that we conceptualize a graphic warning as a stimulus depiction that features a vivid pictorial representation of the consequences of smoking. (A highly graphic level includes extremely vivid or powerful pictures, and a less graphic level is less vivid.) Our conceptualization is largely predicated on the role of fear evoked by the graphic depiction. Thus, drawing from Witte and Allen’s (2000) meta-analysis, we predict that the manipulation of the graphic level of the picture directly affects evoked fear (H_2). In turn, this evoked fear will be positively related to smokers’ intentions to quit smoking, and the level of fear will mediate the effects of the pictorial depiction of the warning on smokers’ intentions (H_3). In summary, this suggests a fear-based route to persuasion, in which the effect of the warning on our primary consequence of interest, intent to quit smoking, is accounted for by the fear evoked through the graphic depiction of the health consequence information. Formally,

H_1 : Stronger graphic pictorial warning depictions have a greater effect on intentions to quit smoking than weaker graphic pictorial depictions. Specifically, (a) stronger graphic warnings result in greater intentions to quit smoking than moderate or weaker graphic warnings, and (b) moderate graphic warnings result in greater intentions to quit smoking than weaker depictions or warnings with no pictures.

H_2 : The use of increasingly graphic pictorial warnings leads to higher levels of evoked fear.

H_3 : Evoked fear mediates the effects of the graphic pictorial warning on smokers’ intentions to quit smoking.

Effects on Warning Message Recall and Package Attitude

Historically, ad and promotion copy test research has used message recall and belief measures (Pechmann and Andrews

²This specific objective for this study does not mean that other key factors (e.g., response efficacy), as we noted previously, are of lesser importance. Although the literature suggests that these other factors indeed matter, they are outside the scope of our study.

2010), as well as attitudinal responses to promotional stimuli (Brown and Stayman 1992; Lutz 1985), to aid in the evaluation of promotion effectiveness. Although more graphic pictures are predicted to have favorable effects on intentions to quit smoking through the level of fear evoked, highly graphic pictures may have a negative impact on copy test variables, such as message recall and package attitude. We expect that smokers will have less favorable evaluations of cigarette packages that contain graphic pictures reminding them of the health consequences of smoking than packages that contain less graphic warnings. Furthermore, we expect that extremely graphic pictures evoking fear will interfere with the processing and comprehension of the stated warning message text (Wyer 1974) and have a negative impact on message recall. For these graphic warnings, we also predict that fear is more strongly related to intentions to quit smoking than either message recall or attitude toward the promotion stimulus (i.e., the package). This also suggests a stronger mediating role of fear in affecting intentions. In summary, this conceptualization suggests that the impact of increasingly graphic pictures is due to more of a fear-based route to persuasion than a route that is related to message recall or promotional attitude.

H₄: More graphic pictorial warnings result in (a) less accurate recall of the stated warning message on the package and (b) more negative attitudes toward the package than less graphic warnings.

H₅: The relationship between evoked fear and intentions to quit smoking is stronger than the relationships between warning message recall or package attitude and intentions to quit smoking. This indicates reduced (or no) meditational effects of message recall or package attitude on intentions to quit, relative to the mediating role of evoked fear.

Pretests, Procedure, and Method

Pretests 1 and 2: Picture and Message Stimuli

We conducted two initial pretests to test pictorial and message stimuli to be used in the main study. The primary purpose of these pretests was to determine three pictures to be used, which varied in the strength of the graphic depiction of the focal health consequence. After examining many graphic pictures used on cigarette packages around the world (see Physicians for a Smoke-Free Canada 2010), we chose oral diseases related to smoking as the health consequence. Unlike many diseases related to smoking, oral effects are externally visible to others (unlike lung cancer or heart disease), and this makes them appropriate for use in tests of graphic pictures related to fear. Pictures of smoking-related mouth diseases are popular in many countries and have been described as one of the “most recognizable and effective package warnings developed to date” (Hammond 2009, p. 58).

In an initial pilot study, 63 undergraduate student smokers and nonsmokers at a major eastern university in the United States were shown nine pictures and three verbal warning statements related to the consequences of smoking that affect the mouth. The pictures and verbal warnings used were available online and were taken from warnings on cigarette packages from various countries around the

world (e.g., Australia, European Union). The goal of this initial pilot was to narrow down the pictures to a set that varied in graphic depiction and to ensure that the verbal message was consistent with each picture. We counterbalanced the order of pictures and warnings shown to participants. On the basis of the results of this initial pilot, we selected three pictures that appeared to differ in their graphic levels, and we then performed a second pilot study with 72 undergraduate students to confirm this empirically. Each participant rated our three package stimuli on the perceived graphic level of the picture (endpoints of “not graphic at all/very graphic,” “not vivid at all/extremely vivid,” “very weak/very powerful,” and “not intense at all/very intense”) using seven-point scales ($\alpha = .87$). The results show that participants perceived the “highly graphic” picture as the most graphic ($M = 6.29$) and significantly more graphic than the “moderately graphic” picture ($M = 5.14$; $F = 43.0$, $p < .01$). Likewise, participants perceived the “less graphic” picture ($M = 2.70$) as significantly less graphic than the moderately graphic picture ($F = 151.0$, $p < .01$). In addition, participants perceived the verbal warning selected from the initial pilot tests (i.e., “WARNING: Smoking Causes Mouth Diseases”) as consistent with pictures related to consequences of smoking that affect the mouth ($M = 5.84$ on a seven-point scale).

Main Study Design and Participants

To test our predictions, professionally designed, four-color mock cigarette packages were created. The study was a 4 (pictorial warning) \times 3 (time spent viewing the package) \times 2 (country of residence) between-subjects design. The pictorial warning conditions included no picture (the control) and, based on the pilot results, three pictures (less, moderately, and highly graphic) that varied in the graphic level of the depiction of the health consequence evoked by the picture. (The package stimuli used in this study appear in the Appendix.) We presented the warning information on the front panel of the cigarette package, and it covered approximately 40% of the package, consistent with levels required by the FTC. All conditions included the single verbal warning “WARNING: Smoking Causes Mouth Diseases.” We designed the stimuli and data collection to be similar to standard ad copy test procedures that use forced exposure to stimuli of interest but include control groups not exposed to certain conditions or messages to examine differences in potential effectiveness (e.g., Andrews and Maronick 1995; Maronick 1991; Pechmann and Andrews 2010).

We manipulated the time participants spent viewing the package stimuli by (1) limiting participants to no more than 5 seconds viewing the package, (2) forcing participants to view the package for 30 seconds, or (3) allowing participants to view the package for as long as they wanted (the mean time spent viewing the package stimuli in the “free” condition was 17.2 seconds). We included the time factor to determine whether a longer time viewing the package would affect the findings. All package information other than the text and pictorial warnings (e.g., the number of cigarettes in the package, brand information) was invariant across conditions.

The main study sample consisted of 511 adult smokers who were members of a Web-based research panel. Participants used the Internet to access and then complete all stimuli and measures. Study participants answered questions pertaining to their “opinions regarding the package of cigarettes.” Participants then saw one of four versions of a cigarette package mock-up. All the mock-ups had text warnings. One had only the text warning (no picture), and the other three had the text warning plus a picture. The dependent measures and manipulation check items (which we describe subsequently) followed. The mean age of participants was approximately 48 years (ranging from 19 to 79). Half the participants lived in Canada, and the other half resided in the United States. All participants were current smokers, and 80% smoked on all days of the prior month (20% had not smoked on all days, but they had smoked on some days and had smoked more than 100 cigarettes in their lifetime).³

Measures

Primary outcome variables included fear evoked by the package, intentions to quit smoking, package attitude, and message recall. Drawing from a review of prior literature (e.g., Passyn and Sujan 2006; Potter et al. 2006; Tanner, Hunt, and Eppright 1991), we measured evoked fear by asking participants to indicate how the cigarette package made them feel; we used three seven-point scale items (“not fearful at all/fearful,” “not anxious at all/very anxious,” and “not nervous at all/very nervous”). Coefficient alpha (.98) for this multi-item scale was acceptable. This short, summated scale is similar to that used in many prior studies (e.g., Block and Keller 1997; Keller and Block 1996). Adopting specific items from policy-related research involving the presentation of package stimuli information (Kees et al. 2006; Keller and Block 1997; Kozup, Creyer, and Burton 2003), we asked study participants to respond, on a seven-point scale, to two statements that measured their intentions to quit: “The information presented on the cigarette package would help me quit smoking,” and “The information presented on the cigarette package motivates me to quit smoking” (“strongly disagree/strongly agree”). The correlation between these two items was .93. Package attitude, defined as a predisposition to respond favorably or unfavorably to a package stimulus, is a concept that is similar to attitude toward the ad, but it is more appropriate when the promotional stimulus is a package rather than an advertisement. Similar to measures used for attitude toward the ad (Lutz 1985; Shimp 1981), we measured package attitude by asking participants to report their attitudes toward the specific package of cigarettes shown in the study using endpoints of “unfavorable/favorable,” “negative/positive,” and “bad/good” ($\alpha = .95$).

We also were interested in participants’ level of recall of the specific verbal warning on the cigarette package. (Note that the verbal warning remained the same across all conditions.) Toward the end of the survey, we asked participants to “please think about the cigarette package you saw at the

beginning of the study. Try to recall what the warning information on the package stated and type it in the box below.” Participants saw the package stimuli only once, at the beginning of the study, and this recall question referred only to the specific stated warning message. Participant responses were coded as “accurate” if there was correct warning message recall of a smoking problem related to the lips, gums, or teeth (i.e., areas associated with the mouth). Responses were coded as “inaccurate” if comments referred to a smoking-related disease not associated with the mouth (e.g., lung cancer, heart disease), a guess that involved a response not related to the mouth or any specific disease associated with the verbal warning, or a “don’t know” or “do not remember” response. The proportional reduction in loss intercoder reliability of .95 was acceptable (Rust and Cooil 1994). An expert coder familiar with the research resolved the few differences between the initial two coders.

The manipulation check for the pictures used in the package stimuli measured participants’ perceptions of the level of the graphic depiction of the warning information. As in the pilot study, this check consisted of four seven-point scale items (endpoints of “not graphic at all/very graphic,” “not vivid at all/extremely vivid,” “very weak/very powerful,” and “not intense at all/very intense”; $\alpha = .95$). We also collected measures for several additional constructs as confounding checks (e.g., credibility of the warning information, perceived attention to the package) (Perdue and Summers 1986). We collected a three-item measure of attitude toward the specific brand used in the package stimuli for potential use as a covariate (coefficient $\alpha = .97$). (We used the Camel brand of cigarettes to increase the realism of the study.)

Results

Manipulation and Confound Checks for the Pictorial Warnings

We performed analyses of variance with the manipulation check and confounding checks serving as dependent variables to ensure that the pictorial warning independent variable operated as intended. The pictorial warning used affected the perceived level of the graphic depiction of the package stimuli ($F(3, 508) = 48.17, p < .001$), with all means in the appropriate direction. Contrasts indicate that the less graphic picture ($M = 4.78$; range from 1 to 7) was significantly below the moderately graphic ($M = 5.67$; range from 1.75 to 7) and highly graphic ($M = 6.29$; range from 2 to 7) depictions of the warning (for all contrasts, $p < .01$). The moderate condition also differed significantly from the highly graphic condition ($p < .01$). In addition, the depiction of the warning information for each stimulus containing a picture differed from the (no-picture) control condition ($M = 4.15, p < .001$).

We also addressed additional effects of the pictorial warning manipulation to ensure that it did not affect other processing constructs that it was not intended to affect (Perdue and Summers 1986). Effects of the pictorial warning on information credibility, involvement, attention to the package stimulus, and brand attitude, as well as several other emotions (guilt, anger, sadness, shame, remorse, upset, and

³Additional analyses indicated that the results were not affected by either the participants’ age or number of cigarettes smoked per day.

disgust), were all nonsignificant. This pattern of findings for the manipulation and confound checks provides support for the pictorial warning manipulations used in the main study.

Initial Analyses

We examined effects of the pictorial warning, country of residence, and time factors with a multivariate analysis of covariance, with follow-up univariate tests and planned comparisons. We included the time factor to determine whether a longer or shorter time viewing the package would affect the findings, but there were no main or interaction effects for time, and so we dropped this factor from subsequent analyses. In these subsequent analyses, we included attitude toward the brand used in the package stimuli as a covariate.⁴ Multivariate and univariate findings appear in Table 1. Mean values and standard deviations appear in Table 2.

⁴Pretest findings indicated that the Camel brand was perceived as neutral and that a specific brand shown should have minimal effect on the specific dependent variables of primary interest, namely, intentions to quit smoking, message recall, and fear evoked by a package. However, attitude toward the brand was partitioned out before we examined the effects of the pictorial warning treatments. This measure was significantly correlated with package attitude ($r = .33$) and fear ($r = .08$) and had significant analysis of covariance effects on these variables ($p < .05$ or better). Analyses excluding the brand attitude covariate did not affect the graphic pictorial warning effect on any of the dependent variables.

Effects of the Pictorial Warning

H_1 predicts that increasing the graphic depiction of the pictorial warnings will result in stronger intentions to quit smoking. Our findings indicate that the pictorial warning manipulation had a significant, positive effect on smokers' intentions to quit smoking ($F(3, 496) = 12.24, p < .001$). The results of modified Bonferroni contrasts (Keppel 1991) indicated by the a priori predictions in H_1 showed that the highly graphic condition ($M = 4.13$) resulted in a significant increase in intentions to quit compared with the moderately and less graphic conditions ($M_s = 3.72$ and 3.07 ; $F_s(1, 496) = 3.70$ and 22.79 , all $p < .05$ or better). In addition, the moderate graphic level ($M = 3.72$) resulted in stronger intentions to quit than the low level or the no-picture control ($M_s = 3.07$ and 2.85 ; $F_s(1, 496) = 7.99$ and 14.31 , all $p < .05$). These contrasts offer support for the predictions in H_{1a} and H_{1b} . The less graphic picture was not any more effective at strengthening smokers' intentions to quit than the no-picture control ($p > .20$). Note that none of the interactions involving country and the visual warning approached statistical significance ($p > .20$).

Tests of the Mediating Role of Evoked Fear

A primary goal of this study was to examine a potential underlying mechanism that might account for the pictorial warning effects. Thus, we first tested evoked fear as a potential mediator of the effects of the manipulation of the

Table 1. Multivariate and Univariate Results

Independent Variables	MANCOVA Results ^a		Univariate Results		
	Wilks' λ	F-Value	Intentions to Quit	Evoked Fear	Attitude Toward the Package
Main Effects					
Pictorial warning (PW)	.82	11.08**	12.24**	22.26**	13.80**
Country (C)	.94	11.26**	29.09**	20.28**	3.44*
Interaction Effects					
PW \times C	.99	.71	.25	.63	1.39

* $p < .05$.

** $p < .001$.

^aTo account for attitudes toward the specific brand of cigarettes used in the stimulus, we included this variable as a covariate in the analysis. Brand attitude had a significant effect on fear and package attitude variables ($p < .05$ or less) but did not have a significant effect on intentions of quitting.

Notes: MANCOVA = multivariate analysis of covariance.

Table 2. Means (Standard Deviations) for the Pictorial Warning Levels

Dependent Variables	Pictorial Warning			
	Control (a)	Low Graphic Level (b)	Moderate Graphic Level (c)	High Graphic Level (d)
Quit intentions	2.85 (1.98) ^{c, d}	3.07 (1.92) ^{c, d}	3.72 (1.91) ^{a, b, d}	4.13 (1.97) ^{a, b, c}
Evoked fear	2.60 (1.96) ^{b, c, d}	3.21 (1.86) ^{a, c, d}	3.91 (2.02) ^{a, b, d}	4.45 (1.93) ^{a, b, c}
Package attitude	3.51 (1.74) ^{b, c, d}	2.88 (1.77) ^{a, c, d}	2.35 (1.60) ^{a, b}	2.32 (1.65) ^{a, b}

Notes: Superscripts adjacent to the means in the table indicate significant differences ($p < .05$ or better) according to contrasts based on predictions. For example, the superscript for the "a" cell (pictorial warning control) indicates that the evoked fear mean is significantly different from the mean for the cells labeled "b," "c," and "d."

graphic level of the picture on intentions to quit. Following Baron and Kenny (1986), and in a first step to examine these effects, we performed an analysis to test the effect of the pictorial warning conditions on the proposed mediator of fear. As Table 1 shows, the pictorial warning factor had a significant effect on the proposed mediator of evoked fear ($F(3, 496) = 22.26, p < .01$). As Table 2 shows, smokers reported higher levels of evoked fear as the depiction of the smoking consequences became more graphic. These findings support H_2 and the requirement for mediation that the independent variable significantly affects the proposed mediator, evoked fear (Baron and Kenny 1986).

A second requirement for mediation is that the mediator must be significantly related to the dependent variable. As we show in Figure 1, there is a significant relationship ($\beta = .73, p < .001$) between evoked fear and intentions to quit.

Finally, we assessed the effect of the pictorial warning on intentions to quit, both when evoked fear is and is not included in the model. In the regression model that tests the effect of the graphic depiction as a single independent variable on intentions to quit, there is a significant effect ($\beta = .27, t = 6.35, p < .01$). However, after the addition of the proposed mediator of fear into the regression equation, the coefficient for the pictorial warning was reduced to .01, a level that was no longer significant ($p = .69$). Furthermore, the Sobel test supports the mediation prediction ($t = -6.79, p < .01$). This pattern of results indicates that the measure of evoked fear fully mediates the effect of the pictorial warning on smokers' intentions to quit smoking (Baron and Kenny 1986). Relevant findings from the regression analyses testing the potential mediating role of fear on intentions to quit appear in Figure 1.

Effects Related to Recall of the Message Statement and Package Attitude

H_{4a} predicts that the use of more graphic pictorial warnings will result in less accurate recall of the stated warning message on the package than the less graphic warnings. We performed a logistic regression and found a significant association ($\beta = -.22; \chi^2 = 6.63, d.f. = 1, p < .01$) between the pictorial warning and accurate message recall. As a follow-up analysis, we conducted a cross-tabulation ($\chi^2 = 12.6, d.f. = 3, p < .01$) consisting of the four levels of the pictorial warning depiction and warning message recall. In

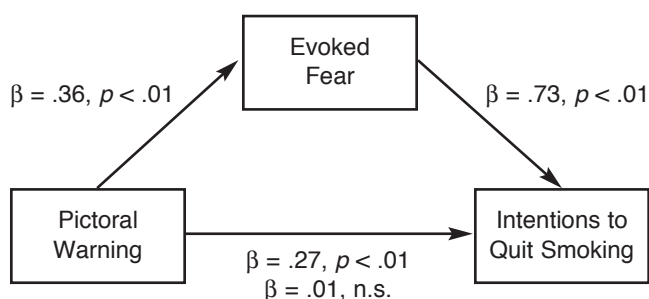
the no-picture control and in the less graphic condition, 70% and 78% of the participants, respectively, identified the message statement accurately. In the moderately graphic and highly graphic conditions, 61% and 60%, respectively, correctly identified the message statement. The pattern of these findings offers support for H_{4a} , and they indicate a less favorable consequence of more graphic pictorial warnings for classic copy test measures, such as message recall. H_{4b} predicts a negative effect of the pictorial warning on attitude toward the package. As Table 1 shows, the presence of the pictorial warning had a negative effect on smokers' attitudes toward the cigarette package ($F(3, 496) = 13.80, p < .001$).

H_5 focuses on the roles of warning message recall and package attitude as possible mediators of effects on intentions. As such, we were particularly interested in the strength of their roles relative to evoked fear (i.e., full mediation demonstrated previously and in Figure 1). As an initial analysis, we examined the pattern of correlations among evoked fear, warning message recall, and package attitude with intention to quit smoking. In this analysis, the respective correlations with intention to quit were $-.06$ ($p < .10$) for package attitude, $-.04$ (not significant, $p > .10$) for warning recall, and $.73$ ($p < .001$) for fear. Tests of differences in these correlation coefficients indicated that the coefficient for evoked fear was significantly greater than the coefficients for either recall or package attitude (z -values = 14.1 and 13.7; $p < .001$). These findings offer partial support for H_5 .

To test directly for potential mediation for warning message recall and attitude, we again used Baron and Kenny's (1986) recommended procedures. As we indicated previously and as we show in Figure 2, the effect of warning message recall on intentions is not significant, suggesting that recall is not a mediator. Similarly, package attitude is not significantly related to intentions ($\beta = -.06, p > .05$). In addition, when either recall or attitude toward the package is added to the model containing only the pictorial warning variable, the coefficient for the relationship between the pictorial warning and intention to quit remains significant and is not reduced.

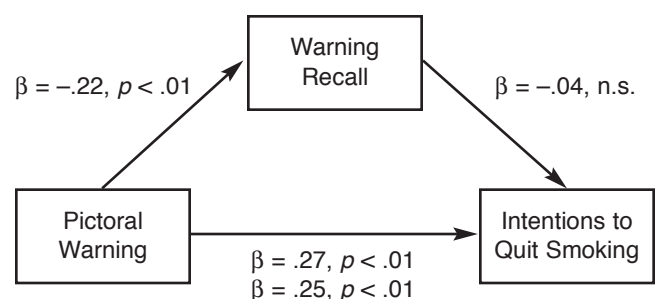
In summary, the results show that neither message recall nor package attitude mediated the effects of the pictorial warning on quit intentions. These findings further reinforce the impor-

Figure 1. Tests for the Mediating Role of Evoked Fear



Notes: n.s. = not significant.

Figure 2. Test of Warning Message Recall as a Possible Mediator



Notes: n.s. = not significant.

tance of the role of fear (which fully mediated the effect of the pictorial warning manipulation) relative to message recall or attitudes in influencing smokers' intentions to quit.

Effects Related to Smokers' Country of Residence

There were significant multivariate and univariate effects of country on evoked fear ($F(1, 496) = 20.28, p < .01$), attitude toward the package ($F(1, 496) = 3.44, p < .05$), and intention to quit ($F(1, 496) = 29.09, p < .01$). The pattern of results shows that smokers in the United States reported higher levels of evoked fear, more negative package attitudes, and stronger intentions to quit smoking, perhaps suggesting that Canadian smokers were less "shocked" by the more graphic pictures. The lower means on both evoked fear and intentions to quit for Canadian participants may be related to their prior exposure to graphic pictures on packages, and further research appears warranted. However, as we noted previously, the results did not show any interactions between the pictorial warning manipulation and country, suggesting that the manipulation of the graphic level of the pictorial warning operates similarly for smokers who have and have not been exposed to pictorial warnings on cigarette packages. This nonsignificant interaction seems to suggest that strengthening the graphic depiction level of the warnings would have similar effects in countries that do and do not currently use pictorial warnings.

General Discussion

With the passage of the Family Smoking Prevention and Tobacco Control Act, U.S. smokers will soon be exposed to pictorial tobacco warnings on cigarette packages for the first time. Currently, it is not known which specific types of pictorial warnings will be employed on packages in the United States. Given the passage of this key U.S. tobacco legislation, the effects related to varying graphic pictorial warning depictions are a timely and critical issue that has emerged for public health and policy officials in the United States.

Within the context of our experimental study, the findings show that more graphic depictions of health consequences had increasingly stronger effects on evoked fear and intentions to quit smoking. Thus, for these variables, and our adult smoker sample, there was evidence for the increasing monotonic effect of strengthening the graphic depiction of the pictorial warning (Witte and Allen 2000). These findings were consistent across variations in the amount of time participants were exposed to the package stimulus, indicating that even a relatively limited exposure to the package may be sufficient to obtain favorable effects (Scott and Solomon 1998). However, we found that recall of the associated warning message statement was reduced by moderately or highly graphic pictorial warnings versus controls or less graphic pictorial warnings. However, it is worth noting that recall of the stated warning is likely to be influenced by multiple exposures to the warnings. For example, the graphic pictorial warnings may affect recall initially because smokers are more "shocked" by the warnings, but the stated message may be better remembered over time. Further research in this area is warranted.

In addition, evoked fear was a mediator of the effect of the graphic pictorial warnings on intentions to quit smoking,

which suggests that the fear evoked by the more graphic depictions is a mechanism that underlies the effects of the pictorial warning on intentions to quit. In contrast to this mediating role of fear, neither warning message recall nor attitude toward the package was a significant mediator of the effect of the pictorial warning depiction on intentions.

Given that standard package and ad copy tests conducted by federal agencies have often relied on recall, belief, and attitude measures (e.g., Andrews and Maronick 1995; Maronick 1991; Pechmann and Andrews 2010), there are potential implications of less accurate message recall in the context of exposure to strong graphic pictorial warnings. For example, an important issue in the case of the FDA (1999) communication testing (now with governance over U.S. tobacco promotion) is the consumer's recall of the major risks (and benefits) associated with using the product and that the communication is "not false or misleading in any respect." However, within our specific experimental context, we show that strong (negative) graphic imagery, and the fear evoked from such graphic imagery, can influence smokers' intentions to quit in the absence of message recall effects. Although there may be some differences in context between our study focus and conventional FDA tests, our findings suggest some reconsideration of how package and ad copy tests are conducted when considering effects of exposure to very strong pictorial imagery.

Although the conclusions drawn from our findings should be considered in the context of the controlled experimental design, specific conditions and stimuli, and dependent measures, the implications of these particular findings are clear. As public health officials and policy makers in the United States and around the world consider potential changes to warnings on cigarette packages, the addition of pictorial warnings to text-based messages seems beneficial, and more graphic depictions of the pictorial warnings seem capable of producing stronger effects for adult smokers than less graphic depictions. These data show that at least moderately graphic pictures should be used, and for these specific data and measures, there seems to be little downside from using extremely graphic pictorial depictions of the negative health outcomes from smoking. Conversely, the least graphic pictures had no additional effect on intentions to quit beyond those of the no-picture control group, indicating that the inclusion of *any* pictorial warning on a package is not necessarily beneficial.

Potential Moderators

Although Witte and Allen (2000) note in their meta-analysis of more than 100 fear-related studies that all the defined message features in fear appeals produce positive results, they do call for additional research to understand moderating variables that explain why some fear appeals may be more effective than others. According to the specific pattern of our results, we believe our study provides valuable implications for health policy. However, it is important for public health officials to consider possible message and personal characteristics that moderate the graphic pictorial warning effects found here to understand more fully how these warnings may operate for various target segments. We subsequently discuss some of these variables.

The strength of effects of highly graphic warnings can be potentially influenced by the message recipient's level of involvement or elaboration. Some findings in the fear literature suggest that high levels of message involvement and/or elaboration can detract from the effectiveness of highly graphic warnings and that referencing others in the message and encouraging objective processing of the message can reduce problem elaboration (and subsequent problem avoidance), rendering the high-fear appeal more effective (Keller and Block 1996). Although it should be noted that time viewing the package had no effect on the dependent variables, this time variable is not viewed as being the same as a direct manipulation of elaboration or involvement. Thus, future studies should address potential moderators, such as extended elaboration or involvement (Sengupta and Johar 2001), efficacy (Rogers and Mewborn 1976), and vulnerability (Das, De Wit, and Stroebe 2003).

The literature shows that the use of graphic warnings may depend in part on the consequences conveyed by the warning. Two popular themes for antismoking messages are health consequences and social consequences. Some research suggests that warnings emphasizing social consequences can be more effective because they are more salient among younger populations (Smith and Stutts 2003). Similarly, the type of fear appeal used (i.e., specific message characteristics) is another important consideration.

Although our study showed a pattern of results consistent across all age groups examined, further research should determine whether highly graphic warnings are as effective for younger segments of interest (e.g., adolescents). Similarly, public health decision makers need to be aware that graphic warnings may not operate equivalently for all segments of interest. There are several examples from the warning literature in which warning messages are argued to produce effects opposite those intended (i.e., "boomerang" effects; for reviews, see Ringold 2002; Stewart and Martin 1994). Given this, there are relevant theories and prior research that may be useful in helping public health officials identify possible boundary conditions for graphic warning label effectiveness.

Limitations and Further Research

In addition to the possible boundary conditions we discussed, there are several other potential limitations to the generalizability of findings of this between-subjects experiment. Although pictorial warnings related to mouth diseases are used in many countries throughout the world and are an externally visible health consequence affecting a person's appearance, we examine only this one type of health-related warning. Further research should examine other types of messages related to other health consequences of smoking.

In addition, although it is difficult to target specific markets with cigarette package warnings distributed to a broad consumer market, further research could examine what types of pictorial warnings work best for specific segments (e.g., young nonsmokers, adolescent smokers, social smokers versus older heavy smokers) to enhance the generalizability of our findings (e.g., Andrews et al. 2004; Mason and Wiener 2009). Given the negative effect of the highly graphic warnings on package attitude, it would be worthwhile to examine whether certain segments of smokers use

cigarette package containers or cases to prevent exposure to the pictures, and further research on this possibility is warranted. Because the salience of our manipulations was high, some participants' responses may have been affected. Possible ways to attempt to remedy this issue include emphasizing the need for "frank and open opinions" and asking participants to answer questions according to what they think the "typical smoker" would do. Our measure of recall focused on asking respondents to specifically recall what the warning message stated (versus a more open/probing question). Further research using interviewers who could probe for details and clarification from respondents would help augment our findings.

Future longitudinal studies should attempt to uncover whether the change in intentions to quit reported in this study is an actual reflection of intentions and leads to quitting behavior. Although experiments such as ours rarely find committed smokers reporting "strong" intentions to quit, we acknowledge that the mean for the reported intentions-to-quit measure for the highly graphic pictorial warning only reached moderate levels (i.e., 4.13 on a seven-point scale). Yet this level was significantly different from the other conditions (i.e., moderate, low, and no-picture control) and for a population (i.e., smokers) likely to hold initial negative views toward antismoking initiatives (Petty and Cacioppo 1986; Slovic 2001). We also recognize that getting smokers to quit is extremely difficult and complex, in part because of the addictive nature of nicotine. As we mentioned previously, warning labels are only one part of the integrated campaign necessary to encourage behavioral change. The role of repetitive exposure to warning labels in helping smokers overcome their habit is one promising area for further research.

We hope that our findings trigger future research efforts on a variety of related topics. For example, although we examined differences between prior exposure to pictorial warnings by using both U.S. and Canadian smokers, more controlled studies involving warning message repetition and delays are warranted. In addition, the vast and rich literature on risk in behavioral decision making (e.g., Eggers and Fischhoff 2004; Fischhoff et al. 1998; Slovic 2001), warning format and display presentation (e.g., Bettman, Payne, and Staelin 1986; Sanfey and Hastie 1998), and the impact of perceived behavioral control, as it relates to effects of tobacco-related warnings and cessation (Norman, Conner, and Bell 1999), offers diverse bases for additional research. Studies examining other potential moderating factors (e.g., providing a solution, personal vulnerability, defensive response mechanisms, response efficacy, resource allocation) on fear and graphic pictorial warning effectiveness offer potential opportunities for researchers (Block and Keller 1997; Rogers and Mewborn 1976; Tanner, Hunt, and Eppright 1991).

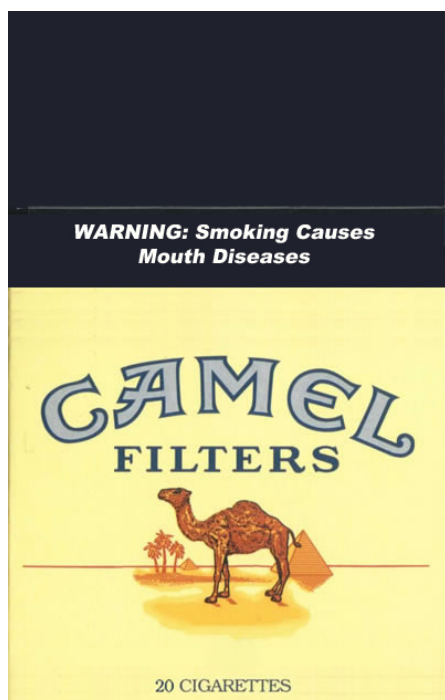
Regulations requiring use of color graphics depicting the negative health consequences of smoking on packages are forthcoming in June 2011. These changes in packaging and promotion, as carried out by the FDA under the oversight of the Department of Health and Human Services, will offer an unprecedented opportunity to improve on the effectiveness of how these persuasive messages are communicated. Although experiments, such as the one used in this study, offer one means to build a large stream of research examin-

ing various warning combinations, changes made in the United States and elsewhere will offer unique opportunities for a series of quasi-experimental, longitudinal field studies to examine effects on consumer behavior. We hope that the U.S. Family Smoking Prevention and Tobacco Control Act

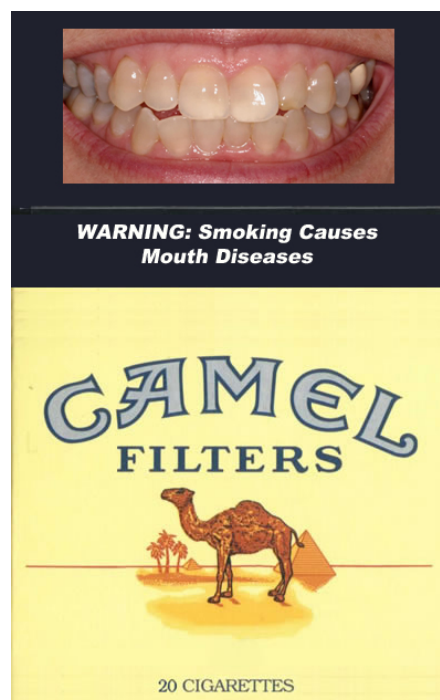
and the FCTC will continue to motivate further research efforts on how to best communicate health risks in advertising, packaging, and other marketing communications that will benefit not only people today but future generations on a global scale.

Appendix: Examples of Package Stimuli Used

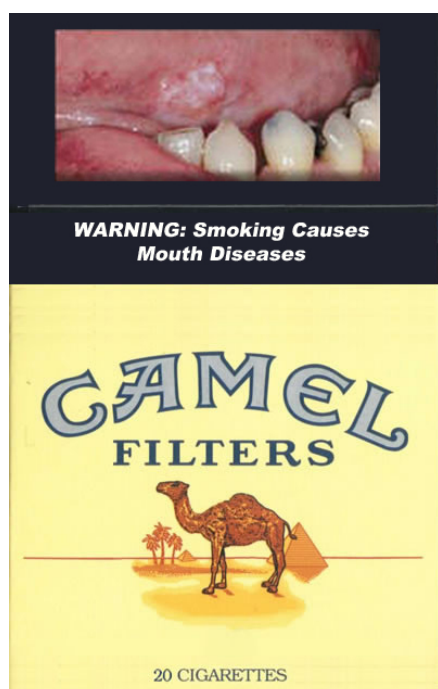
Control (No Visual) Condition



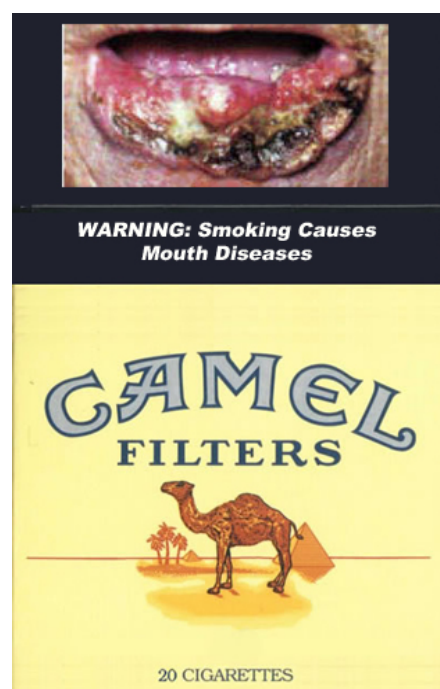
Less Graphic Condition



Moderately Graphic Condition



Highly Graphic Condition



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