December 2010

Experimental Study of Graphic Cigarette Warning Labels

Final Results Report

Contract No. HHSF-223-2009-10135G
Task Order 7

Prepared for

Center for Tobacco Products
Food and Drug Administration
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Rockville, MD 20850

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1. INTRODUCTION

1.1 Background and Purpose of Report

On June 22, 2009, the President signed the Family Smoking Prevention and Tobacco Control Act (Tobacco Control Act) (Public Law 111-31) into law, granting the Food and Drug Administration (FDA) new authority to regulate the manufacture, marketing, and distribution of tobacco products to protect the public health generally and to reduce tobacco use by minors. The Tobacco Control Act requires nine new health warning statements on cigarette packages and in cigarette advertisements:

- WARNING: Cigarettes are addictive.
- WARNING: Tobacco smoke can harm your children.
- WARNING: Cigarettes cause fatal lung disease.
- WARNING: Cigarettes cause cancer.
- WARNING: Cigarettes cause strokes and heart disease.
- WARNING: Smoking during pregnancy can harm your baby.
- WARNING: Smoking can kill you.
- WARNING: Tobacco smoke causes fatal lung disease in nonsmokers.
- WARNING: Quitting smoking now greatly reduces serious risks to your health.

The Act also requires FDA to issue "regulations that require color graphics depicting the negative health consequences of smoking to accompany the nine label statements."

The new graphic warning labels required on cigarette packs must cover at least 50% of the front and back of the pack. In addition, the new graphic warning labels required in cigarette advertisements must cover at least 20% of the area of the ad. The Act permits FDA, after notice and an opportunity for the public to comment, to adjust the format, type size, color graphics, and text of any health warning statement if such change would promote greater public understanding of the risks associated with the use of tobacco products. Similarly, FDA may adjust the type size, text, and format of the warning statements as FDA determines appropriate so that both the textual warning statements and the accompanying color graphics are clear, conspicuous, legible, and appear within the specified area.

The objective of this project is to develop graphic images to accompany the nine warning statements and to conduct a series of studies to assess the relative efficacy of the graphic warning labels (i.e., warning statements plus images) at conveying information about various health risks of smoking and at encouraging smoking cessation and discouraging smoking initiation.

This report presents the results from the experimental study. Throughout the report, we use the term "warning statement" to refer to the nine statements above, "image" to refer to the images that accompany the warning statements, and "graphic warning label" to refer to the warning statement plus image. In the remainder of this section, we give an overview of the experimental design. Section 2 briefly outlines the study methods, describing in particular the measures and statistical analyses. Section 3 summarizes the results for each warning statement and warning images for a subset of key outcomes. Conclusions and limitations are discussed in Section 4.

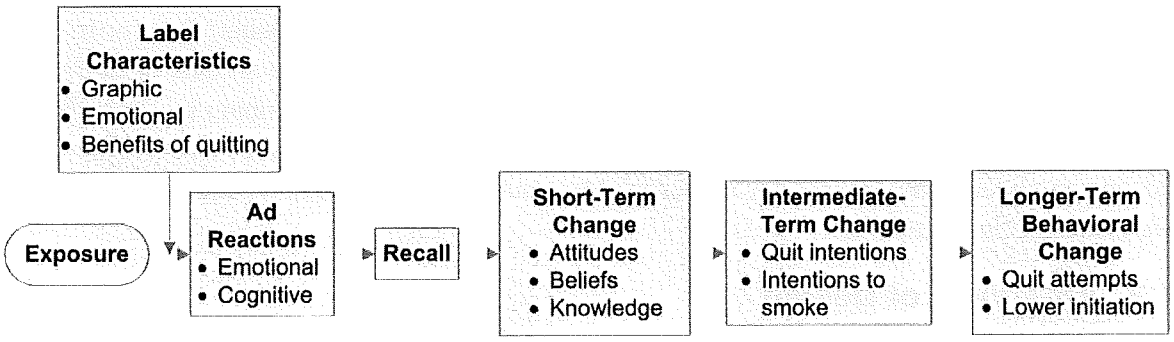
1.2 Overview of Design

Images were designed and created for each of the nine warning statements. The experimental study's purpose was to

- measure consumer attitudes, beliefs, perceptions, and intended behaviors related to cigarette smoking in response to graphic warning labels (i.e., warning statement plus image);
- evaluate the relative efficacy of various graphic images associated with each of the nine warning statements specified in the Tobacco Control Act for achieving each of the communication goals; and
- determine whether consumer responses to graphic warning labels differ across the target groups based on age or other demographic variables.

Figure 1-1 illustrates a simple conceptual model to guide the analyses presented in this report. This conceptual model is consistent with several theories of message processing (e.g., Lang, 2000; Petty & Cacioppo, 1986) and health behavior change (Azjen, 1991; Fishbein & Azjen, 1975). This model illustrates possible short- and long-term responses to the graphic cigarette warning labels, beginning with emotional (e.g., worried, disgusted, hopeful) and cognitive (e.g., informative, worth remembering) responses. Eliciting strong emotional and cognitive reactions to the graphic cigarette warning label enhances recall and processing of the health warning, which helps ensure that the warning is better processed, understood, and remembered. Thus, these responses potentially enhance the effectiveness of the health warning. These immediate responses in turn influence short-term outcomes, such as later recall of the message and changes in knowledge, attitudes, and beliefs related to the dangers of tobacco use and exposure to secondhand smoke. As attitudes and beliefs change, they eventually lead to changes in intentions to quit/start smoking and then later to lower smoking initiation and successful cessation. The time scale on which this behavior change process occurs is largely unknown in the context of the impact of exposure to graphic warning labels on smoking behaviors, but the effects on behavior change are unlikely to be immediate or short-term. In the context of the current experiment, respondents in the treatment conditions are exposed to one graphic warning label once. Consequently, the ability of the experiment to discriminate across warning labels in terms of longer-term outcomes is limited.

Figure 1-1. Illustrative Conceptual Model of Message Processing, Reactions, and Outcomes



The respondent universe for the experimental study is (1) current smokers aged 25 or older, (2) young adult smokers aged 18 to 24, and (3) youth aged 13 to 17 who are current smokers or who may be susceptible to initiation of smoking. Because the new graphic warning labels will be required on all advertisements for cigarettes, we also tested the effect of the labels on adult responses to a cigarette advertisement. The four separate samples were selected from Research Now's e-Rewards online member panel, a national opt-in e-mail list sample.

The experimental study tested two to seven warning images per warning statement with a control group for each warning. The control group viewed a hypothetical pack of cigarettes with no warning image but just the warning statement presented in the style or format of the current standard warning. The treatment groups (exposed to warning images) viewed a hypothetical pack of cigarettes that included the graphic warning label. Each group viewed several different screen shots of the pack and were able to view the images for as long as they wanted. However, once they moved to the next image, they could not go back and view the previous image again. Thus, for each outcome, the experiment tested the relative efficacy of each warning image within a warning statement relative to the control for that warning statement.

After being shown the cigarette package with a graphic warning label (treatment group) or warning statement (control group), respondents answered questions about their reactions to the cigarette package, related attitudes and beliefs, and intentions to quit (young adults and adults) or start smoking (youth). At the end of the survey, subjects were asked to recall which warning statement and image they saw earlier in the survey to assess the accuracy of recall. In addition, 1 week after completing this survey, subjects were re-contacted and asked to recall the warning statement and image to which they were exposed.

The analyses presented below contrast the various outcomes illustrated in Figure 1-1 between each of the treatment groups exposed to an individual graphic warning label and the control group and among the treatment groups to assess the relative efficacy of each graphic warning label.

2. METHODS

In this section, we briefly outline the study methods. The survey instruments used for the study are presented in Appendix A, and additional details about the study methodology, including the coding of specific outcomes for analyses, are provided in Appendix B.

2.1 Measures

2.1.1 Key Outcomes

The following key outcomes were measured post exposure and/or at 1-week follow-up:

- Emotional and cognitive reactions to the warning statements and warning labels (i.e., warning statement plus image)
- Emotional and cognitive reactions to the print ad (adult sample viewing print ad)
- Recall of the nine warning statements
- Recall of the warning images
- Recall of the print ad (adult sample viewing print ad)
- Beliefs about the health risks of smoking and secondhand smoke
- Quit intentions (self-reported likelihood of quitting within the next 30 days)
- Self-reported likelihood of smoking 1 year from now (youth)

2.1.2 Covariates and Controls

We included the following control variables in our regression models: age, gender, race/ethnicity, socioeconomic status (income and education), and quit intentions.

2.1.3 Data Reduction/Scale Creation

As a data reduction strategy, we explored the creation of several possible measurement scales. Our approach was to use factor analysis to see if the items loaded on a single factor and, if so, to assess the alpha reliability of the scaled items. In each case where we created a scale, we found a single eigenvalue greater than 1 (typically a factor is indicated for each eigenvalue over 1). We did not use specific cut-off criteria in terms of factor loadings or alpha reliability; however, for the scales we created, factor loadings for individual items generally were greater than 0.6 and alpha reliabilities generally were greater than 0.7. In particular, we investigated the scaling of survey questions D1 (emotional reactions to the labels), D2 (cognitive reactions to the labels), D3 (beliefs about the risks of smoking), D4 (beliefs about the risks of secondhand smoke exposure), E5 (beliefs about the risks of smoking and exposure to secondhand smoke), and E6 (attitudes about smoking; only asked of youth and young adults). Based on the results from the factor analyses (conducted by warning statement), we were able to scale D1 (emotional reaction scale), D2 (cognitive

reaction scale), D3 (belief scale: health risks of smoking to smoker), and D4 (belief scale: health risks of secondhand smoke exposure to nonsmokers). The items from E5 and E6 did not scale. See Appendix B for additional information on scale creation.

2.2 Regression Analyses

We assessed the relative efficacy of the warning images using regression analyses. Regressions for each outcome were estimate separately for each warning statement.

The regression models were of the following general form:

$$\text{outcome} = f(I_i, \text{age, gender, race/ethnicity, education, income, Internet connection, plans to quit}),$$

where I_i are indicators for treatment conditions (exposure to warning images) with control group as the referent category. Thus, we are interested in the parameter estimates or beta coefficients on the image exposure indicators because these estimates represent the effect of exposure to the image compared with the effect of the exposure the controls received. The number of treatment indicators ranges from 2 to 7.

We used logistic regression for dichotomous outcomes. Ordinal outcomes were dichotomized collapsing the top two categories (e.g., agree and strongly agree). For scaled outcomes, we used ordinary least squares regression. Note that when we estimate the regression with the indicator for correct recall of the warning image, we exclude the control group respondents (because they did not view an image) and specify one of the treatment groups (warning images) as the referent category (image). Because there was no variation in the Internet connection measure, we dropped it as a control. Also note that the measures of plans to quit, education, and income were not included in the models for the youth sample: plans to quit was not included in the models for the youth sample because the measure is not meaningful for youth susceptible to smoking but not yet smoking and less salient for youth who are relatively new smokers; education was not included for youth because grade is similar to age; and income was not included because it is difficult to get valid and reliable estimates of income from youth.

In linear or ordinary least squares regression, when the outcome is continuous, the estimates of interest are the beta coefficients on each warning image indicator variable. A higher value on this coefficient indicates that exposure to the warning image is associated with a greater value on the outcome variable (e.g., a higher score on the emotional reaction scale) compared to the value of the outcome for control participants.

When using logistic regression for dichotomous outcomes, we converted the coefficient obtained from the regression for each warning image indicator into an odds ratio (OR). An OR greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR

less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

In this report, we summarize the results from the regression analyses, focusing on a set of key outcomes. Descriptive statistics and a comprehensive set of regression results are provided in Appendix C.

3. RESULTS

In this section, we present results from the experimental study described in Section 1.2. Only statistically significant results ($p < 0.05$) are discussed.

3.1 Sociodemographic Description of the Samples

Table 3-1 summarizes the sociodemographic characteristics of the four samples: adult (pack), adult (ad), young adult, and youth. All four sample sizes were over 4,500, ranging from 4,584 young adults to 4,890 adults in the pack study. The average age of adults was 43.5 and 44.7 years in the pack and ad studies, respectively. The average age was 21.6 years for young adults and 15.7 years for youth. Gender distribution was roughly even for all samples—the adult ad study was the most unbalanced at 56.1% female. White was the predominant race in all four study samples, ranging from 65.2% for young adults to 82.4% for adults in the ad study. The distribution of education levels varied across the four samples, with expected differences considering the age ranges of each study. Income differences between the adult and young adult samples were again expected given age differences. Youth were not asked about their household income. Additional details about the samples are provided in Appendix B.

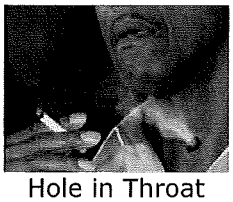
Table 3-1. Summary of the Sociodemographic Characteristics of the Four Samples

Characteristic	Adult Pack	Young Adult	Youth	Adult Ad
N	4,890	4,584	4,600	4,685
Age (average)	43.5	21.6	15.7	44.7
Gender				
Male	49.4%	53.8%	52.7%	43.9%
Female	50.6%	46.2%	47.3%	56.1%
Race/Ethnicity				
White	77.9%	65.2%	68.7%	82.4%
Black	6.5%	2.8%	5.4%	4.3%
Hispanic	9.3%	17.1%	14.1%	6.4%
Other	6.4%	14.9%	11.9%	6.9%
Education Level				
Elementary or middle school	0.2%	0.2%	10.3%	0.4%
High school	0.9%	0.8%	86.9%	1.1%
High school graduate	13.0%	11.9%	2.8%	12.8%
Some college	32.4%	56.3%	—	34.0%
College graduate or more	53.4%	30.8%	—	51.6%
Income				
Less than $25,000	11.2%	32.4%	—	8.9%
Between $25,000 and $49,999	24.9%	32.4%	—	26.1%
Between $50,000 and $74,999	27.2%	17.5%	—	26.6%
More than $75,000	36.7%	17.7%	—	38.5%

3.2 Warning Statement 1: Cigarettes are Addictive

Cigarette Injection

Red Puppet


Hole in Throat

Woman in Rain

3.2.1 Emotional and Cognitive Reactions

Cigarette Injection, Red Puppet, and Hole in Throat consistently elicited higher scores on the emotional reaction scale (e.g., disgusted, worried) from adults, young adults, and youth compared with the control group who did not view the images (see Table 3-2, presented at the end of this section). Woman in Rain elicited higher scores on this scale from adults and young adults compared with controls.

Similarly, Cigarette Injection, Red Puppet, and Hole in Throat elicited higher scores on the cognitive reaction scale (e.g., informative, worth remembering) from adults, young adults, and youth compared with controls. Woman in Rain elicited a higher score on this scale only from youth.

Cigarette Injection, Hole in Throat, and Woman in Rain elicited a stronger response (i.e., higher odds of agreeing that the pack was difficult to look at) from adults and young adults compared with controls. Among youth, only Hole in Throat evoked a stronger response compared with the control condition.

3.2.2 Recall of Warning Statements and Images at Baseline and Follow-up

At baseline, Cigarette Injection prompted higher correct recall of the warning statement for adults and young adults compared with the control condition (Table 3-2). At 1-week follow-up, Red Puppet elicited higher correct recall for young adults compared with the control condition. In contrast, Hole in Throat elicited relatively lower correct recall at follow-up for young adults compared with the control condition. Cigarette Injection, Red Puppet, and Hole in Throat were more likely to elicit correct recall of the warning image at baseline and follow-up than the referent image (Woman in Rain).

3.2.3 Influences on Beliefs

Cigarette Injection, Hole in Throat, and Woman in Rain elicited stronger beliefs (i.e., higher scale scores) about the health risks of smoking (e.g., more likely to believe that regular smokers will get cancer, have fatal lung disease) compared with the control condition for adults (Table 3-3).

Hole in Throat evoked stronger beliefs about the health risks of exposure to secondhand smoke to nonsmokers (e.g., more likely to believe that nonsmokers will get cancer, heart disease) compared with the control condition for adults.

3.2.4 Behavioral Responses

Cigarette Injection was associated with higher intentions to quit in the next 30 days compared with the control condition for young adults (Table 3-3).

3.2.5 Adult Advertisement Study

In the adult advertisement study, all of the warning images except Red Puppet received higher scores on the emotional reaction scale (e.g., disgusted, worried) compared with the control condition (see Table 3-2). Cigarette Injection, Red Puppet, and Hole in Throat elicited higher scores on the cognitive reaction scale (e.g., informative, worth remembering) compared with the control condition. All warning images were reported as difficult to look at relative to controls.

Hole in Throat prompted lower correct recall of the warning statement at follow-up compared with the control condition. Red Puppet was more likely to evoke correct recall of the warning image at baseline and follow-up compared with the referent image. As noted in Section 2 (Methods), we excluded the control group respondents from this analysis because they did not view an image. Thus, when we estimated the regression with the indicator for correct recall of the warning image, we specified one of the treatment groups (warning images) as the referent category (image). In this case, Woman in Rain is the referent image.

Cigarette Injection elicited a less favorable response (i.e., lower score) on the health risks of smoking beliefs scale (e.g., less likely to believe that regular smokers will get cancer, have fatal lung disease) compared with the control condition (see Table 3-3).

Table 3-2. Emotional and Cognitive Reactions and Recall for Warning Statement 1

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Cigarette injection	4.022***	(0.000)	1.893**	(0.001)	4.190***	(0.001)	2.125*	(0.049)	0.944	(0.879)	9.892***	(0.000)	10.798***	(0.000)
Red puppet	3.046***	(0.000)	1.790**	(0.002)	3.033**	(0.009)	1.361	(0.387)	1.506	(0.297)	5.034***	(0.000)	6.035***	(0.000)
Hole in throat	5.233***	(0.000)	2.664***	(0.000)	5.380***	(0.000)	0.831	(0.576)	0.745	(0.424)	4.134***	(0.000)	5.125***	(0.000)
Woman in rain	1.877**	(0.005)	0.955	(0.098)	2.392*	(0.045)	0.998	(0.994)	0.994	(0.987)	Ref.	Ref.	Ref.	Ref.
Observations	539		539		539		539		394		433		316	
Young Adult														
Cigarette injection	3.933***	(0.000)	3.326***	(0.000)	2.590*	(0.014)	2.083*	(0.042)	2.135	(0.109)	12.936***	(0.000)	16.736***	(0.000)
Red puppet	2.282**	(0.001)	1.748**	(0.006)	1.640	(0.227)	1.327	(0.396)	4.288**	(0.009)	5.266***	(0.000)	15.425***	(0.000)
Hole in throat	5.485***	(0.000)	2.352***	(0.000)	5.446***	(0.000)	0.697	(0.247)	0.367*	(0.010)	5.881***	(0.000)	5.957***	(0.000)
Woman in rain	2.423***	(0.000)	0.542	(0.388)	2.750**	(0.009)	1.181	(0.609)	1.666	(0.247)	Ref.	Ref.	Ref.	Ref.
Observations	507		507		507		507		342		404		268	
Youth														
Cigarette injection	2.706***	(0.000)	4.888***	(0.000)	1.151	(0.716)	1.103	(0.840)	2.421	(0.083)	14.152***	(0.000)	22.280***	(0.000)
Red puppet	1.557*	(0.018)	3.326***	(0.000)	1.317	(0.468)	1.129	(0.803)	2.049	(0.145)	5.388***	(0.000)	4.221***	(0.001)
Hole in throat	3.932***	(0.000)	4.036***	(0.000)	4.180***	(0.000)	0.627	(0.295)	0.772	(0.536)	7.786***	(0.000)	7.985***	(0.000)
Woman in rain	1.273	(0.053)	1.833**	(0.003)	1.413	(0.360)	0.515	(0.124)	1.354	(0.495)	Ref.	Ref.	Ref.	Ref.
Observations	511		512		512		512		300		410		239	
Adult Ad														
Cigarette injection	3.462***	(0.000)	1.912**	(0.003)	13.255***	(0.001)	1.385	(0.464)	0.824	(0.682)	1.865	(0.113)	1.674	(0.180)
Red puppet	0.922	(0.153)	1.305*	(0.043)	8.287**	(0.007)	0.583	(0.160)	0.821	(0.682)	4.431**	(0.002)	3.139**	(0.009)
Hole in throat	5.042***	(0.000)	3.442***	(0.000)	31.437***	(0.000)	0.568	(0.136)	0.259**	(0.002)	1.337	(0.422)	2.091	(0.071)
Woman in rain	1.942**	(0.003)	0.838	(0.193)	8.524**	(0.006)	0.748	(0.458)	0.562	(0.203)	Ref.	Ref.	Ref.	Ref.
Observations	517		517		517		517		402		413		329	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-3. Influences on Beliefs and Behavior for Warning Statement 1

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Cigarette injection	2.039***	(0.001)	0.892	(0.101)	1.215	(0.577)
Red puppet	0.670	(0.273)	0.284	(0.598)	0.763	(0.444)
Hole in throat	1.544*	(0.013)	1.099*	(0.044)	1.060	(0.869)
Woman in rain	1.489*	(0.015)	0.559	(0.300)	0.946	(0.873)
Observations	539		539		539	
Young Adult						
Cigarette injection	0.027	(0.967)	0.789	(0.169)	2.011*	(0.044)
Red puppet	−0.464	(0.469)	−0.029	(0.960)	1.149	(0.696)
Hole in throat	0.344	(0.590)	0.965	(0.095)	1.108	(0.773)
Woman in rain	−0.906	(0.154)	−0.133	(0.816)	0.835	(0.609)
Observations	507		507		506	
Youth						
Cigarette injection	0.159	(0.794)	0.001	(0.999)	0.927	(0.812)
Red puppet	0.337	(0.582)	−0.032	(0.955)	1.085	(0.800)
Hole in throat	0.300	(0.624)	−0.272	(0.631)	1.220	(0.545)
Woman in rain	0.474	(0.442)	−0.024	(0.966)	0.894	(0.722)
Observations	512		512		512	
Adult Ad						
Cigarette injection	−1.514**	(0.010)	−0.404	(0.458)	1.587	(0.178)
Red puppet	−0.370	(0.527)	0.160	(0.770)	1.262	(0.508)
Hole in throat	−0.333	(0.566)	−0.244	(0.652)	0.865	(0.687)
Woman in rain	−0.645	(0.270)	−0.070	(0.898)	0.538	(0.097)
Observations	517		517		517	

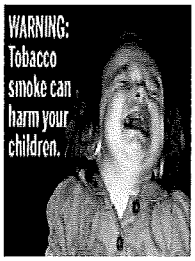
Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

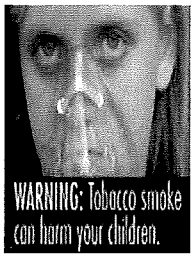
An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

3.3 Warning Statement 2: Tobacco Smoke Can Harm Your Children

Smoke at Toddler

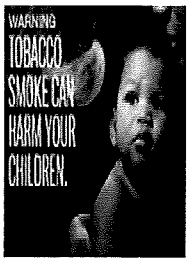


Girl Crying

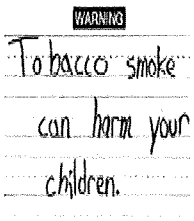


Girl in Oxygen Mask

Smoke at Baby



Smoke Approaching Baby



Warning in Child Lettering

3.3.1 Emotional and Cognitive Reactions

All six warning images elicited higher scores on the emotional reaction scale (e.g., disgusted, worried) compared with the control condition for adults, young adults, and youth (see Table 3-4 at the end of this section).

All six warning images also received higher scores on the cognitive reaction scale (e.g., informative, worth remembering) from adults, young adults, and youth compared with the control condition (see Table 3-4 at the end of this section).

Smoke at Toddler, Girl Crying, Girl in Oxygen Mask, and Smoke Approaching Baby elicited a stronger response (i.e., higher odds of agreeing) to the reaction item "the pack was difficult to look at" compared with the control condition for adults, young adults, and youth. Smoke at Baby evoked a stronger response from adults and youth compared with the control condition.

3.3.2 Recall of Warning Statements and Images at Baseline and Follow-up

Girl Crying, Smoke Approaching Baby, and Warning in Child Lettering elicited higher correct recall of the warning statement at baseline compared with the control condition for adults (see Table 3-4). Warning in Child Lettering prompted higher correct recall of the warning statement at baseline for young adults compared with controls, and Smoke Approaching Baby prompted higher correct recall for youth. Girl Crying, Smoke at Baby, and Warning in Child Lettering elicited higher correct recall of the warning statement at follow-up compared with the control group for adults and young adults. In addition, Smoke Approaching Baby prompted higher correct recall at follow-up for young adults. Warning in Child Lettering elicited higher correct recall of the warning statement at follow-up for youth compared with the control condition.

Compared with the referent image (Girl Crying), Warning in Child Lettering elicited lower correct recall of the warning image at baseline and follow-up for adults, young adults, and youth.

3.3.3 Influences on Beliefs

Among young adults and youth, none of the warning images were significantly associated with beliefs about the health risks of smoking or of secondhand smoke exposure compared with the control condition (see Table 3-4 at the end of this section). Among adults, Girl Crying and Girl in Oxygen Mask were negatively associated with beliefs about the health risks of secondhand smoke exposure to nonsmokers (i.e., less likely to believe that nonsmokers will get cancer, heart disease).

3.3.4 Behavioral Responses

None of the warning images were significantly associated with quit intentions among adults and young adults compared with controls (see Table 3-5). However, Girl Crying and Smoke Approaching Baby were positively associated with the likelihood of smoking 1 year from now for youth (i.e., respondents who viewed these images were more likely than controls to report being moderately to extremely likely to be smoking 1 year from now).

3.3.5 Adult Advertisement Study

Consistent with the results above, all warning images in the adult ad study received higher scores on the emotional and cognitive reaction scales compared with the control condition (see Table 3-4). Furthermore, all images evoked a stronger response (i.e., more likely to agree) to the reaction item "the ad was difficult to look at" compared with the control group.

Warning in Child Lettering prompted higher correct recall of the warning statement at baseline only compared with the control condition. Smoke at Toddler elicited lower correct recall of the warning image at baseline and follow-up compared with the referent image Girl Crying. Furthermore, Smoke at Baby prompted lower correct recall at baseline compared with Girl Crying. Finally, Smoke at Baby was associated with lower quit intentions in the next 30 days compared with the control condition for adults in the ad study (see Table 3-5).

Table 3-4. Emotional and Cognitive Reactions and Recall for Warning Statement 2

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Smoke at toddler	4.764***	(0.000)	1.900**	(0.003)	6.593***	(0.000)	1.767	(0.094)	1.700	(0.174)	0.430	(0.091)	0.682	(0.441)
Girl crying	4.007***	(0.000)	1.593*	(0.013)	6.515***	(0.000)	5.132***	(0.000)	3.424**	(0.005)	Ref.	Ref.	Ref.	Ref.
Girl in oxygen mask	4.855***	(0.000)	2.556***	(0.000)	13.478***	(0.000)	1.172	(0.626)	1.099	(0.799)	0.745	(0.592)	1.439	(0.531)
Smoke approaching baby	3.888***	(0.000)	2.715***	(0.000)	5.158***	(0.000)	2.012*	(0.045)	1.654	(0.188)	0.908	(0.865)	1.300	(0.626)
Smoke at baby	4.173***	(0.000)	2.258***	(0.000)	5.484***	(0.000)	1.538	(0.201)	2.668*	(0.023)	0.524	(0.212)	1.277	(0.672)
Warning in child lettering	2.827***	(0.000)	1.742**	(0.007)	1.156	(0.766)	2.343*	(0.021)	2.665*	(0.020)	0.047***	(0.000)	0.076***	(0.000)
Observations	748		748		748		748		534		641		454	
Young Adult														
Smoke at toddler	3.863***	(0.000)	2.293***	(0.000)	2.364**	(0.009)	1.176	(0.661)	1.683	(0.202)	0.464	(0.227)	2.057	(0.420)
Girl crying	4.919***	(0.000)	2.660***	(0.000)	5.922***	(0.000)	2.112	(0.079)	3.111*	(0.021)	Ref.	Ref.	Ref.	Ref.
Girl in oxygen mask	4.297***	(0.000)	3.075***	(0.000)	4.900***	(0.000)	0.866	(0.684)	1.262	(0.562)	0.614	(0.464)	0.974	(0.971)
Smoke approaching baby	2.138**	(0.005)	3.012***	(0.000)	2.145*	(0.023)	1.627	(0.221)	3.217*	(0.023)	0.998	(0.997)	4.328	(0.200)
Smoke at baby	2.736***	(0.000)	2.426***	(0.000)	1.477	(0.259)	1.509	(0.294)	2.649*	(0.040)	0.962	(0.957)	3.931	(0.230)
Warning in child lettering	1.733*	(0.023)	1.933***	(0.000)	1.279	(0.487)	3.232*	(0.013)	2.677*	(0.037)	0.038***	(0.000)	0.083***	(0.000)
Observations	709		709		709		709		500		607		425	
Youth														
Smoke at toddler	4.427***	(0.000)	2.317***	(0.000)	5.620***	(0.000)	0.894	(0.758)	2.395	(0.079)	0.376	(0.110)	0.130	(0.062)
Girl crying	3.994***	(0.000)	3.230***	(0.000)	9.399***	(0.000)	1.446	(0.352)	1.330	(0.530)	Ref.	Ref.	Ref.	Ref.
Girl in oxygen mask	4.101***	(0.000)	4.098***	(0.000)	5.418***	(0.000)	0.746	(0.408)	0.646	(0.305)	0.667	(0.543)	0.323	(0.338)
Smoke approaching baby	4.431***	(0.000)	3.738***	(0.000)	5.737***	(0.000)	2.543*	(0.039)	1.906	(0.175)	0.562	(0.371)	.	.
Smoke at baby	3.448***	(0.000)	2.532***	(0.000)	3.647**	(0.002)	0.827	(0.597)	0.798	(0.593)	0.661	(0.531)	0.258	(0.234)
Warning in child lettering	2.040**	(0.004)	1.821***	(0.000)	2.014	(0.116)	1.211	(0.617)	3.193*	(0.029)	0.026***	(0.000)	0.015***	(0.000)
Observations	713		714		714		714		378		612		273	
Adult Ad														
Smoke at toddler	3.542***	(0.000)	2.769***	(0.000)	9.341***	(0.000)	1.964	(0.091)	1.170	(0.721)	0.125***	(0.000)	0.409*	(0.043)
Girl crying	4.027***	(0.000)	1.752**	(0.006)	18.947***	(0.000)	1.828	(0.110)	2.515	(0.065)	Ref.	Ref.	Ref.	Ref.
Girl in oxygen mask	3.609***	(0.000)	3.085***	(0.000)	9.542***	(0.000)	0.770	(0.450)	1.082	(0.856)	0.565	(0.367)	0.890	(0.812)
Smoke approaching baby	3.155***	(0.000)	2.892***	(0.000)	5.178**	(0.004)	1.870	(0.109)	1.235	(0.632)	0.480	(0.228)	1.026	(0.958)
Smoke at baby	4.046***	(0.000)	2.385***	(0.000)	8.720***	(0.000)	1.096	(0.796)	0.624	(0.241)	0.311*	(0.044)	1.171	(0.753)
Warning in child lettering	3.424***	(0.000)	3.027***	(0.000)	3.686*	(0.028)	3.677**	(0.005)	1.735	(0.226)	1.380	(0.672)	0.817	(0.666)
Observations	727		727		727		727		567		624		483	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-5. Influences on Beliefs and Behavior for Warning Statement 2

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Smoke at toddler	0.049	(0.935)	−0.599	(0.274)	1.000	(0.999)
Girl crying	0.280	(0.645)	−1.249*	(0.024)	1.556	(0.221)
Girl in oxygen mask	−0.816	(0.177)	−1.533**	(0.005)	1.495	(0.262)
Smoke approaching baby	0.362	(0.548)	−1.025	(0.062)	1.352	(0.405)
Smoke at baby	0.271	(0.653)	−0.388	(0.479)	1.199	(0.620)
Warning in child lettering	0.602	(0.322)	−0.053	(0.924)	1.964	(0.057)
Observations	748		748		748	
Young Adult						
Smoke at toddler	0.545	(0.368)	−0.545	(0.361)	1.391	(0.319)
Girl crying	0.188	(0.756)	0.399	(0.504)	0.741	(0.375)
Girl in oxygen mask	0.305	(0.611)	0.451	(0.445)	1.165	(0.644)
Smoke approaching baby	0.198	(0.744)	0.298	(0.619)	1.187	(0.607)
Smoke at baby	0.522	(0.390)	0.035	(0.954)	0.836	(0.593)
Warning in child lettering	0.168	(0.783)	0.009	(0.988)	1.112	(0.750)
Observations	709		709		709	
Youth						
Smoke at toddler	−0.893	(0.153)	0.470	(0.426)	1.514	(0.160)
Girl crying	−0.320	(0.609)	1.036	(0.080)	1.823*	(0.045)
Girl in oxygen mask	−0.711	(0.256)	0.336	(0.570)	1.710	(0.072)
Smoke approaching baby	−0.079	(0.900)	0.832	(0.158)	1.990*	(0.023)
Smoke at baby	−0.331	(0.596)	0.586	(0.321)	1.615	(0.105)
Warning in child lettering	−0.638	(0.307)	0.462	(0.434)	1.693	(0.075)
Observations	714		714		714	
Adult Ad						
Smoke at toddler	0.594	(0.316)	0.295	(0.585)	0.916	(0.804)
Girl crying	0.192	(0.744)	0.339	(0.529)	0.978	(0.949)
Girl in oxygen mask	−0.143	(0.810)	−0.598	(0.270)	0.766	(0.461)
Smoke approaching baby	0.151	(0.798)	0.084	(0.877)	0.871	(0.698)
Smoke at baby	−0.859	(0.146)	−0.118	(0.826)	0.479*	(0.047)
Warning in child lettering	−0.374	(0.528)	0.021	(0.969)	0.866	(0.686)
Observations	727		727		727	

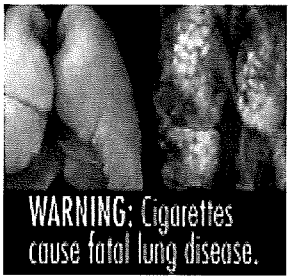
Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

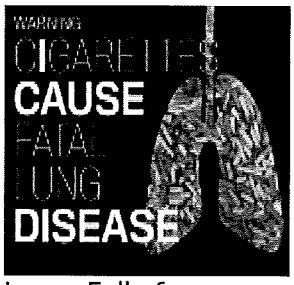
An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

3.4 Warning Statement 3: Cigarettes Cause Fatal Lung Disease

Toe Tag



Healthy/Diseased Lungs



Lungs Full of Cigarettes

Dr. with X-ray

3.4.1 Emotional and Cognitive Reactions

All four warning images received higher scores on the emotional and cognitive reaction scales from adults, young adults, and youth compared with the control group (see Table 3-6 at the end of this section).

All four images evoked a stronger response (i.e., more likely to agree) to the reaction item "the ad was difficult to look at" from adults and youth compared with the control group. Among young adults, all images except for Dr. with X-ray evoked a stronger response to this item compared with the control group.

3.4.2 Recall of Warning Statements and Images at Baseline and Follow-up

Lungs Full of Cigarettes and Dr. with X-ray prompted higher correct recall of the warning statement at baseline and follow-up among young adults. Among youth, Toe Tag prompted lower correct recall of the warning statement at baseline, whereas Dr. with X-ray prompted higher correct recall at follow-up. Healthy/Diseased Lungs and Lungs Full of Cigarettes elicited higher correct recall of the warning image at baseline and follow-up among adults and youth than the referent image (Dr. with X-Ray). Lung Full of Cigarettes elicited higher correct recall of the warning image at baseline only than Dr. with X-ray for young adults.

3.4.3 Influences on Beliefs

None of the warning images were significantly associated with beliefs about health risks to regular smokers for adults, young adults, or youth compared with the control group (see Table 3-7 at the end of this section). Among young adults, Dr. with X-ray was negatively associated with beliefs about the health risks of secondhand smoke exposure to nonsmokers (i.e., less likely to believe that nonsmokers will get lung cancer, heart disease).

3.4.4 Behavioral Responses

None of the warning images were significantly associated with the likelihood of quitting in the next 30 days (among adults and young adults) or the likelihood of smoking 1 year from now (among youth) compared with the control group (see Table 3-7).

3.4.5 Adult Advertisement Study

All four warning images elicited higher scores on the emotional and cognitive reaction scales (see Table 3-6). Toe Tag, Healthy/Diseased Lungs, and Lungs Full of Cigarettes were reported as "difficult to look at" relative to controls.

At follow-up, Dr. with X-ray elicited higher correct recall of the warning statement compared with the control group. Lungs Full of Cigarettes elicited higher correct recall of the warning image at follow-up than Dr. with X-ray (the referent image) among adults exposed to warning images.

Dr. with X-ray was also negatively associated with beliefs about the health risks of secondhand smoke exposure to nonsmokers. None of the four images were significantly associated with quit intentions relative to controls (see Table 3-7).

Table 3-6. Emotional and Cognitive Reactions and Recall for Warning Statement 3

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Toe tag	2.116**	(0.003)	2.214***	(0.000)	3.999**	(0.001)	0.684	(0.334)	0.963	(0.921)	0.884	(0.668)	0.909	(0.769)
Healthy/diseased lungs	4.929***	(0.000)	3.640***	(0.000)	12.232***	(0.000)	0.530	(0.087)	1.071	(0.854)	2.608**	(0.002)	2.342*	(0.016)
Lungs full of cigarettes	3.638***	(0.000)	2.343***	(0.000)	5.279***	(0.000)	1.148	(0.740)	2.136	(0.081)	5.148***	(0.000)	4.523***	(0.000)
Dr. with X-ray	2.877***	(0.000)	2.890***	(0.000)	3.839**	(0.001)	0.597	(0.177)	1.011	(0.978)	Ref.	Ref.	Ref.	Ref.
Observations	543		543		543		543		415		434		328	
Young Adult														
Toe tag	2.856***	(0.000)	2.321***	(0.000)	2.758**	(0.003)	1.348	(0.406)	1.167	(0.718)	0.711	(0.302)	0.643	(0.282)
Healthy/diseased lungs	4.758***	(0.000)	3.756***	(0.000)	4.682***	(0.000)	1.388	(0.362)	2.291	(0.074)	2.004	(0.066)	1.625	(0.291)
Lungs full of cigarettes	4.328***	(0.000)	2.534***	(0.000)	3.568***	(0.000)	2.684*	(0.016)	2.675*	(0.045)	2.397*	(0.028)	1.664	(0.301)
Dr. with X-ray	2.587***	(0.000)	1.596**	(0.006)	1.777	(0.104)	2.257*	(0.033)	4.271**	(0.004)	Ref.	Ref.	Ref.	Ref.
Observations	511		512		512		512		340		408		280	
Youth														
Toe tag	2.872***	(0.000)	3.652***	(0.000)	3.207**	(0.004)	0.441*	(0.026)	1.000	(1.000)	1.055	(0.860)	0.583	(0.200)
Healthy/diseased lungs	3.644***	(0.000)	6.128***	(0.000)	7.721***	(0.000)	0.931	(0.860)	1.549	(0.423)	4.084***	(0.000)	2.976*	(0.044)
Lungs full of cigarettes	3.333***	(0.000)	5.381***	(0.000)	3.703**	(0.001)	1.049	(0.909)	12.181*	(0.022)	3.696***	(0.001)	3.266*	(0.037)
Dr. with X-ray	1.773*	(0.010)	3.492***	(0.000)	2.507*	(0.026)	1.944	(0.158)	1.290	(0.625)	Ref.	Ref.	Ref.	Ref.
Observations	511		511		511		511		271		409		217	
Adult Ad														
Toe tag	3.214***	(0.000)	2.469***	(0.000)	3.678**	(0.002)	0.734	(0.481)	0.844	(0.667)	0.582	(0.196)	0.753	(0.489)
Healthy/diseased lungs	5.666***	(0.000)	4.253***	(0.000)	12.871***	(0.000)	0.531	(0.136)	2.316	(0.080)	1.628	(0.318)	1.671	(0.258)
Lungs full of cigarettes	4.069***	(0.000)	2.662***	(0.000)	3.544**	(0.003)	0.563	(0.176)	1.878	(0.149)	1.861	(0.234)	3.322*	(0.016)
Dr. with X-ray	2.793***	(0.000)	2.337***	(0.000)	1.706	(0.250)	1.249	(0.640)	2.885*	(0.033)	Ref.	Ref.	Ref.	Ref.
Observations	515		515		515		515		386		412		310	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-7. Influences on Beliefs and Behavior for Warning Statement 3

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Toe tag	0.004	(0.994)	−0.818	(0.118)	1.360	(0.383)
Healthy/diseased lungs	0.245	(0.686)	−0.876	(0.092)	1.943	(0.054)
Lungs full of cigarettes	0.768	(0.205)	−0.096	(0.853)	0.982	(0.959)
Dr. with X-ray	0.175	(0.774)	−0.096	(0.855)	1.306	(0.450)
Observations	543		543		543	
Young Adult						
Toe tag	−0.612	(0.313)	−0.296	(0.591)	1.147	(0.671)
Healthy/diseased lungs	−0.534	(0.377)	−0.392	(0.476)	0.862	(0.650)
Lungs full of cigarettes	0.119	(0.847)	−0.424	(0.448)	1.697	(0.111)
Dr. with X-ray	−0.212	(0.726)	−1.282*	(0.020)	1.034	(0.919)
Observations	512		512		512	
Youth						
Toe tag	−0.267	(0.639)	0.786	(0.159)	1.031	(0.917)
Healthy/diseased lungs	−0.577	(0.310)	−0.177	(0.751)	0.878	(0.657)
Lungs full of cigarettes	0.731	(0.199)	0.618	(0.268)	1.840	(0.053)
Dr. with X-ray	−0.099	(0.862)	0.320	(0.566)	1.322	(0.358)
Observations	511		511		511	
Adult Ad						
Toe tag	−0.470	(0.443)	−0.987	(0.074)	0.746	(0.445)
Healthy/diseased lungs	−0.561	(0.364)	−0.915	(0.100)	1.160	(0.684)
Lungs full of cigarettes	−0.936	(0.131)	−0.807	(0.148)	0.638	(0.242)
Dr. with X-ray	−0.139	(0.822)	−1.132*	(0.042)	0.875	(0.722)
Observations	515		515		515	

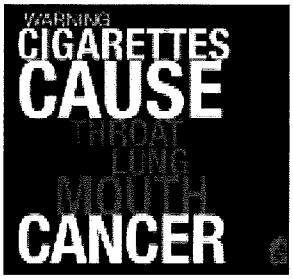
Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$, ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a greater value on the outcome variable (e.g., higher score on the emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

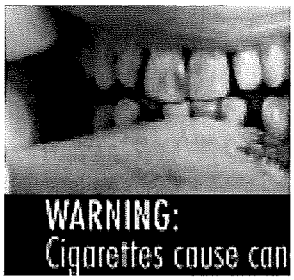
3.5 Warning Statement 4: Cigarettes Cause Cancer

Deathly Ill Woman



Red Cigarette Burning

White Cigarette Burning



Cancerous Lesion on Lip

3.5.1 Emotional and Cognitive Reactions

Deathly Ill Woman, Red Cigarette Burning, White Cigarette Burning, and Cancerous Lesion on Lip elicited higher scores on the emotional and cognitive reaction scales from adults, young adults, and youth compared with the control group (see Table 3-8). Among adults, all four warning images elicited stronger responses (i.e., higher odds of agreeing) to the reaction item "the pack was difficult to look at" compared with the control condition. For young adults and youth, Deathly Ill Woman, Red Cigarette Burning, and Cancerous Lesion on Lip were reported as difficult to look at relative to controls.

3.5.2 Recall of Warning Statements and Images at Baseline and Follow-up

Deathly Ill Woman and Red Cigarette Burning prompted higher correct recall of the warning statement at baseline for adults compared with the control group (see Table 3-8). At follow-up, all images except for White Cigarette Burning elicited higher correct recall of the warning statement for adults compared with the control group. For young adults and youth, only recall of Red Cigarette Burning was significantly higher at baseline and follow-up compared with the control group. Additionally, White Cigarette Burning prompted higher correct recall of the warning statement at baseline for youth compared with the control group. Red Cigarette Burning elicited lower correct recall of the warning image at baseline and follow-up than Cancerous Lesion on Lip (the referent image) for adults, young adults, and youth. Adults and young adults exposed to White Cigarette Burning were less likely to recall the correct warning image at baseline and follow-up than those exposed to Cancerous Lesion on Lip. Youth exposed to White Cigarette Burning were less likely to recall the correct warning image at baseline only than those exposed to Cancerous Lesion on Lip.

3.5.3 Influences on Beliefs

None of the four warning images were significantly associated with beliefs about the health risks of smoking to regular smokers or beliefs about the health risks of secondhand smoke exposure to nonsmokers (see Table 3-9 at the end of this section).

3.5.4 Behavioral Responses

Red Cigarette Burning was significantly associated with the likelihood of smoking 1 year from now for youth compared with the control group (see Table 3-9). Specifically, youth who viewed this warning image were more likely to report that they will be smoking 1 year from now.

3.5.5 Adult Advertisement Study

In the adult advertisement study, all four warning images elicited higher scores on the emotional reaction scale compared with the control group (see Table 3-8). All images except for White Cigarette Burning elicited higher scores on the cognitive reaction scale. All four images evoked a stronger response (i.e., more likely to agree) to the reaction item "the pack was difficult to look at" compared with the control group.

Red Cigarette Burning prompted lower correct recall of the warning statement at baseline and follow-up compared with the control group. Those exposed to Deathly Ill Woman were significantly less likely than the control group to correctly recall the warning statement at baseline. White Cigarette Burning elicited lower correct recall of the warning image than Cancerous Lesion on Lip (the referent image).

Cancerous Lesion on Lip was positively associated with beliefs about the health risks to regular smokers (i.e., more likely than controls to believe that a regular smoker would get cancer, have fatal lung disease, etc.) and beliefs about the health risks of secondhand smoke exposure to nonsmokers compared with the control condition (i.e., more likely than controls to believe that regularly breathing secondhand smoke would cause nonsmokers to get cancer, have fatal lung disease, etc.) (see Table 3-9). None of the images were significantly associated with quit intentions for adults and young adults or the likelihood of smoking 1 year from now for youth.

Table 3-8. Emotional and Cognitive Reactions and Recall for Warning Statement 4

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Deathly ill woman	6.109***	(0.000)	3.369***	(0.000)	10.402***	(0.000)	0.475*	(0.045)	0.338**	(0.009)	0.962	(0.911)	0.839	(0.669)
Red cigarette burning	3.719***	(0.000)	3.591***	(0.000)	2.426*	(0.016)	0.139***	(0.000)	0.190***	(0.000)	0.231***	(0.000)	0.314**	(0.002)
White cigarette burning	4.840***	(0.000)	3.821***	(0.000)	2.754**	(0.005)	2.076	(0.133)	1.193	(0.698)	0.267***	(0.000)	0.315**	(0.002)
Cancerous lesion on lip	6.291***	(0.000)	3.169***	(0.000)	7.591***	(0.000)	0.641	(0.247)	0.366*	(0.015)	Ref.	Ref.	Ref.	Ref.
Observations	538		539		539		539		407		430		334	
Young Adult														
Deathly ill woman	6.570***	(0.000)	3.860***	(0.000)	9.997***	(0.000)	0.588	(0.168)	0.820	(0.619)	1.169	(0.776)	0.827	(0.779)
Red cigarette burning	3.436***	(0.000)	3.567***	(0.000)	2.042*	(0.041)	0.238***	(0.000)	0.354**	(0.007)	0.241**	(0.001)	0.277*	(0.024)
White cigarette burning	3.276***	(0.000)	3.881***	(0.000)	1.568	(0.212)	2.432	(0.085)	2.133	(0.102)	0.192***	(0.000)	0.278*	(0.025)
Cancerous lesion on lip	6.906***	(0.000)	3.998***	(0.000)	8.171***	(0.000)	0.576	(0.157)	0.906	(0.808)	Ref.	Ref.	Ref.	Ref.
Observations	505		505		505		505		366		402		294	
Youth														
Deathly ill woman	5.000***	(0.000)	6.060***	(0.000)	16.889***	(0.000)	1.152	(0.705)	1.810	(0.262)	0.888	(0.808)	1.515	(0.545)
Red cigarette burning	3.357***	(0.000)	6.089***	(0.000)	2.295*	(0.048)	0.342**	(0.001)	0.281**	(0.002)	0.193***	(0.000)	0.327*	(0.035)
White cigarette burning	2.403***	(0.001)	5.631***	(0.000)	1.446	(0.408)	2.788*	(0.023)	1.295	(0.599)	0.150***	(0.000)	0.414	(0.109)
Cancerous lesion on lip	6.195***	(0.000)	6.473***	(0.000)	15.205***	(0.000)	0.566	(0.093)	0.559	(0.183)	Ref.	Ref.	Ref.	Ref.
Observations	511		511		511		511		289		409		218	
Adult Ad														
Deathly ill woman	6.078***	(0.000)	3.501***	(0.000)	57.334***	(0.000)	0.463*	(0.038)	0.473	(0.068)	1.013	(0.980)	0.853	(0.736)
Red cigarette burning	3.981***	(0.000)	2.723***	(0.000)	16.565***	(0.000)	0.157***	(0.000)	0.222***	(0.000)	0.837	(0.712)	0.609	(0.264)
White cigarette burning	1.602*	(0.019)	0.593	(0.369)	7.199*	(0.011)	1.048	(0.911)	0.824	(0.662)	0.438	(0.071)	0.367*	(0.022)
Cancerous lesion on lip	6.966***	(0.000)	4.503***	(0.000)	87.765***	(0.000)	0.759	(0.474)	0.557	(0.155)	Ref.	Ref.	Ref.	Ref.
Observations	518		518		518		518		391		414		310	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-9. Influences on Beliefs and Behavior for Warning Statement 4

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Deathly ill woman	0.780	(0.181)	0.267	(0.628)	1.366	(0.396)
Red cigarette burning	−0.395	(0.500)	−0.175	(0.752)	1.663	(0.171)
White cigarette burning	0.420	(0.467)	0.215	(0.695)	1.385	(0.374)
Cancerous lesion on lip	0.192	(0.741)	−0.398	(0.470)	1.355	(0.406)
Observations	539		539		539	
Young Adult						
Deathly ill woman	0.158	(0.785)	−0.546	(0.319)	1.302	(0.417)
Red cigarette burning	−0.751	(0.196)	−0.021	(0.970)	1.528	(0.200)
White cigarette burning	−0.480	(0.408)	0.023	(0.966)	1.076	(0.826)
Cancerous lesion on lip	−0.776	(0.180)	−0.704	(0.199)	1.297	(0.432)
Observations	505		505		505	
Youth						
Deathly ill woman	0.090	(0.881)	0.043	(0.938)	1.258	(0.492)
Red cigarette burning	−0.695	(0.247)	−0.596	(0.277)	0.503*	(0.025)
White cigarette burning	−0.399	(0.505)	−0.494	(0.365)	1.027	(0.934)
Cancerous lesion on lip	0.089	(0.882)	0.309	(0.571)	0.890	(0.712)
Observations	511		511		511	
Adult Ad						
Deathly ill woman	−0.682	(0.257)	−0.129	(0.804)	0.532	(0.097)
Red cigarette burning	0.828	(0.163)	0.722	(0.160)	1.155	(0.686)
White cigarette burning	−0.133	(0.825)	0.286	(0.583)	0.926	(0.830)
Cancerous lesion on lip	1.363*	(0.022)	1.402**	(0.007)	0.890	(0.744)
Observations	518		518		518	

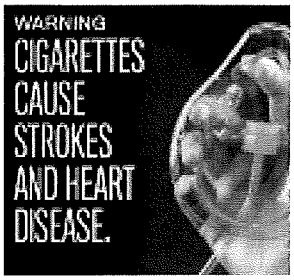
Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

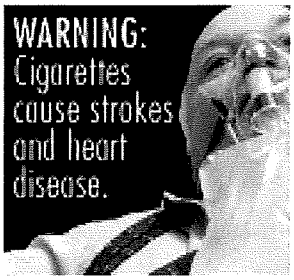
3.6 Warning Statement 5: Cigarettes Cause Strokes and Heart Disease

Red Lightning with Heart



Hand with Oxygen Mask

Man in Pain with Hand on Chest



Oxygen Mask on Man's Face

3.6.1 Emotional and Cognitive Reactions

All four warning images elicited higher scores on the emotional reaction scale for adults, young adults, and youth (see Table 3-10). For young adults and youth, all four warning images consistently elicited higher scores on the cognitive reaction scale compared with the control group (see Table 3-10). For adults, all images except Man in Pain with Hand on Chest elicited higher scores on the cognitive reaction scale compared with controls.

For the reaction item "the pack was difficult to look at," all warning images except Man in Pain with Hand on Chest elicited a stronger response (i.e., higher odds of agreeing that the pack was difficult to look at) from young adults compared with controls. For youth, all images except Red Lightning with Heart elicited a stronger response to the reaction item compared with controls.

3.6.2 Recall of Warning Statements and Images at Baseline and Follow-up

For adults and young adults, Red Lightning with Heart elicited higher correct recall of the warning statement at follow-up compared with controls (see Table 3-10). For youth, Red Lightning with Heart and Man in Pain with Hand on Chest elicited higher correct recall of the warning statement at follow-up compared with the control group. Man in Pain with Hand on Chest elicited lower correct recall of the warning image at baseline for adults than Oxygen Mask on Man's Face (referent image). Among youth, Red Lightning with Heart prompted lower correct recall of the warning image at baseline and follow-up than Oxygen Mask on Man's Face. Moreover, youth exposed to Hand with Oxygen Mask were less likely to recall the correct image at baseline only in comparison with those exposed to Oxygen Mask on Man's Face.

3.6.3 Influences on Beliefs

None of the warning images were associated with either belief scale compared with the control group (see Table 3-11).

3.6.4 Behavioral Responses

Hand with Oxygen Mask was associated with significantly lower likelihood of quitting within the next month for adults compared with the control group (see Table 3-11). None of the warning images were associated with quit intentions for young adults or the likelihood of smoking 1 year from now for youth compared with the control group.

3.6.5 Adult Advertisement Study

In the adult advertisement study, all four warning images consistently elicited higher scores on the emotional and cognitive reaction scales compared with the control group (see Table 3-10). Only Oxygen Mask on Man's Face evoked a stronger response to the reaction item "the pack was difficult to look at" compared with the control group. Red Lightning with Heart elicited higher correct recall of the warning statement at baseline compared with the control group. Hand with Oxygen Mask elicited lower correct recall of the warning image at follow-up than Oxygen Mask on Man's Face (the referent image).

None of the warning images were associated with either belief scale (see Table 3-11). Likewise, the warning images were not significantly associated with quit intentions for adults and young adults or the likelihood of smoking 1 year from now for youth.

Table 3-10. Emotional and Cognitive Reactions and Recall for Warning Statement 5

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Red lightning w/heart	3.698***	(0.000)	1.832**	(0.003)	3.915**	(0.003)	1.251	(0.513)	2.565*	(0.029)	0.612	(0.146)	0.788	(0.549)
Hand w/oxygen mask	3.269***	(0.000)	2.522***	(0.000)	6.885***	(0.000)	0.723	(0.313)	1.004	(0.992)	0.628	(0.173)	0.855	(0.695)
Man in pain with hand on chest	2.139**	(0.001)	0.580	(0.335)	4.301**	(0.001)	1.272	(0.483)	1.358	(0.419)	0.457*	(0.019)	0.531	(0.108)
Oxygen mask on man's face	4.870***	(0.000)	2.281***	(0.000)	11.338***	(0.000)	0.593	(0.100)	0.793	(0.535)	Ref.	Ref.	Ref.	Ref.
Observations	541		541		541		541		403		434		331	
Young Adult														
Red lightning w/heart	3.330***	(0.000)	4.084***	(0.000)	2.928**	(0.001)	1.728	(0.185)	3.082*	(0.038)	0.855	(0.681)	0.973	(0.955)
Hand w/oxygen mask	4.603***	(0.000)	4.404***	(0.000)	2.384**	(0.009)	0.593	(0.137)	0.668	(0.338)	1.042	(0.916)	1.946	(0.213)
Man in pain with hand on chest	3.974***	(0.000)	3.026***	(0.000)	1.633	(0.157)	0.782	(0.493)	1.844	(0.193)	1.151	(0.719)	1.179	(0.731)
Oxygen mask on man's face	4.771***	(0.000)	3.093***	(0.000)	4.449***	(0.000)	0.526	(0.062)	0.866	(0.729)	Ref.	Ref.	Ref.	Ref.
Observations	504		504		504		504		344		404		279	
Youth														
Red lightning w/heart	2.305***	(0.001)	4.401***	(0.000)	2.190	(0.088)	1.472	(0.303)	2.699*	(0.036)	0.219***	(0.000)	0.259*	(0.012)
Hand w/oxygen mask	3.524***	(0.000)	5.690***	(0.000)	5.123***	(0.000)	0.685	(0.260)	1.826	(0.168)	0.424*	(0.045)	0.609	(0.401)
Man in pain with hand on chest	3.353***	(0.000)	4.398***	(0.000)	4.185***	(0.001)	1.588	(0.225)	2.940*	(0.026)	0.540	(0.158)	0.660	(0.479)
Oxygen mask on man's face	5.138***	(0.000)	5.427***	(0.000)	15.514***	(0.000)	0.894	(0.744)	1.471	(0.355)	Ref.	Ref.	Ref.	Ref.
Observations	511		511		511		511		292		409		236	
Adult Ad														
Red lightning w/heart	1.885**	(0.005)	1.893**	(0.002)	1.944	(0.109)	2.354*	(0.042)	2.711	(0.077)	1.642	(0.367)	0.564	(0.235)
Hand w/oxygen mask	1.948**	(0.004)	1.227*	(0.046)	1.131	(0.779)	0.588	(0.120)	1.172	(0.736)	0.725	(0.508)	0.340*	(0.026)
Man in pain with hand on chest	1.911**	(0.005)	1.337*	(0.029)	1.841	(0.150)	2.028	(0.086)	1.013	(0.977)	0.891	(0.810)	0.708	(0.488)
Oxygen mask on man's face	4.847***	(0.000)	3.220***	(0.000)	7.741***	(0.000)	0.705	(0.312)	0.506	(0.105)	Ref.	Ref.	Ref.	Ref.
Observations	517		517		517		517		399		413		314	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-11. Influences on Beliefs and Behavior for Warning Statement 5

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Red lightning w/heart	0.745	(0.189)	−0.193	(0.712)	0.694	(0.269)
Hand w/oxygen mask	0.041	(0.942)	−0.085	(0.871)	0.325**	(0.002)
Man in pain with hand on chest	−0.510	(0.368)	−0.869	(0.096)	0.635	(0.173)
Man w/mask and bag	−0.116	(0.838)	−0.512	(0.328)	0.653	(0.199)
Observations	541		541		541	
Young Adult						
Red lightning w/heart	0.210	(0.739)	0.565	(0.347)	1.036	(0.917)
Hand w/oxygen mask	−0.214	(0.733)	−0.095	(0.873)	1.174	(0.626)
Man in pain with hand on chest	−0.227	(0.720)	0.959	(0.110)	0.635	(0.186)
Man w/mask and bag	0.644	(0.301)	0.883	(0.136)	0.830	(0.569)
Observations	504		504		504	
Youth						
Red lightning w/heart	−0.887	(0.142)	−0.605	(0.288)	0.864	(0.619)
Hand w/oxygen mask	1.025	(0.090)	0.178	(0.754)	1.342	(0.330)
Man in pain with hand on chest	0.202	(0.738)	0.181	(0.750)	1.596	(0.127)
Man w/mask and bag	0.493	(0.413)	0.860	(0.130)	1.532	(0.162)
Observations	511		511		511	
Adult Ad						
Red lightning w/heart	−0.356	(0.535)	−0.945	(0.073)	1.124	(0.755)
Hand w/oxygen mask	−0.280	(0.628)	−0.433	(0.417)	1.192	(0.633)
Man in pain with hand on chest	0.528	(0.360)	−0.562	(0.290)	1.454	(0.308)
Man w/mask and bag	0.054	(0.925)	−0.605	(0.254)	0.669	(0.312)
Observations	517		517		517	

Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

3.7 Warning Statement 6: Smoking during Pregnancy Can Harm Your Baby

Pacifier & Ashtray

Baby in Incubator

3.7.1 Emotional and Cognitive Reactions

Pacifier & Ashtray and Baby in Incubator received higher scores on the emotional and cognitive reaction scales from adults, young adults, and youth relative to the control group (see Table 3-12). Results for the reaction item "the pack was difficult to look at" diverged somewhat across study populations. In the adult pack study population, respondents viewing either image were significantly more likely than the control group to agree or strongly agree that the pack was difficult to look at. Among young adults and youth, however, only Baby in Incubator evoked stronger responses to this reaction item.

3.7.2 Recall of Warning Statements and Images at Baseline and Follow-up

At baseline, Baby in Incubator elicited higher correct recall of the warning statement by youth, and Pacifier & Ashtray elicited higher correct recall by young adults compared with the control group (see Table 3-12). At follow-up, Pacifier & Ashtray and Baby in Incubator elicited higher correct recall of the warning statement by young adults. Pacifier & Ashtray prompted lower correct recall of the warning image than Baby in Incubator (the referent image) at baseline and follow-up among adults, young adults, and youth compared with controls.

3.7.3 Influences on Beliefs

Among adults, Pacifier & Ashtray and Baby in Incubator elicited stronger beliefs (i.e., higher scale scores) about the health risks of smoking (e.g., more likely to believe that regular smokers will get cancer, have fatal lung disease) compared with the control condition (see Table 3-13). In contrast, Baby in Incubator was negatively associated with beliefs about the health risks of smoking for youth compared with the control condition. None of the images were associated with beliefs about the health risks of secondhand smoke exposure to nonsmokers.

3.7.4 Behavioral Responses

Neither warning image was significantly associated with quit intentions (for adults and young adults) or the likelihood of smoking 1 year from now (for youth) compared with the control condition (see Table 3-13).

3.7.5 Adult Advertisement Study

In the adult advertisement study, both images elicited significantly higher scores on the emotional and cognitive reaction scales from respondents compared with controls (see Table 3-12). Only Baby in Incubator was reported as "difficult to look at" relative to controls. Pacifier & Ashtray elicited significantly lower recall of the correct image at baseline than Baby in Incubator. Neither image was significantly associated with beliefs about the health risks of smoking or secondhand smoke exposure or with quit intentions (see Table 3-13).

Table 3-12. Emotional and Cognitive Reactions and Recall for Warning Statement 6

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Pacifier & ashtray	2.786***	(0.000)	2.038**	(0.001)	4.008**	(0.005)	1.741	(0.204)	1.705	(0.284)	0.074***	(0.000)	0.063***	(0.000)
Baby in Incubator	5.397***	(0.000)	2.306***	(0.000)	9.931***	(0.000)	2.027	(0.123)	2.086	(0.145)	Ref.	Ref.	Ref.	Ref.
Observations	321		321		321		321		229		213		159	
Young Adult														
Pacifier & ashtray	2.978***	(0.000)	2.926***	(0.000)	1.340	(0.430)	5.612**	(0.004)	3.612*	(0.020)	0.235**	(0.001)	0.168**	(0.006)
Baby in Incubator	5.355***	(0.000)	3.426***	(0.000)	3.514***	(0.000)	2.048	(0.139)	4.083*	(0.010)	Ref.	Ref.	Ref.	Ref.
Observations	303		303		300		303		209		200		141	
Youth														
Pacifier & ashtray	1.883**	(0.005)	4.648***	(0.000)	2.839*	(0.029)	1.770	(0.210)	1.061	(0.926)	0.130***	(0.000)	0.290*	(0.011)
Baby in Incubator	4.258***	(0.000)	5.661***	(0.000)	10.658***	(0.000)	4.670*	(0.010)	0.626	(0.443)	Ref.	Ref.	Ref.	Ref.
Observations	306		306		306		306		175		204		120	
Adult Ad														
Pacifier & ashtray	1.547*	(0.019)	1.720**	(0.006)	2.351	(0.058)	1.894	(0.289)	0.645	(0.517)	0.207**	(0.002)	0.417	(0.059)
Baby in Incubator	4.350***	(0.000)	2.896***	(0.000)	5.123***	(0.000)	1.443	(0.517)	0.565	(0.386)	Ref.	Ref.	Ref.	Ref.
Observations	310		310		310		310		243		199		155	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-13. Influences on Beliefs and Behavior for Warning Statement 6

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Pacifier & ashtray	1.222*	(0.037)	−0.195	(0.714)	0.560	(0.130)
Baby in Incubator	1.508*	(0.011)	0.576	(0.282)	0.876	(0.716)
Observations	321		321		321	
Young Adult						
Pacifier & ashtray	0.173	(0.779)	−0.438	(0.434)	1.668	(0.121)
Baby in Incubator	−0.447	(0.475)	−0.358	(0.529)	1.812	(0.078)
Observations	303		303		303	
Youth						
Pacifier & ashtray	−1.029	(0.107)	−0.270	(0.637)	0.598	(0.093)
Baby in Incubator	−1.546*	(0.017)	−0.858	(0.139)	0.619	(0.119)
Observations	306		306		306	
Adult Ad						
Pacifier & ashtray	0.088	(0.876)	−0.603	(0.264)	0.987	(0.969)
Baby in Incubator	0.015	(0.979)	0.152	(0.778)	0.877	(0.705)
Observations	310		310		310	

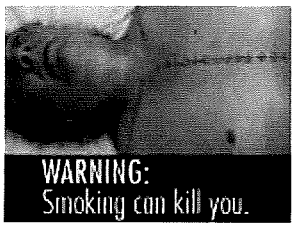
Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., higher score on the emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

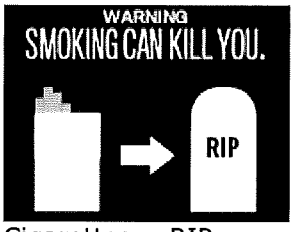
3.8 Warning Statement 7: Smoking Can Kill You

Man in Casket



Man with Chest Staples

Red Coffin with Body in Black



Cigarettes = RIP

3.8.1 Emotional and Cognitive Reactions

All four images elicited higher scores on the emotional reaction scale for adults and youth compared with the control condition (see Table 3-14). Among young adults, Man with Chest Staples and Cigarettes = RIP received higher scores on the emotional reaction scale relative to controls.

All four images also received significantly higher scores on the cognitive reaction scale for adults, young adults, and youth compared with controls (see Table 3-14).

All four images evoked a stronger response to the reaction item "this pack was difficult to look at" (i.e., higher odds of agreeing that the pack was difficult to look at) from adults and youth compared with controls. However, among young adults, only Man with Chest Staples elicited a stronger response compared with the control condition.

3.8.2 Recall of Warning Statements and Images at Baseline and Follow-up

Among adults, Red Coffin with Body in Black and Cigarettes = RIP prompted higher correct recall of the warning statement at baseline compared with the control group (see Table 3-14). Among youth, Man in Casket elicited higher correct recall of the warning statement at baseline compared with the control group. In contrast, Man in Casket and Man with Chest Staples elicited lower correct recall of the warning statement at baseline among young adults, as did Man with Chest Staples at follow-up. Man with Chest Staples elicited higher correct recall of the warning image at follow-up than Cigarettes = RIP (the referent image).

3.8.3 Influences on Beliefs

None of the warning images were significantly associated with either belief scale for adults, young adults, or youth (see Table 3-15).

3.8.4 Behavioral Responses

Man with Chest Staples was significantly associated with quit intentions among adults in the pack sample (see Table 3-15).

3.8.5 Adult Advertisement Study

In the adult advertisement study, all four images elicited higher scores on the emotional reaction scale (see Table 3-14). Man in Casket, Man with Chest Staples, and Cigarettes = RIP also elicited higher scores on the cognitive reaction scale. All four images evoked stronger responses to the reaction item, "the pack was difficult to look at" compared with the control group. Man in Casket, Red Coffin with Body in Black, and Cigarettes = RIP all elicited stronger beliefs (i.e., higher scale scores) about the health risks of smoking compared with the control group (see Table 3-15). None of the four images were significantly associated with quit intentions.

Table 3-14. Emotional and Cognitive Reactions and Recall for Warning Statement 7

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Man in casket	3.592***	(0.000)	1.641**	(0.007)	3.668**	(0.001)	1.652	(0.228)	1.891	(0.166)	1.422	(0.344)	0.841	(0.676)
Man w/chest staples	5.920***	(0.000)	2.926***	(0.000)	7.658***	(0.000)	1.683	(0.205)	1.067	(0.881)	1.910	(0.098)	0.981	(0.964)
Red coffin w/body in black	4.040***	(0.000)	2.783***	(0.000)	4.139***	(0.000)	9.027***	(0.001)	2.093	(0.107)	1.123	(0.740)	1.678	(0.241)
Cigarettes = RIP	3.842***	(0.000)	3.035***	(0.000)	4.024***	(0.001)	2.553*	(0.034)	2.532	(0.059)	Ref.	Ref.	Ref.	Ref.
Observations	539		539		539		540		407		432		332	
Young Adult														
Man in casket	1.284	(0.066)	2.452***	(0.000)	1.368	(0.369)	0.352*	(0.021)	1.093	(0.886)	0.782	(0.587)	1.663	(0.376)
Man w/chest staples	4.251***	(0.000)	3.386***	(0.000)	4.083***	(0.000)	0.256**	(0.002)	0.335*	(0.040)	1.768	(0.277)	4.484*	(0.035)
Red coffin w/body in black	1.160	(0.101)	1.537*	(0.020)	1.505	(0.241)	0.573	(0.245)	0.770	(0.652)	0.523	(0.132)	0.650	(0.390)
Cigarettes = RIP	2.073**	(0.003)	2.082**	(0.002)	1.471	(0.271)	0.738	(0.547)	0.672	(0.490)	Ref.	Ref.	Ref.	Ref.
Observations	508		508		508		508		354		405		286	
Youth														
Man in casket	2.529***	(0.000)	2.758***	(0.000)	7.067***	(0.000)	3.270*	(0.022)	0.543	(0.358)	1.939	(0.136)	1.848	(0.330)
Man w/chest staples	4.189***	(0.000)	4.385***	(0.000)	16.268***	(0.000)	1.388	(0.443)	0.456	(0.218)	2.520	(0.056)	1.714	(0.392)
Red coffin w/body in black	2.316***	(0.001)	3.205***	(0.000)	6.395***	(0.000)	2.321	(0.085)	4.988	(0.159)	1.336	(0.487)	1.886	(0.345)
Cigarettes = RIP	1.705*	(0.015)	3.056***	(0.000)	2.997*	(0.046)	2.393	(0.065)	1.361	(0.701)	Ref.	Ref.	Ref.	Ref.
Observations	511		511		511		511		264		409		219	
Adult Ad														
Man in casket	3.682***	(0.000)	2.657***	(0.000)	4.338**	(0.002)	1.061	(0.907)	0.610	(0.405)	0.143	(0.075)	0.570	(0.335)
Man w/chest staples	4.747***	(0.000)	1.723**	(0.009)	11.938***	(0.000)	0.932	(0.886)	0.500	(0.233)	0.164	(0.102)	1.275	(0.707)
Red coffin w/body in black	2.351***	(0.000)	1.097	(0.097)	3.708**	(0.005)	0.856	(0.747)	0.800	(0.717)	0.120	(0.050)	0.605	(0.375)
Cigarettes = RIP	2.512***	(0.000)	1.776**	(0.007)	2.633*	(0.044)	1.221	(0.699)	1.185	(0.809)	Ref.	Ref.	Ref.	Ref.
Observations	516		516		516		501		402		414		324	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-15. Influences on Beliefs and Behavior for Warning Statement 7

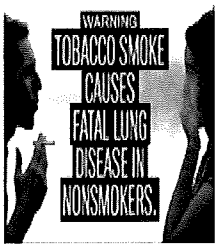
Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Man in casket	0.357	(0.543)	0.702	(0.198)	1.539	(0.237)
Man w/chest staples	0.882	(0.133)	0.314	(0.564)	2.428*	(0.012)
Red coffin w/body in black	0.029	(0.960)	0.255	(0.637)	1.901	(0.070)
Cigarettes = RIP	0.011	(0.986)	0.341	(0.534)	1.567	(0.213)
Observations	540		540		540	
Young Adult						
Man in casket	−0.248	(0.687)	−0.324	(0.575)	1.275	(0.451)
Man w/chest staples	0.355	(0.567)	−0.239	(0.681)	0.892	(0.727)
Red coffin w/body in black	−1.030	(0.099)	−0.805	(0.171)	0.768	(0.426)
Cigarettes = RIP	−1.087	(0.082)	−0.801	(0.172)	1.363	(0.345)
Observations	508		507		508	
Youth						
Man in casket	0.821	(0.186)	0.683	(0.247)	0.666	(0.174)
Man w/chest staples	1.221	(0.051)	0.505	(0.394)	0.892	(0.709)
Red coffin w/body in black	1.090	(0.080)	0.317	(0.591)	0.837	(0.559)
Cigarettes = RIP	1.073	(0.085)	0.613	(0.300)	0.676	(0.192)
Observations	511		511		511	
Adult Ad						
Man in casket	1.492**	(0.009)	0.892	(0.096)	1.218	(0.590)
Man w/chest staples	0.270	(0.632)	0.163	(0.759)	1.312	(0.457)
Red coffin w/body in black	1.303*	(0.022)	0.775	(0.148)	1.072	(0.850)
Cigarettes = RIP	1.544**	(0.007)	0.779	(0.146)	1.822	(0.099)
Observations	516		516		516	

Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

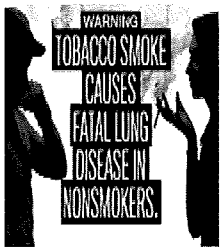
A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., higher score on the emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

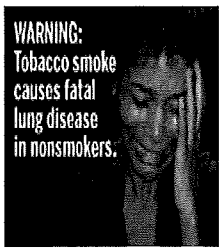
3.9 Warning Statement 8: Tobacco Smoke Causes Fatal Lung Disease in Nonsmokers



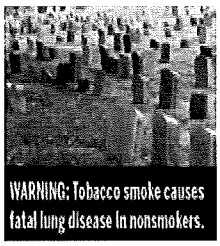
Man Smoke at Woman



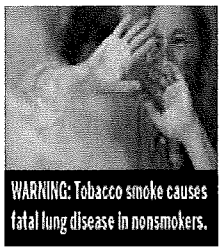
Woman Smoke at Man



Woman Crying



Graveyard



Man Hands Up & Smoke

3.9.1 Emotional and Cognitive Reactions

All five warning images elicited higher scores on the emotional reaction scale from adults, young adults, and youth compared with the control group (see Table 3-16). In the adult pack sample, only Man Smoke at Woman and Woman Crying elicited higher scores on the cognitive scale compared with the control group.

Man Smoke at Woman, Woman Smoke at Man, Woman Crying, and Graveyard evoked stronger responses to the reaction item "the pack was difficult to look at" from youth compared with the control group. Woman Crying and Man Smoke at Woman elicited stronger responses to this item from young adults, and Woman Smoke at Man and Woman Crying elicited stronger responses from adults.

3.9.2 Recall of Warning Statements and Images at Baseline and Follow-up

Graveyard elicited lower correct recall of the warning statement at baseline by adults and at follow-up by young adults compared with the control group. In contrast, Woman Smoke at Man elicited higher correct recall of the warning statement at follow-up by adults compared with the control group. Woman Smoke at Man, Woman Crying, and Graveyard prompted lower correct recall of the warning statement at baseline by youth compared with the control group.

Woman Crying elicited higher correct recall of the warning image at baseline and follow-up than Man Hands Up & Smoke (the referent image) by adults, young adults, and youth. In contrast, Man Smoke at Woman and Woman Smoke at Man elicited lower correct recall of the warning image at baseline than Man Hands Up & Smoke by adults.

3.9.3 Influences on Beliefs

Man Smoke at Woman, Woman Crying, and Graveyard were positively associated with beliefs that regular smokers are at risk for various health consequences of smoking for young adults compared with controls (see Table 3-17).

3.9.4 Behavioral Responses

Woman Smoke at Man was significantly associated with quit intentions for young adults compared with the control group (see Table 3-17).

3.9.5 Adult Advertisement Study

In the adult ad sample, Woman Crying, Graveyard, and Man Hands Up & Smoke all received higher scores on the emotional reaction scale. Woman Crying and Graveyard also received higher scores on the cognitive reaction scale. Those who viewed Woman Crying and Man Smoke at Woman were more likely than controls to report that the pack was difficult to look at (see Table 3-16).

Woman Smoke at Man elicited higher correct recall of the warning statement at follow-up compared with the control group. Woman Crying prompted higher correct recall of the warning image at baseline than Man Hands Up & Smoke (the referent image).

None of the warning images were significantly associated with belief scales or quit intentions in the adult ad sample (see Table 3-17).

Table 3-16. Emotional and Cognitive Reactions and Recall for Warning Statement 8

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Man smoke at woman	2.134**	(0.001)	1.202*	(0.047)	1.465	(0.320)	1.048	(0.867)	1.488	(0.246)	0.532*	(0.030)	1.623	(0.169)
Woman Smoke at Man	2.682***	(0.000)	0.659	(0.277)	2.885**	(0.003)	0.868	(0.610)	2.260*	(0.024)	0.283***	(0.000)	0.513	(0.054)
Woman crying	3.465***	(0.000)	1.384*	(0.023)	2.848**	(0.004)	1.061	(0.835)	1.241	(0.532)	2.627**	(0.006)	3.241**	(0.004)
Graveyard	2.061**	(0.002)	0.502	(0.412)	0.983	(0.965)	0.503*	(0.014)	0.684	(0.269)	0.749	(0.335)	1.438	(0.317)
Man hands up & smoke	1.473*	(0.027)	0.366	(0.545)	1.668	(0.169)	1.052	(0.857)	1.508	(0.234)	Ref.	Ref.	Ref.	Ref.
Observations	649		650		650		650		450		541		378	
Young Adult														
Man smoke at woman	2.698***	(0.000)	N/A	N/A	2.249*	(0.028)	1.381	(0.278)	1.336	(0.443)	1.395	(0.333)	1.002	(0.996)
Woman Smoke at Man	2.694***	(0.000)	N/A	N/A	2.050	(0.052)	1.300	(0.375)	1.352	(0.407)	0.753	(0.380)	0.716	(0.413)
Woman crying	3.798***	(0.000)	N/A	N/A	5.290***	(0.000)	0.672	(0.166)	0.568	(0.113)	4.942***	(0.000)	6.007**	(0.007)
Graveyard	1.933**	(0.007)	N/A	N/A	1.371	(0.412)	0.700	(0.219)	0.482*	(0.039)	0.942	(0.855)	0.618	(0.225)
Man hands up & smoke	1.901**	(0.008)	N/A	N/A	1.462	(0.323)	0.943	(0.841)	0.864	(0.684)	Ref.	Ref.	Ref.	Ref.
Observations	612		N/A	N/A	612		612		424		509		355	
Youth														
Man smoke at woman	1.958**	(0.003)	N/A	N/A	3.264*	(0.017)	0.883	(0.679)	1.003	(0.995)	1.075	(0.823)	1.090	(0.851)
Woman Smoke at Man	2.164**	(0.001)	N/A	N/A	2.956*	(0.031)	0.553*	(0.045)	1.179	(0.694)	0.620	(0.118)	0.643	(0.327)
Woman crying	3.563***	(0.000)	N/A	N/A	12.106***	(0.000)	0.476*	(0.012)	0.628	(0.242)	2.726**	(0.009)	8.667**	(0.006)
Graveyard	2.363***	(0.000)	N/A	N/A	5.600***	(0.000)	0.525*	(0.029)	0.634	(0.253)	0.862	(0.640)	1.042	(0.930)
Man hands up & smoke	1.580*	(0.016)	N/A	N/A	2.492	(0.075)	0.608	(0.093)	0.835	(0.651)	Ref.	Ref.	Ref.	Ref.
Observations	612		N/A	N/A	612		612		329		509		272	
Adult Ad														
Man smoke at woman	1.266	(0.055)	1.000	(0.103)	4.948**	(0.001)	0.919	(0.790)	1.116	(0.763)	0.916	(0.824)	1.040	(0.928)
Woman Smoke at Man	0.929	(0.155)	0.774	(0.202)	1.750	(0.300)	0.728	(0.306)	2.403*	(0.027)	1.432	(0.396)	0.793	(0.567)
Woman crying	2.840***	(0.000)	1.709**	(0.005)	9.107***	(0.000)	0.705	(0.259)	0.752	(0.408)	2.641*	(0.046)	1.604	(0.299)
Graveyard	2.674***	(0.000)	2.640***	(0.000)	2.702	(0.051)	0.616	(0.115)	0.681	(0.276)	1.054	(0.895)	0.951	(0.906)
Man hands up & smoke	1.713**	(0.009)	0.651	(0.282)	1.724	(0.312)	0.674	(0.197)	1.155	(0.687)	Ref.	Ref.	Ref.	Ref.
Observations	618		619		619		619		483		517		406	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., higher score on the emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-17. Influences on Beliefs and Behavior for Warning Statement 8

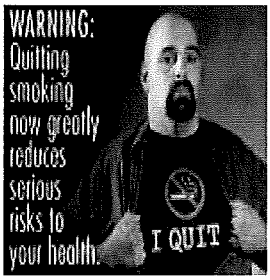
Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Man smoke at woman	−0.016	(0.978)	0.402	(0.456)	0.866	(0.695)
Woman Smoke at Man	0.395	(0.487)	0.069	(0.899)	1.056	(0.880)
Woman crying	0.243	(0.671)	0.738	(0.175)	1.222	(0.572)
Graveyard	0.464	(0.419)	0.527	(0.335)	1.071	(0.849)
Man hands up & smoke	0.463	(0.414)	0.337	(0.532)	1.057	(0.874)
Observations	650		650		650	
Young Adult						
Man smoke at woman	1.301*	(0.043)	0.228	(0.695)	1.704	(0.111)
Woman Smoke at Man	0.923	(0.149)	−0.006	(0.992)	1.995*	(0.039)
Woman crying	1.290*	(0.042)	0.234	(0.684)	1.871	(0.059)
Graveyard	1.301*	(0.042)	0.927	(0.111)	1.779	(0.082)
Man hands up & smoke	−0.051	(0.936)	0.041	(0.944)	1.501	(0.224)
Observations	612		612		612	
Youth						
Man smoke at woman	−0.579	(0.327)	−0.328	(0.557)	0.907	(0.743)
Woman Smoke at Man	−0.613	(0.301)	−0.097	(0.862)	0.892	(0.702)
Woman crying	0.513	(0.386)	0.896	(0.109)	1.184	(0.578)
Graveyard	−0.031	(0.958)	0.551	(0.325)	0.949	(0.862)
Man hands up & smoke	−0.362	(0.540)	−0.037	(0.947)	0.979	(0.943)
Observations	612		612		612	
Adult Ad						
Man smoke at woman	−0.053	(0.927)	0.752	(0.161)	1.142	(0.704)
Woman Smoke at Man	0.204	(0.721)	0.574	(0.281)	0.963	(0.915)
Woman crying	−0.115	(0.842)	0.939	(0.079)	1.214	(0.579)
Graveyard	0.673	(0.241)	0.922	(0.084)	0.816	(0.573)
Man hands up & smoke	0.315	(0.582)	0.622	(0.242)	1.085	(0.818)
Observations	619		619		619	

Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

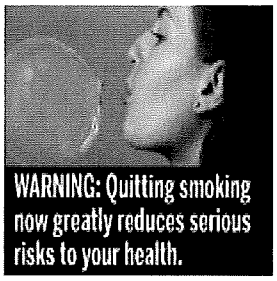
A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., higher score on the emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

3.10 Warning Statement 9: Quitting Smoking Now Greatly Reduces Serious Risk to Your Health



Man I Quit T-shirt



Woman Blowing Bubble

Cigarettes in Toilet Bowl

3.10.1 Emotional and Cognitive Reactions

Cigarettes in Toilet Bowl elicited higher scores on the emotional reaction scale from adults and young adults compared with the control group (see Table 3-18). Among young adults, Man I Quit T-Shirt elicited higher emotional scale scores than controls.

Cigarettes in Toilet Bowl and Man I Quit T-shirt elicited higher scores on the cognitive reaction scale from adults, young adults, and youth compared with controls. Among youth, Woman Blowing Bubble also elicited higher scores on the cognitive reaction scale compared with the control group. None of the warning images were rated as difficult to look at compared to controls.

3.10.2 Recall of Warning Statements and Images at Baseline and Follow-up

Cigarettes in Toilet Bowl elicited higher correct recall of the warning statement at follow-up for youth compared with controls (see Table 3-18). Man I Quit T-shirt and Woman Blowing Bubble prompted higher correct recall of the warning image at baseline and follow-up compared with Cigarettes in Toilet Bowl (the referent image) for adults, young adults, and youth.

3.10.3 Influences on Beliefs

Cigarettes in Toilet Bowl was positively associated with beliefs about the health risks of smoking to regular smokers compared with controls among young adults (see Table 3-19). Among youth, Woman Blowing Bubble was negatively associated with beliefs about the health risks of smoking to both smokers and nonsmokers (e.g., less like to believe that smokers and nonsmokers exposed to secondhand smoke will get lung cancer, heart disease).

3.10.4 Behavioral Responses

None of the warning images were significantly associated with quit intentions (for adults and young adults) or the likelihood of smoking 1 year from now (for youth) compared with the control group (see Table 3-19).

3.10.5 Adult Advertisement Study

Cigarettes in Toilet Bowl elicited significantly higher scores on the cognitive reaction scale compared with controls (see Table 3-18). Man I Quit T-shirt elicited higher correct recall of the warning image at baseline than Cigarettes in Toilet Bowl (the referent image). Woman Blowing Bubble was negatively associated with quit intentions for adults and young adults compared with the control group (i.e., respondents exposed to Woman Blowing Bubble were less likely than the control group to express intentions to quit smoking in the next 30 days) (see Table 3-19).

Table 3-18. Emotional and Cognitive Reactions and Recall for Warning Statement 9

Sample/image	Emotional reaction scale		Cognitive reaction scale		The pack was difficult to look at		Recall of correct warning statement		Recall of correct warning statement (Follow-up)		Recall of correct image		Recall of correct image (Follow-up)	
Adult Pack	ß		ß		OR		OR		OR		OR		OR	
Man I quit T-shirt	0.920	(0.097)	1.310*	(0.023)	1.594	(0.287)	1.465	(0.279)	1.282	(0.497)	12.504***	(0.000)	20.319***	(0.000)
Woman blowing bubble	0.587	(0.290)	0.207	(0.719)	1.077	(0.872)	1.308	(0.441)	2.083	(0.063)	2.083*	(0.011)	4.945***	(0.000)
Cigarettes in toilet bowl	1.376*	(0.014)	2.189***	(0.000)	1.982	(0.110)	1.017	(0.960)	1.727	(0.159)	Ref.	Ref.	Ref.	Ref.
Observations	430		430		430		430		322		323		236	
Young Adult														
Man I quit T-shirt	1.643*	(0.010)	1.633**	(0.005)	1.460	(0.301)	1.386	(0.398)	0.676	(0.354)	13.515***	(0.000)	15.469***	(0.000)
Woman blowing bubble	−0.077	(0.903)	−0.110	(0.847)	1.219	(0.596)	1.308	(0.484)	0.785	(0.576)	4.757***	(0.000)	4.246**	(0.001)
Cigarettes in toilet bowl	1.471*	(0.020)	2.065***	(0.000)	0.785	(0.536)	1.833	(0.130)	1.735	(0.237)	Ref.	Ref.	Ref.	Ref.
Observations	405		405		393		393		285		305		215	
Youth														
Man I quit T-shirt	0.043	(0.942)	2.323***	(0.000)	1.258	(0.570)	1.173	(0.690)	1.340	(0.459)	16.420***	(0.000)	15.964***	(0.000)
Woman blowing bubble	−0.168	(0.779)	1.546**	(0.004)	1.024	(0.956)	0.855	(0.684)	1.828	(0.168)	2.372**	(0.003)	7.335***	(0.000)
Cigarettes in toilet bowl	0.087	(0.885)	3.223***	(0.000)	1.185	(0.680)	1.126	(0.767)	3.067*	(0.023)	Ref.	Ref.	Ref.	Ref.
Observations	409		409		409		409		234		306		170	
Adult Ad														
Man I quit T-shirt	−0.207	(0.690)	0.593	(0.321)	1.385	(0.629)	0.699	(0.289)	0.450	(0.067)	3.797**	(0.008)	1.788	(0.167)
Woman blowing bubble	0.049	(0.925)	0.364	(0.542)	2.594	(0.125)	1.235	(0.559)	0.723	(0.487)	1.122	(0.765)	0.987	(0.974)
Cigarettes in toilet bowl	0.989	(0.059)	1.275*	(0.034)	1.549	(0.513)	1.541	(0.253)	0.880	(0.783)	Ref.	Ref.	Ref.	Ref.
Observations	409		409		389		409		314		305		241	

Notes: Ref = referent image; p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

Table 3-19. Influences on Beliefs and Behavior for Warning Statement 9

Sample/image	Beliefs about health risks to regular smokers (scale)		Beliefs about health risks of secondhand smoke exposure to nonsmokers (scale)		How likely do you think it is that you will try to quit smoking within the next 30 days (adults/young adults)/... be smoking 1 year from now (youth)	
Adult Pack	**ß**		**ß**		**OR**	
Man I quit T-shirt	0.476	(0.423)	0.229	(0.664)	1.234	(0.555)
Woman blowing bubble	0.807	(0.175)	0.431	(0.415)	1.544	(0.223)
Cigarettes in toilet bowl	−0.108	(0.856)	−0.413	(0.437)	1.319	(0.439)
Observations	430		430		430	
Young Adult						
Man I quit T-shirt	0.808	(0.194)	0.352	(0.549)	1.277	(0.466)
Woman blowing bubble	−0.443	(0.471)	−0.564	(0.332)	1.217	(0.555)
Cigarettes in toilet bowl	1.350*	(0.028)	0.974	(0.094)	1.209	(0.573)
Observations	405		405		405	
Youth						
Man I quit T-shirt	−0.599	(0.319)	−0.187	(0.736)	0.985	(0.959)
Woman blowing bubble	−1.331*	(0.028)	−1.172*	(0.037)	0.969	(0.917)
Cigarettes in toilet bowl	0.062	(0.919)	0.547	(0.330)	1.130	(0.689)
Observations	409		409		409	
Adult Ad						
Man I quit T-shirt	0.190	(0.747)	0.239	(0.672)	0.814	(0.562)
Woman blowing bubble	0.333	(0.573)	0.173	(0.759)	0.476*	(0.049)
Cigarettes in toilet bowl	0.872	(0.142)	−0.055	(0.923)	1.273	(0.498)
Observations	409		409		409	

Notes: p value in parentheses; *Significant at $p < 0.05$; **Significant at $p < 0.01$; ***Significant at $p < 0.001$.

A higher value on ß indicates that exposure to the warning image is associated with a higher score on the outcome variable (e.g., higher score on the emotional reaction scale) compared with the value of the outcome for control participants.

An odds ratio (OR) greater than 1 indicates that those exposed to the warning image were more likely to have experienced the outcome (have a 1 on the outcome) than control participants. An OR less than 1 means that those exposed to the warning image were less likely to have experienced the outcome (less likely to have a 1 on the outcome) than control participants.

4. DISCUSSION

This report highlights results of an experiment to assess the relative efficacy of graphic cigarette warning labels created for each of nine warning statements required by the Tobacco Control Act. This was accomplished by randomly selecting study participants to be exposed to a cigarette package with either one of the nine warning statements with a corresponding warning image (treatment group) or only the warning statement similar to the current standard warning statement (control group). The outcomes we examined to assess relative efficacy were selected based on theories of message processing and health behavior change. These theories suggest that immediate emotional and cognitive reactions to and recall of messages are part of a process that eventually leads to changes in beliefs and intentions and ultimately behavior change. The specific measures of beliefs and intentions were selected to assess the relative effectiveness of the graphic warning labels at conveying information about the various health risks of smoking and at encouraging smoking cessation and discouraging smoking initiation. We report a set of outcomes intended to gauge whether these warning statements and images might meet those goals.

4.1 Emotional and Cognitive Reactions

Most of the warning images elicited strong emotional and cognitive responses compared with controls. This is significant because the literature suggests that such responses are likely to be related to behavior change (Dillard, Weber, & Vail, 2007).

Given that most warning images elicited strong emotional and cognitive responses in all samples, those images that did not elicit strong reactions in some samples are worth noting:

- Warning 1: Woman in Rain
- Warning 4: White Cigarette Burning
- Warning 5: Man with Hand on Chest
- Warning 7: Man in Casket, Red Coffin with Body in Black
- Warning 8: Man Blowing Smoke at Woman, Woman Blowing Smoke at Worker, Graveyard, and Man Hands Up & Smoke
- Warning 9: Man I Quit T-shirt, Woman Blowing Bubble, and Cigarettes in Toilet Bowl

It is possible that the reaction items are less salient for warning statement 9, which focuses on the benefits of quitting versus the risks of smoking. Perhaps images associated with such a statement are less likely to elicit strong emotional reactions. It is not clear whether to expect a strong reaction on the cognitive scale for such a statement, although one would expect that items related to meaningfulness or how informative this warning statement is would be salient. Thus, it is not surprising that the images for warning statement 9 have

relatively low scores on the emotional reaction scale and that the scores on the cognitive reaction scale are higher.

Consistent with evidence from research on smoking cessation advertisements (Biener et al., 2000; Durkin, Biener, & Wakefield, 2009; Durkin & Wakefield, 2009) and an emerging literature examining graphic warning labels (e.g., Hammond et al., 2004, 2006; Leshner, Bolls, & Thomas, 2009), our results suggest that cigarette warning labels that are most graphic (e.g., Hole in Throat, Healthy/Diseased Lungs) or emotional (e.g., Girl Crying or Woman Crying) elicit the strongest emotional reactions. These same graphic warning labels also are more likely to be rated as difficult to look at compared to the control groups. The literature also suggests that images that evoke the strongest graphic or emotional responses are likely to be most effective in promoting increased awareness of the warnings of the health risks of smoking and in turn promoting behavior change (e.g., Hammond et al., 2004) although there remains debate about this (e.g., Biener & Taylor, 2002; Hastings & MacFadyen, 2002).

Also, with the exception of warning statement 9, there is more differentiation across cigarette warning labels on the emotional scale than the cognitive scale.

4.2 Recall

Recall is another important measure because if a graphic warning label is not remembered, then it is unlikely to have a lasting impact. Recall of warning statements and images at baseline (immediate) and at the 1-week follow-up were relatively high. For most warning statements and images, recall was above 70% even at the 1-week follow-up. The following warning images were associated with an increased likelihood of correct recall of warning statements at follow-up relative to controls in at least one sample (i.e., adult pack, adult advertisement, young adult, or youth):

- Warning 1: Red Puppet, Hole in Throat
- Warning 2: Girl Crying, Smoke at Baby, Warning in Child Lettering
- Warning 3: Lungs Full of Cigarettes, Dr. with X-ray
- Warning 5: Red Lightning with Heart, Man with Hand on Chest
- Warning 6: Pacifier & Ashtray, Baby in Incubator
- Warning 8: Woman Smoke at Man, Woman Crying
- Warning 9: Cigarettes in Toilet Bowl

The following warning images were associated with lower correct recall of warning statements at follow-up relative to controls in at least one sample:

- Warning 4: Deathly Ill Woman, Red Cigarette Burning, and Cancerous Lesion on Lip
- Warning 7: Man with Chest Staples

4.3 Communicate Health Risks of Smoking

A number of warning images had a significant impact on beliefs about the health risks of smoking to regular smokers and in some cases on beliefs about the health risks of secondhand smoke exposure to nonsmokers relative to no image (control condition).

The following warning images elicited higher ratings about the health risks of smoking compared with no image (control condition) as measured by the belief scales in at least one sample:

- Warning 1: Cigarette Injection (smoking risks), Hole in Throat (smoking and secondhand smoke risks), Woman in Rain (smoking risks)
- Warning 4: Cancerous Lesion on Lip (smoking and secondhand smoke risks)
- Warning 6: Pacifier & Ashtray (smoking risks), Baby in Incubator (smoking risks)
- Warning 7: Man in Casket (smoking risks), Red Coffin with Body in Black (smoking risks), Cigarettes = RIP (smoking risks) (significant results in the adult ad sample)
- Warning 8: Man Smoke at Woman (smoking risks), Woman Crying (smoking risks), Graveyard (smoking risks)
- Warning 9: Cigarettes in Toilet Bowl (smoking risks)

The following warning images elicited lower ratings about the health risks of smoking compared with no image (control condition) as measured by the belief scales in at least one sample:

- Warning 2: Girl Crying (secondhand smoke risks), Girl with Oxygen Mask (secondhand smoke risks)
- Warning 3: Dr. with X-ray (secondhand smoke risks)
- Warning 6: Baby in Incubator (smoking risks: negative in youth sample)
- Warning 9: Woman Blowing Bubble (smoking and secondhand smoke risks)

4.4 Encourage Smoking Cessation and Discourage Youth Smoking

To assess the impact on cessation, we used a measure of intentions to quit: "How likely do you think it is that you will try to quit in the next month?" We do not find strong evidence that the warning labels tested in this experiment had much of an impact on this measure of cessation.

The following warning images were positively associated with quit intentions in at least one sample:

- Warning 1: Cigarette Injection
- Warning 7: Man with Staples in Chest
- Warning 8: Woman Smoke at Man

The following warning images were negatively associated with quit intentions in at least one sample:

- Warning 2: Smoke at Baby
- Warning 5: Hand with Oxygen
- Warning 9: Woman Blowing Bubble

For youth, we used a measure of how likely the youth felt they were to be smoking 1 year from now as a measure of the impact of viewing the warning images on potential initiation. We did not find much evidence for an impact of the warning labels on this outcome.

The following warning images were associated with youth reporting being less likely to be smoking 1 year from now:

- Warning 2: Girl Crying, Smoke Approaching Baby

The following warning images were associated with youth reporting being more likely to be smoking 1 year from now:

- Warning 4: Red Cigarette Burning

The graphic cigarette warning labels did not elicit strong responses in terms of intentions related to cessation or initiation. One possibility is that the observation period is too short to see any change in these types of outcomes. In a model of behavior change, exposure to a stimulus is posited to elicit an initial reaction and recall, which then results in changes in attitudes and beliefs followed by changes in intentions and then eventually behaviors (see Section 1.2). However, the time-scale on which this process occurs as well as the relative importance of each step in the process is not well-known.

Another possibility is that the "dose" is simply too small (Hornik, 2002). We do not know the dose required to elicit a response in intentions or behavior. The results do suggest that our dose was sufficient to elicit emotional and cognitive responses and some beliefs.

Responses vary somewhat by the age of the sample, suggesting that a one size fits all strategy for the graphic warning labels might not be optimal: what works best for one group might not be best for other groups.

4.5 Limitations

Measuring health behaviors and attitudes and beliefs related to smoking is an inexact science. The same is true, maybe even more so, for measuring emotional and cognitive reactions to warning images. There is also much uncertainty about how these shorter-term outcomes are related to the longer-term outcomes that are of most interest.

Given the time limitations of the research, we exposed participants to a single viewing of the graphic warning labels, which may not have been sufficient to elicit behavior changes

compared to controls. This design also does not allow for assessment of the effect that repetitive viewing of the graphic warning labels may have on recall or other outcomes. Once these graphic warning labels are on packs of cigarettes in the market, exposure will be more extensive. Time constraints prevented us from designing a longitudinal experiment involving repeated exposures and testing for dosing differences.

Small sample sizes for populations of interest (e.g., African Americans, Latinos, lower income or lower educational status) prevented us from obtaining precise parameter estimates for these populations, making it difficult to assess differences in efficacy of the warning labels across these groups. Time constraints prevented us from attempting to recruit additional members of some populations of interest. To increase the representation for these groups would have involved sending reminders to those who initially refused to participate (which has a slower response rate) or sending invites to potential respondents within these groups who had not answered the smoking interest question. The qualifying rate in this context would thus be much lower than originally assumed for the study. The time frame available for this study simply did not allow for such efforts to recruit additional members of these groups.

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