Original investigation

Potential Effectiveness of Pictorial Warning Labels That Feature the Images and Personal Details of Real People

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Abstract

Introduction: Pictorial warning labels (PWL) that use photographs and the personal details of real people whose health has been affected by smoking (*testimonial PWL*) provide factual information about the consequences of tobacco use.

Methods: Nine hundred and twenty-four adult current smokers participated in an online experiment that tested responses to four types of warning labels: (1) *non-testimonial text warning labels* (currently on packs in the United States); (2) *non-testimonial PWL* (previously proposed by the United States Food and Drug Administration); (3) *image only testimonial PWL* (created for study); (4) *image + personal details testimonial PWL* (created for study). Participants were randomly assigned to condition and then exposed to up to five warning labels addressing different health effects. Differences between conditions were assessed using emotional responses and a set of intention measures immediately following exposure, and self-reported behavior change at 5-week follow-up.

Results: Compared to the *non-testimonial text warning labels*, all PWL elicited stronger emotional responses and intentions to forgo cigarettes and avoid the warning labels. *Non-testimonial PWL* and *image + personal details testimonial PWL* elicited stronger intentions to quit, whereas *image only testimonial PWL* generated a greater amount of quitting activity in the weeks following exposure. There were no significant differences in responses when comparing the *non-testimonial PWL* with both types of *testimonial PWL*.

Conclusions: PWL that use images of real people convey factual information about the health effects of tobacco use. These *testimonial PWL* may be a promising alternative to the images previously proposed for use on PWL in the United States.

Implications: In the United States, the PWL developed by the Food and Drug Administration (FDA) in 2011 were found by the courts to be unconstitutional, in part because they were deemed to present an opinion rather than fact. Findings from this experimental study indicate that PWL that use the images and personal details of real people to convey factual information about the health effects of tobacco use may satisfy the FDA's requirement for a set of PWL that (1) have the potential to positively impact the determinants of smoking cessation behavior, (2) meet legislative requirements under the Family Smoking Prevention and Tobacco Control Act and (3) may be more acceptable to the courts than the previously proposed and now dismissed PWL that carried non-factual images.

Introduction

In 2009, the US Family Smoking Prevention and Tobacco Control Act (FSPTCA) mandated the Food and Drug Administration (FDA) to create nine color pictorial warning labels (PWL), which were to replace the text-only warning labels that had appeared on cigarette packs in the United States since 1984.[1] Consistent with standards recommended by the World Health Organization's Framework Convention on Tobacco Control,[2] the PWL were to cover 50% of the front and back of the pack with a prescribed textual warning statement and a color image depicting the negative health consequences of smoking.[1] In June 2011, FDA issued its final rule specifying the set of nine PWL. However, these PWL were quickly subject to legal challenges from the tobacco industry, culminating in a ruling from the US Court of Appeals for the DC Circuit that the PWL were unconstitutional because they limited tobacco companies' right to freedom of speech.[3] Rather than challenge this decision, FDA withdrew the proposed PWL and announced their intention to generate a new set of PWL following additional research.[4]

Scholars have analyzed the previous court rulings for insights into the label elements that, if modified, may help to minimize how vulnerable FDA's next iteration of PWL are to similar legal challenges.[5–8] One consideration is the extent to which the labels are judged to present factual information versus an opinion, an issue on which the courts disagreed when reviewing the FDA's original PWL.[5,6] For instance, in the case of "Discount Tobacco City & Lottery Inc. v. United States"[9] in the court of the Sixth Circuit, the PWL were deemed factual and accurate, and consequently, were subject to the most lenient form of legal review and were upheld.[6] By comparison, when the Court of Appeals for the DC Circuit decided that the PWL were not purely factual but were intended to evoke an emotional response ("R.J. Reynolds Tobacco Co. v. FDA"[10]), a stricter form of review was applied, and the evidence required to defend the policy was beyond that currently available to the FDA.[6] Kraemer and Baig[5] have therefore argued that it is critical that the images used in the next iteration of PWL are deemed to present factual information rather than an opinion. One way to achieve this may be to use photographs that accurately represent the health consequences of smoking.[5,6] In the current study we test the potential effectiveness of a set of PWL that feature photographs of real people whose health has been affected by smoking, which we call "testimonial PWL." We propose that these photographs comprise factual information, and so may be more amenable to the courts than were the images originally used by FDA, which included created or staged photographs of people whose health or wellbeing had been affected by their own or others' smoking, simulations of diseased body parts, and animations (see[5]).

Testimonial (or narrative) messages have been the subject of considerable recent attention from health communication scholars, who have aimed to document and explain the persuasive benefits associated with such messages. Two recent meta-analyses have confirmed that narratives can have persuasive effects on attitudes, intentions, and behaviors,[11,12] due to their ability to garner attention and facilitate comprehension by illustrating the potential consequences of an event or behavior to the audience (as per exemplification theory[13–15]), or to transport audiences into the world of the narrative, thereby reducing counterarguing and increasing emotional responding (as per transportation theory[16,17]). In other domains of tobacco control communications, such as television advertisements[18–20] and newspaper articles,[21] there is evidence that personal testimonials can be particularly effective in certain circumstances, such as when encouraging smokers of lower socioeconomic status to call a quitting helpline.[18] However, past research has produced more mixed evidence regarding the potential effectiveness of testimonial warning labels, with some indication that effects may depend on the amount of testimonial information presented. Using measures of perceived effectiveness, credibility, and relevance, a handful of studies have shown that images depicting the "lived experiences" of the sufferers of tobacco-related illnesses do not perform as well as images depicting diseased organs and body parts,[22–26] although the use of "lived experiences" images can still confer some benefit over alternatives such as symbolic images.[22,23,27] In one of these studies, PWL were most effective when the image was accompanied by a textual message that took a didactic rather than testimonial form,[24] whereas another study found that effectiveness was increased by the addition of a brief narrative statement that provided the name, age, and a quote from the person in the image.[25]

In the current study, we use the term *testimonial PWL* to indicate that the label features just the image, or image and personal details of a real person, whereas *non-testimonial PWL* are those that contain created or staged images. Although other definitions of "testimonial" have previously been used,[24,25] we believe this term captures the essence of what is communicated by these warning labels: one person's testimony (in visual and/or visual plus textual format) of their experience with the health consequences of tobacco use. Specifically, we tested the effectiveness of two types of *testimonial PWL*. The *image only testimonial PWL* contained only the image of the real person whose health had been affected by smoking. Importantly, these PWL were designed to be compliant with the formatting requirements specified under the FSPTCA.[1] By comparison, the *image + personal details testimonial PWL* supplemented the image with a brief statement providing the person's name, age, and health status. Although these PWL are not entirely compliant with the FSPTCA, the addition of a testimonial statement was found to enhance effectiveness in the study by Hammond and colleagues,[25] and it may be that such information is required to clearly convey the factual nature of these images. Given that our objective was to support the FDA in their search for alternative PWL that (1) have the potential to positively impact the determinants of smoking cessation behavior, (2) meet legislative requirements under the FSPTCA and (3) may be more acceptable to the courts than the previously proposed and now dismissed *non-testimonial PWL*, our primary aim was to test whether both types of *testimonial PWL* were more effective than the *non-testimonial text warning labels (TWL)* that currently appear on packs in the United States, and were at least as effective as the *non-testimonial PWL* that were originally proposed by the FDA.

Method

Sample

In October–December 2014, participants were recruited through Survey Sampling International's (SSI) US panel.[28] SSI's panel is comprised of individuals who voluntarily opt-in to be a member of the panel and receive small financial incentives for completing surveys. Prospective panel members are sourced using online banners, invitations, and messages on online communities, social networks and websites of all types, but are then subject to rigorous quality controls before being added to the panel.[28] As with other non-probability online panels, the SSI panel cannot be considered representative of the population, and so we do not suggest our parameter estimates represent the national population statistically. However, the patterns

of responses observed in this large and varied sample are expected to reflect those in the population to a meaningful extent.

Eligible participants were 18–60 year old current smokers who had smoked at least 100 cigarettes and had completed fewer than three online surveys about cigarette smoking or other tobacco products in the past 3 months. As part of a larger experimental study, 3055 participants were randomly assigned to one of 17 experimental conditions. However, only four of these conditions were relevant to the current study, and so the sample is limited to the N = 924 participants randomized to one of those conditions.

Stimuli

For each experimental condition, we created five warning labels with five different "themes," meaning they each focused on a different health effect of tobacco use (Table 1). Given that our primary objective was to provide evidence pertinent to the situation in the United States, the five themes were based on five of the nine warning statements prescribed in the FSPTCA[1]: "Smoking can kill you"; "Cigarettes cause fatal lung disease"; "Cigarettes cause stroke and health disease"; "Cigarettes are addictive"; and "Tobacco smoke causes fatal lung disease in nonsmokers."

To create the testimonial PWLs, we searched for case studies of individuals whose health had been affected in the way described by each theme. Images and stories of these case studies were sourced and used with permission from the US Center for Disease Control and Prevention's Tips From Former Smokers mass media campaign (Terrie, Roosevelt, and Nathan) and with permission from Health Canada (Lena and Barb). For each theme, we created two types of testimonial PWL, one which featured just an image of the person (*image only testimonial PWL*) and one which featured an image plus a brief statement providing the person's name, age, and health status (*image + personal details testimonial PWL*). Both types of *testimonial PWL* also carried the mandatory warning statement.

To create warning labels for the *non-testimonial PWL* condition, we paired the five mandatory warning statements with the non-testimonial image used by the FDA (see[5]). The *non-testimonial PWL* used in our study differed from those proposed by the FDA only in that the format of the warning statement was standardized across themes, and the warning labels did not carry the 1-800-QUIT-NOW phone number.

Stimuli in the *non-testimonial TWL* condition comprised the four text warning statements that currently appear on cigarette packets in the United States. The content of these statements does not match the five themes used in the other two conditions, but this condition represents the warnings currently encountered by smokers.

As shown in Supplementary Appendix A, for each warning label, participants saw a static image of a front-of-pack view, a back-of-pack view, and a side-of-pack view. Supplementary Appendix A also details the text that appeared on each warning label.
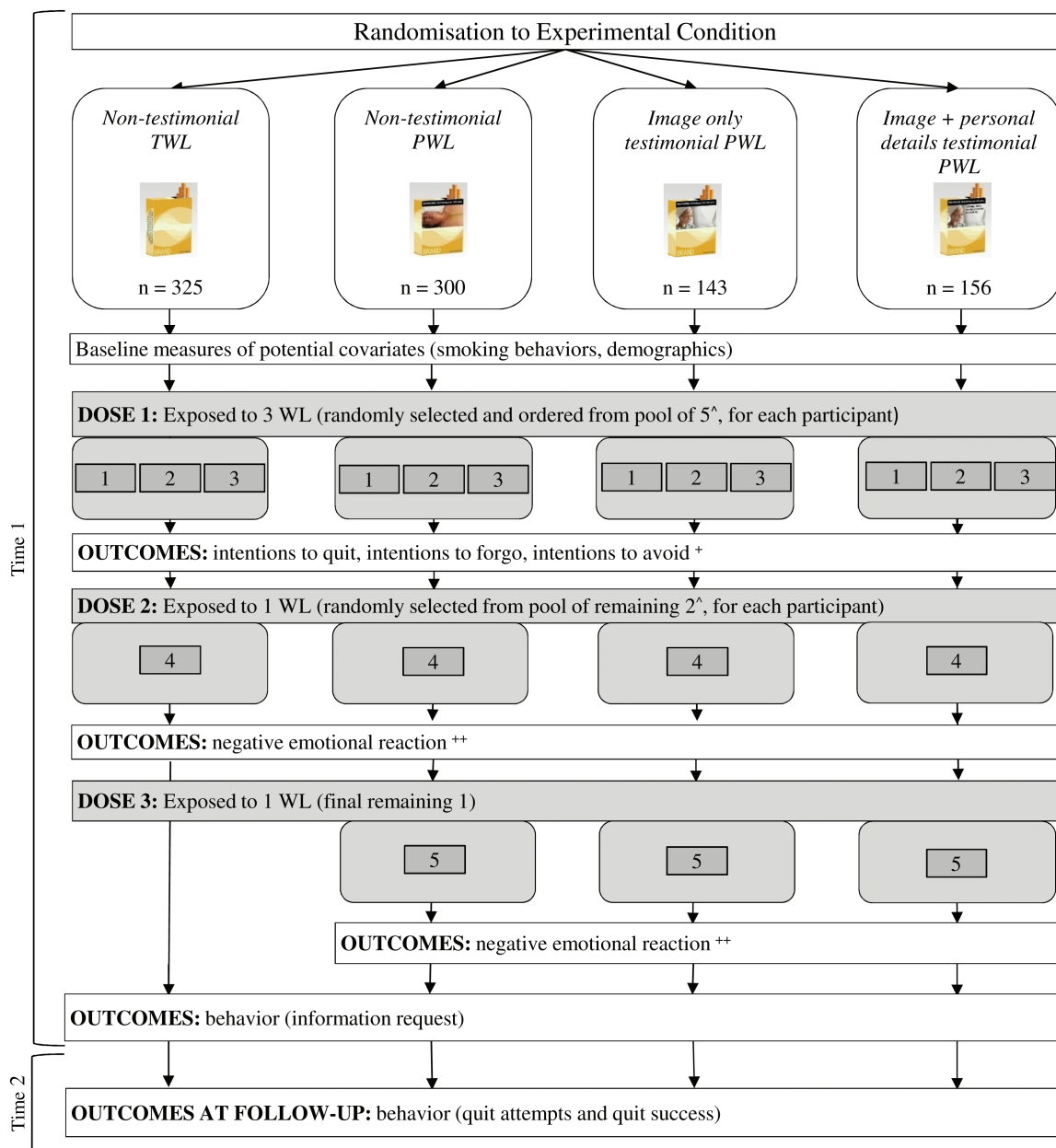
Procedure

This study was approved by the Institutional Review Board at the University of Pennsylvania. The study comprised an online experimental session (Time 1) during which participants were exposed to the warning labels, and a 5-week follow-up online survey (Time 2).

Table 1. Warning Label Content

Condition	Theme 1 ("kill")	Theme 2 ("fatal lung disease")	Theme 3 ("heart disease/stroke")	Theme 4 ("addiction")	Theme 5 ("fatal lung disease in nonsmokers")
Non-testimonial TWL					
Non-testimonial PWL					
Image only testimonial PWL					
Image + personal details testimonial PWL					

TWL = text warning label; *PWL* = pictorial warning label. Images and personal details of Terrie (Theme 1), Roosevelt (Theme 3) and Nathan (Theme 5) were used with permission from US Centers for Disease Control and Prevention. Image and personal details of Lena (Theme 2) and Barb (Theme 4) were used with permission from Health Canada. Digital images of the warning labels and cigarette packs were created by Kyle Cassidy, Annenberg School for Communication, University of Pennsylvania. Supplementary Appendix A details the text that appeared on each warning label.

Figure 1. Study procedure. ^For participants in the *non-testimonial TWL* condition, the first three warning labels were selected from a pool of four warning labels (and so the fourth label was the final one remaining). For participants in the *non-testimonial PWL* and *testimonial PWL* conditions, the first three warning labels were selected from a pool of five warning labels (Table 1). +Additional outcomes measured following Dose 1 included intentions to seek help when trying to quit (ie, intentions to call a quitline, buy a nicotine replacement product, enrol in a smoking cessation program), unprompted and prompted knowledge of the health effects of smoking, attitudes towards smoking, and self-efficacy to quit. ++Additional outcomes measured following Dose 2 and Dose 3 included engagement with the warning labels, identification with the person shown in the warning label, defensive processing, and perceived effectiveness of the warning labels. Digital images of the warning labels and cigarette packs were created by Kyle Cassidy, Annenberg School for Communication, University of Pennsylvania.

Figure 1 illustrates the procedure. As shown in Figure 1, one feature of this procedure is that participants were exposed to five different warning labels (or four, in the *non-testimonial TWL* condition) over three separate "doses." At Time 1, we measured the aggregate impact of warning labels on intentions after Dose 1. In Dose 1 participants were exposed to three of the warning labels in their condition. The three labels were randomly selected from the five themes and presented in random order for each participant. Measuring intentions after exposure to multiple warning labels better enabled us to approximate real world conditions of warning label exposure, in which smokers are repeatedly exposed to multiple warning labels

conveying information about different health effects. After measuring intentions, we also collected detailed assessments of the two remaining individual warning labels within each condition (ie, emotional reactions following Doses 2 and 3). By measuring emotional reactions after intentions, we avoided the potential confounding of message processing and overall impact that could have occurred if we instead measured emotional reactions before intentions. Our design avoided this potential confounding, while still allowing us to measure both the aggregate impact of exposure (after Dose 1) and detailed information about reactions to the individual images (after Dose 2 and 3) in each condition. It also meant that our assessment of

behavioral outcomes at the end of Time 1 and at Time 2 once again approximated conditions of real world exposure, in that participants had been exposed to four (in the *non-testimonial TWL* condition) or five different warning labels (all other conditions) (Figure 1).

Measures

Warning label effectiveness was assessed using several of the measures recommended by the International Agency for Research on Cancer.[29] Given that this experimental study involved such limited exposure to the warning labels, our primary outcomes were affective reactions (negative emotions) and intentions to quit smoking, forgo cigarettes, and avoid the warning labels. However, the follow-up survey also allowed us to assess whether even this limited exposure was associated with self-reported behavior change in the weeks following exposure.

Negative Emotional Reactions

After Doses 2 and 3 (Figure 1), participants completed a set of measures representing potential mediators of the effect of warning label exposure on intentions and behaviors; however, for the purposes of the current study, only the results for the negative emotional reactions are reported. Past research has demonstrated that affective reactions are one of the critical mechanisms through which warning labels contribute to changes in smoking behaviors.[7,8,29–33] We measured "negative emotional reactions" using a scale of seven items adapted from Gibson et al.[34] The question wording encouraged smokers to consider their emotional reaction to the specific warning label that they had just seen: While looking at the warning on this pack of cigarettes, I felt... (1) disgusted; (2) fearful; (3) guilty; (4) regretful; (5) sad; (6) worried; and (7) angry at myself for being a smoker. Responses were measured using 5-point scales (1 "strongly disagree"–5 "strongly agree") ($\alpha = 0.92$ after second dose; $\alpha = 0.93$ after third dose).

Intention Outcomes

Following Dose 1 (Figure 1), participants rated their willingness to engage in three quitting-related behaviors in the next 30 days: (1) try to quit smoking; (2) reduce the number of cigarettes smoked per day; and (3) quit smoking completely (1 "definitely will not"–4 "definitely will").[34] Responses were averaged into an "intentions to quit" scale ($\alpha = 0.87$).

Longitudinal population surveys have demonstrated that smokers who forgo cigarettes because of warning labels may be more likely to make subsequent quit attempts.[30,35–38] Following exposure to the first three warning labels, "intentions to forgo" were measured using the item: If my usual pack of cigarettes looked like these packs of cigarettes, I would hold back from smoking a cigarette when I was about to smoke one (1 "strongly disagree"–5 "strongly agree").[34,35]

As a result of the negative feelings that can occur when exposed to warning labels, some smokers attempt to avoid these labels by covering them up or moving their cigarettes to a different container.[29,30,39] While such warning label avoidance is sometimes considered an undesirable outcome, longitudinal population studies have shown that rather than being undesirable, warning label avoidance is actually associated with more frequent thoughts about the harms of smoking[30] and increased quitting activity,[38] most likely because attempts to suppress or avoid certain thoughts actually tend to increase the frequency of those thoughts.[40] Following Dose 1, participants indicated how likely they would be to engage in three avoidance behaviors: If my usual pack of cigarettes looked like these packs of cigarettes, I would...(1) cover it up; (2) keep the pack out of sight; and (3) transfer the cigarettes to a different container (1 "strongly disagree"–5 "strongly agree").[34,35] Responses were averaged into an "intentions to avoid" scale ($\alpha = 0.86$).

Behavioral Outcomes

At the end of Time 1, participants were given the opportunity to read some tips on how to quit smoking. If they requested to read these tips, they were taken to a new page displaying information from websites such as the US Centers for Disease Control and Prevention. We created one binary variable capturing the proportion who "requested quitting info."

At the beginning of Time 2, participants were reminded that they recently took part in a study in which they viewed and evaluated cigarette packs. They were then asked whether they had changed or had thought about changing their smoking behavior, since participating in that study. Response options included: (1) I have not made any changes to my smoking behavior; (2) I thought about quitting, but did not make an attempt; (3) I tried to cut down the number of cigarettes, but didn't make an actual attempt to quit; (4) I decided to quit, but haven't made an actual attempt yet; (5) I made an attempt to quit, but I've relapsed to smoking; and (6) I quit, and I'm still quit.[41] We created one binary variable measuring self-reported "quit attempts" ((5) "I made an attempt, but I've relapsed to smoking" or (6) "I quit, and I'm still quit"; compared to responses (1)–(4) combined), and a second binary variable measuring "quit success" ((6) "I quit, and I'm still quit"; compared to responses (1)–(5) combined).

Potential Covariates

Potential covariates included age, sex, educational attainment, race, ethnicity, parental status, and annual household income (see Table 2). Readiness to quit was measured at the beginning of the study using the 0–10 Contemplation Ladder scale adapted from Biener and Abrams.[42] Six questions from the Fagerström Test for Nicotine Dependence measured participants' nicotine dependence.[43] Participants also reported whether or not they currently smoked every day, and how many times they had tried to quit smoking in the past year. Two questions adapted from the brief questionnaire of smoking urges measured cigarette cravings.[44,45] In addition, at the end of Time 1, we asked participants whether they had smoked at any point during the study[45] (Table 2).

Statistical Analysis

All analyses were conducted using Stata Version 14.1.[46] For each outcome, we estimated a linear (for continuous outcomes) or logistic (for binary outcomes) regression model, first with the *non-testimonial TWL* condition as referent and then again with the *non-testimonial PWL* condition as referent. With the *non-testimonial TWL* condition as the referent category, we could examine whether the *non-testimonial PWL, image only testimonial PWL,* and *image + personal details testimonial PWL* were more effective than the labels that currently appear on packs. With the *non-testimonial PWL* condition as the referent category, we could assess the benefit of using testimonial rather than non-testimonial images. Each model was run unadjusted and then adjusted for covariates: in Table 3 we present results from both unadjusted and adjusted models but in text we refer only to the results from adjusted models. Preliminary analyses indicated that of all potential covariates, smoking status (daily vs. non-daily) was the only variable that was unevenly distributed across conditions (Table 2). Given that smoking status was also significantly associated with six of the seven outcome measures (in bivariate models; data not shown) it was included as a covariate in adjusted models. In addition, sensitivity analyses assessed whether the overall pattern of effects was the same for daily and non-daily smokers, by adding an interaction term (condition x smoking status) to the unadjusted regression model for each outcome.

Table 2. Sample Characteristics

	Total N = 924	Non-testimonial TWL n = 325	Non-testimonial PWL n = 300	Image only testimonial PWL n = 143	Image + personal details testimonial PWL n = 156	
	%	%	%	%	%	χ^2
Sex (female)	50.3	52.9	50.7	45.5	48.7	2.41
Education (low)[a]	22.7	23.1	23.0	25.9	18.6	2.36
Race						7.84
White	84.4	85.9	81.3	85.9	85.9	
Black	6.9	7.1	6.4	7.8	7.1	
Other[b]	8.7	7.1	12.4	6.3	7.1	
Ethnicity (Hispanic)	9.9	8.9	10.3	9.1	11.5	0.99
Children in household (any)[c]	56.1	52.3	60.0	53.2	59.0	4.78
Smoking status (daily)	81.1	86.5	79.3	76.9	76.9	10.09*
Smoking during study (yes)	19.8	17.9	22.0	20.3	19.2	1.75
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	F
Age (18–60)	38.5 (10.8)	39.0 (10.9)	37.7 (10.7)	39.6 (11.5)	37.9 (10.3)	1.33
Annual household income (in $1000s)[d]	59.5 (38.7)	58.3 (38.7)	59.6 (37.2)	54.3 (35.6)	66.3 (43.4)	2.60
Readiness to quit (0–10 scale)[e]	6.2 (2.8)	6.1 (2.8)	6.2 (2.8)	6.4 (3.0)	5.9 (2.9)	0.72
Nicotine dependence (0–10 scale)[c]	5.3 (2.6)	5.3 (2.5)	5.5 (2.6)	5.0 (2.8)	5.3 (2.5)	1.13
Quitting history (N attempts in past year; 0–99)[f]	3.1 (8.0)	2.5 (5.3)	3.0 (7.7)	4.0 (10.8)	3.5 (10.1)	1.40
Smoking urge at beginning of study (1–5 scale)	3.8 (0.9)	3.7 (1.0)	3.8 (0.9)	3.7 (0.9)	3.8 (0.9)	0.34

TWL = text warning label; PWL = pictorial warning label; SD = standard deviation. N varied slightly for some variables due to missing data, but where there was missing data, it applied to less than 1% of all cases. Chi-Squares and F statistics (from ANOVA models) tested differences in the distribution of sample characteristics across the four conditions. Degrees of freedom for Chi-Squares ranged from 3 to 6. Degrees of freedom for F statistics were (df1, df2) = (3, 923). By design, twice as many participants were randomized to the *non-testimonial TWL* and *non-testimonial PWL* conditions (control conditions) as to the two *testimonial PWL* conditions. Images and personal details of Terrie (Theme 1) were used with permission from US Centers for Disease Control and Prevention. Digital images of the warning labels and cigarette packs were created by Kyle Cassidy, Annenberg School for Communication, University of Pennsylvania.
[a]Low educational attainment was defined as high school or less.
[b]Participants who chose more than one race were categorized as "Other" race.
[c]Comparable measures were not available in the US Centers for Disease Control and Prevention's 2013–2014 National Adult Tobacco Survey (NATS).
[d]For comparison with the NATS measure of the percentage of smokers whose total household income was less than $40 000, this variable was dichotomized at <$40 000 (vs. ≥$40 000).
[e]For comparison with the NATS measure of the percentage of smokers who were thinking about quitting cigarettes for good, this variable was dichotomized at ≥5, which was the scale point labelled as "I think I should quit smoking but I am not quite ready."
[f]For comparison with the NATS measure of the percentage of smokers who had made at least one quit attempt in the past 12 months, this variable was dichotomized at ≥1 (vs. 0).
***$p < .001$; **$p < .01$; *$p < .05$.

Of 924 participants who completed Time 1, 226 (24.5%) did not complete the Time 2 survey. The non-completion rate was similar across the conditions (25.9%, 24.7%, 27.3%, and 18.6%; $\chi^2 = 3.87$, $p = .276$) and the baseline characteristics of those lost to follow-up did not differ significantly between conditions (with one exception: a greater percentage of those lost to follow-up in the *non-testimonial PWL* condition were from a visible minority group (27.4%) compared with the *non-testimonial TWL* (13.1%), *image only testimonial PWL* (5.1%) and *image + personal details testimonial PWL* (17.2%) conditions, $\chi^2 = 12.82$, $p = .046$) (data not shown). For analyses predicting quit attempts and quit success at Time 2, we therefore conducted an intention-to-treat analysis ($N = 924$) with those who were lost to follow-up assumed not to have made a quit attempt or have successfully quit. Sensitivity analyses assessed whether the same pattern of effects was observed when limiting the sample to those who completed Time 2 (Supplementary Appendix B).

Results

Our sample of adult established current smokers (Table 1) had a highly similar profile to the sample of adult established current smokers in the 2013–2014 Centers for Disease Control and Prevention's National Adult Tobacco Survey (NATS)[47] in terms of age and the percentage of the sample who were female, Hispanic, lived in households with a total annual income of <$40 000, were thinking about quitting, and had made at least one quit attempt in the past 12 months. Our sample contained fewer respondents with low levels of education (22.7% cf. 48.4%), slightly more respondents who were white (84.4% cf.

Table 3. Effects of *Non-testimonial TWL, Non-testimonial PWL, Image Only Testimonial PWL*, and *Image + Personal Details Testimonial PWL* Conditions: Results From Unadjusted and Adjusted Linear and Logistic Regression Models

	N	%	vs. Non-testimonial TWL				vs. Non-testimonial PWL			
			Unadjusted		Adjusted		Unadjusted		Adjusted	
			OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Negative emotion (1–5 scale)[a]										
Non-testimonial TWL	324	3.05 (1.02)	Ref		Ref		−0.30***	−0.46, −0.14	−0.28**	−0.44, −0.12
Non-testimonial PWL	300	3.35 (1.07)	0.30***	0.14, 0.46	0.28**	0.12, 0.44	Ref		Ref	
Image only testimonial PWL	143	3.35 (1.06)	0.29***	0.09, 0.49	0.28**	0.08, 0.47	−0.00	−0.20, 0.20	−0.01	−0.21, 0.19
Image + personal details testimonial PWL	156	3.43 (1.02)	0.38***	0.19, 0.56	0.36***	0.17, 0.55	0.08	−0.11, 0.27	0.08	−0.11, 0.27
Intention outcomes										
Intentions to quit (1–4 scale)										
Non-testimonial TWL	325	2.44 (0.75)	Ref		Ref		−0.20*	−0.32, −0.08	−0.18**	−0.30, −0.06
Non-testimonial PWL	300	2.64 (0.75)	0.20**	0.08, 0.32	0.18**	0.06, 0.30	Ref		Ref	
Image only testimonial PWL	143	2.58 (0.79)	0.14	−0.01, 0.29	0.11	−0.04, 0.25	−0.07	−0.22, 0.09	−0.07	−0.22, 0.08
Image + personal details testimonial PWL	156	2.67 (0.80)	0.23**	0.09, 0.38	0.20*	0.05, 0.34	0.03	−0.12, 0.18	0.02	−0.13, 0.17
Intentions to forgo (1–5 scale)										
Non-testimonial TWL	325	2.33 (1.14)	Ref		Ref		−0.79***	−0.98, −0.61	−0.77***	−0.96, −0.59
Non-testimonial PWL	300	3.13 (1.21)	0.79***	0.61, 0.98	0.77***	0.59, 0.96	Ref		Ref	
Image only testimonial PWL	143	3.05 (1.21)	0.72***	0.48, 0.95	0.69***	0.45, 0.92	−0.08	−0.31, 0.16	−0.09	−0.32, 0.15
Image + personal details testimonial PWL	156	3.05 (1.22)	0.72***	0.49, 0.95	0.69***	0.46, 0.92	−0.08	−0.31, 0.15	−0.08	−0.31, 0.15
Intentions to avoid (1–5 scale)										
Non-testimonial TWL	325	2.21 (1.04)	Ref		Ref		−1.08***	−1.25, −0.91	−1.07***	−1.24, −0.90
Non-testimonial PWL	300	3.29 (1.08)	1.08***	0.91, 1.25	1.07***	0.90, 1.24	Ref		Ref	
Image only testimonial PWL	143	3.18 (1.02)	0.98***	0.77, 1.18	0.96***	0.75, 1.17	−0.10	−0.32, 0.11	−0.11	−0.32, 0.11
Image + personal details testimonial PWL	156	3.32 (1.11)	1.12***	0.92, 1.32	1.11***	0.90, 1.31	0.04	−0.17, 0.25	0.04	−0.17, 0.24
Behavioral outcomes	N	%	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Requested quitting info[b]										
Non-testimonial TWL	325	33.9	Ref		Ref		0.91	0.65, 1.26	0.89	0.64, 1.24
Non-testimonial PWL	300	36.0	1.10	0.79, 1.53	1.12	0.80, 1.56	Ref		Ref	
Image only testimonial PWL	143	35.0	1.05	0.69, 1.59	1.08	0.71, 1.63	0.96	0.63, 1.45	0.96	0.63, 1.46
Image + personal details testimonial PWL	156	36.5	1.13	0.76, 1.68	1.15	0.76, 1.72	1.02	0.68, 1.53	1.03	0.69, 1.54
Quit attempt[c]										
Non-testimonial TWL	325	7.4	Ref		Ref		0.72	0.41, 1.26	0.75	0.43, 1.32
Non-testimonial PWL	300	10.0	1.39	0.79, 2.44	1.33	0.76, 2.34	Ref		Ref	
Image only testimonial PWL	143	15.4	2.28**	1.23, 4.22	2.16*	1.16, 4.01	1.64	0.91, 2.95	1.62	0.89, 2.93
Image + personal details testimonial PWL	156	11.5	1.64	0.86, 3.11	1.54	0.81, 2.95	1.17	0.63, 2.18	1.16	0.62, 2.15

Table 3. *Continued*

	N	%	vs. Non-testimonial TWL				vs. Non-testimonial PWL			
			Unadjusted		Adjusted		Unadjusted		Adjusted	
			OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Quit success[c]										
Non-testimonial TWL	325	1.5	Ref		Ref		0.45	0.15, 1.34	0.51	0.17, 1.53
Non-testimonial PWL	300	3.3	2.21	0.75, 6.53	1.95	0.66, 5.83	Ref		Ref	
Image only testimonial PWL	143	7.0	4.81**	1.61, 14.35	4.16*	1.38, 12.56	2.18	0.89, 5.36	2.13	0.86, 5.30
Image + personal details testimonial PWL	156	4.5	3.01	0.94, 9.63	2.57	0.79, 8.33	1.36	0.51, 3.65	1.32	0.49, 3.56

B = unstandardized beta coefficient; CI = confidence interval; M = mean; OR = odds ratio; PWL = pictorial warning label; Ref = referent category in regression model; SD = standard deviation; TWL = text warning label. Adjusted models control for the effect of smoking status (non-daily vs. daily). In the adjusted models, smoking status was a statistically significant predictor ($p < .05$) of negative emotion, intentions to quit, intentions to forgo, quit attempts, and quit success (daily < non-daily).

[a]Participants in the *non-testimonial PWL*, *image only testimonial PWL*, and *image + personal details testimonial PWL* conditions provided two ratings each, one after Dose 2 and one after Dose 3. Therefore, models adjusted for clustering at the individual level and used robust standard errors. Because participants in the *non-testimonial TWL* condition provided only one rating (after Dose 2), sensitivity analyses tested whether effects were of the same magnitude when using just one rating for each participant in the three PWL conditions (ie, only Dose 2, and then only Dose 3). This indicated that coefficients for the comparison between *non-testimonial TWL* and each PWL condition were larger when using Dose 2 emotion ratings for all participants (range of adjusted $B = 0.32–0.40$), compared to when using Dose 2 emotion ratings for participants in the *non-testimonial TWL* condition and Dose 3 emotion ratings for all other participants (range of adjusted $B = 0.23–0.32$). However, all coefficients were still statistically significant ($p < .05$).

[b]Measured at the end of Time 1 survey.

[c]Measured at the beginning of the Time 2 survey.

***p < .001; **p < .01; *p < .05.

77.2%) and fewer who were black (6.9% cf. 14.4%), and slightly more daily smokers (81.1% cf. 75.8%). Intercorrelations among the seven outcomes analyzed ranged from 0.02 (intentions to avoid and quit attempts) to 0.56 (quit attempts and quit success).

As shown in Table 3, the *non-testimonial PWL* (ie, FDA warning labels) elicited higher levels of negative emotion ($B = 0.28$, 95% CI [0.12, 0.44]) compared to the *non-testimonial TWL* (ie, current warning labels), and higher scores on all three intention measures, but particularly so on avoidance intentions (intentions to quit: $B = 0.18$, 95% CI [0.06, 0.30]; intentions to forgo: $B = 0.77$, 95% CI [0.59, 0.96]; intentions to avoid: $B = 1.07$, 95% CI [0.90, 1.24]). There were no significant differences between the *non-testimonial TWL* and *non-testimonial PWL* conditions across the three behavioral measures, although the direction of effects consistently favored the *non-testimonial PWL* (requested quitting info: $OR = 1.12$, 95% CI [0.80, 1.56]; quit attempt: $OR = 1.33$, 95% CI [0.76, 2.34]; quit success: $OR = 1.96$, 95% CI [0.66, 5.83]).

Table 3 also shows that the *image only testimonial PWL* and *image + personal details testimonial PWL* both elicited higher levels of negative emotion compared to the *non-testimonial TWL* (ie, current warning labels) (*image only*: $B = 0.28$, 95% CI [0.08, 0.47]; *image + personal details*: $B = 0.36$, 95% CI [0.17, 0.55]) and higher scores on intentions to forgo cigarettes (*image only*: $B = 0.69$, 95% CI [0.45, 0.92]; *image + personal details*: $B = 0.69$, 95% CI [0.46, 0.92]) and intentions to avoid the warning labels (*image only*: $B = 0.96$, 95% CI [0.75, 1.17]; *image + personal details*: $B = 1.11$, 95% CI [0.90, 1.31]). Only the *image + personal details testimonial PWL* elicited higher scores on intentions to quit ($B = 0.20$, 95% CI [0.05, 0.34]). Compared to the *non-testimonial TWL*, similar proportions of smokers in the two testimonial PWL conditions requested information on quitting at the end of Time 1 (Table 3). However, whereas only 7.4% of smokers exposed to the *non-testimonial TWL* reported that they had attempted to quit in the weeks preceding the follow-up survey, 15.4% of smokers exposed to the *image only testimonial PWL* had attempted to quit ($OR = 2.16$, 95% CI [1.16, 4.01]). Furthermore, 1.5% of participants in the *non-testimonial TWL* condition reported that they were quit at the time of follow-up, compared with 7.0% in the *image only testimonial PWL* condition (although we note the particularly wide 95% CI around this effect; $OR = 4.16$, 95% CI [1.38, 12.56]; Table 3).

Compared to the *non-testimonial PWL* (ie, FDA warning labels), neither the *image only testimonial PWL* nor the *image + personal details testimonial PWL* were any more effective at eliciting any of the outcomes (Table 3).

Sensitivity Analyses

We tested interactions between condition and smoking status, to ensure that the overall pattern of effects was not driven by the uneven distribution of daily smokers across conditions. For all seven outcomes, the overall interaction effect was non-significant (all *p*'s > .20), indicating that the effect of condition was not moderated by daily versus non-daily smoking status. In addition, as shown in Supplementary Appendix B, the same overall pattern of findings was observed when effects on quit attempts and quit success were examined using only those participants who completed Time 2.

Discussion

These findings indicate that PWL that use the images and personal details of real people to convey factual information about the health effects of tobacco use may be a promising alternative to the fictional

photographs, simulations of diseased body parts, and animations that were originally proposed by FDA. Compared to the *non-testimonial TWL* that currently appear on cigarette packs in the United States, the *non-testimonial PWL* and both types of *testimonial PWL* (*image only* and *image + personal details*) elicited stronger negative emotional reactions and stronger intentions to forgo cigarettes and to avoid the warning labels. Intentions to quit were also stronger among those exposed to *non-testimonial PWL* and *image + personal details testimonial PWL*, but not the *image only testimonial PWL*. However, the *image only testimonial PWL* were the only labels to generate significantly greater quitting activity in the weeks following exposure. Compared to those exposed to the current *non-testimonial TWL*, smokers exposed to the new *image only testimonial PWL* were more than twice as likely to have attempted to quit in the weeks between exposure and the follow-up survey, and were more than four times as likely to report that they had quit and were still quit.

While the results for the behavioral outcomes could suggest that using images of real people rather than non-testimonial images may enhance the effectiveness of PWL, the more robust finding to emerge from this study is that there is unlikely to be any detrimental effects of replacing the images originally proposed by the FDA with images of real people whose health has been affected by smoking. We found that *non-testimonial PWL* and both types of *testimonial PWL* performed similarly on the measures of negative emotion reactions and intentions to quit, forgo cigarettes, and avoid the warning labels. There was a tendency for the *image only testimonial PWL* to generate more quitting activity than the *non-testimonial PWL*, although these differences were not statistically significant. Therefore, while further exploration of differences in effectiveness between the *non-testimonial* and *testimonial PWL* is required, it remains the case that the use of testimonial images may help to minimize how vulnerable the next iteration of warning labels in the United States are to legal challenges based on the factual nature of the messages.[5]

For jurisdictions that already have PWL in effect, these findings suggest that it may be worth considering the potential benefits of including *testimonial PWL* as part of the mix of warning labels in effect at any one time (as has been done in Canada and Australia, among other countries[48]). Maintaining salience is a key challenge for warning label policies,[2,30,49–51] and it is possible that using a mix of different styles of images (ie, non-testimonial and testimonial) may help to reduce the rate at which the impact of the warning labels wears out. It is also possible that *testimonial PWL* may be more effective among some groups than others,[18,24] although further work is required to investigate this. *Testimonial PWL* may also provide jurisdictions with useful opportunities for enhancing the impact of the warning labels through linkages with mass media campaigns.[52] For instance, the successful Tips From Former Smokers mass media campaign in the United States[53–55] featured a series of testimonials, three of which were the source of content for the *testimonial PWL* tested here. If the testimonial television advertisements were aired at the same as the *testimonial PWL* were appearing on cigarette packs, then past research suggests that the reinforcing effects of being exposed to the same message via two different sources could lead to stronger effects overall.[56,57]

One limitation of this study is that we did not measure whether smokers exposed to the *testimonial PWL* were aware that they were viewing images of real people, or if they believed that these photographs were staged. It is therefore difficult to claim that the beneficial effects of the *testimonial PWL* (particularly the *image only testimonial PWL*) are due to the fact that smokers knew they were viewing images of real people. Future research should investigate whether

such knowledge moderates the impact of the *PWL*. Participants in the *non-testimonial TWL* condition were exposed to one less warning label than were participants in the three PWL conditions (four vs. five, respectively). This resulted from our decision to use the four TWL that currently appear on cigarette packs in the United States as stimuli in the *non-testimonial TWL* condition, an upside of which is that our analyses compare possible future warning labels with the current situation. We are confident that this differential exposure did not drive the overall pattern of effects, given that significant differences were also observed for the intention measures, which in all conditions, were measured following exposure to three warning labels.

Additional limitations associated with the experimental design include that exposure to the warning labels was limited, involved looking at the warning label on a static image of an unbranded cigarette pack, and occurred online in an artificial setting. On the other hand, the inclusion of a follow-up component is a particular strength, as it allowed an initial test of the potential impact of these *testimonial PWL* on self-reported quitting activities removed in time from immediate exposure to the labels. Additional research is certainly required to replicate these behavioral effects, and such work would be strengthened by the inclusion of more stringent definitions of quit success (eg, sustained cessation) and objectively validated measures of abstinence. Finally, we reiterate that our use of a non-probability online panel to recruit participants means that some uncertainty remains that these effects would be replicated within the broader population of smokers, both within the United States and elsewhere. In particular, this sample was more highly educated that the general population of smokers in the United States. Several other studies have observed that low- and high-education smokers in the United States are equally affected by exposure to PWL,[34,58,59] and one study with smokers in Mexico found that highly educated smokers responded more favorably to PWL that carried non-testimonial than testimonial statements.[24] Therefore, we do not expect the educational composition of our sample to undermine our conclusions about the potential effectiveness of *testimonial PWL*.

The findings from this study suggest that warning label images that present a factual account of the impact of tobacco on one individual, warrant consideration by the FDA as they work to develop PWL with the capacity to survive inevitable legal challenges from the tobacco industry. Final decisions about what will constitute a legally acceptable set of warning labels will come from a much larger body of scientific research and robust exchanges among interested parties in legal scholarship and in the courts.[5–8] However, the present study suggests that smokers can be affected in important ways following even modest exposure to images of real people whose health has been affected by smoking.

Supplementary Material

Supplementary data are available at *Nicotine & Tobacco Research* online.

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Declaration of Interests

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