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# Why smokers avoid cigarette pack risk messages: Two randomized clinical trials in the United States

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ABSTRACT

*Background:* Message avoidance (e.g., trying not to look at the message) may be motivated by reactance, a maladaptive rejection of the message. An alternative view is that avoidance indicates that a message is eliciting fear and other negative affect, thereby increasing the likelihood of behavioral change. We sought to identify which psychological mechanism—reactance or fear and other negative affect—explains message avoidance. We also examined whether avoidance was associated with more forgoing or butting out of cigarettes.

*Method:* Trial 1 randomly assigned 2149 adult U.S. smokers to receive either pictorial warnings (intervention) or text-only warnings (control) on their cigarette packs for four weeks in 2014 and 2015. Trial 2 randomly assigned 719 adult U.S. smokers to receive either messages about toxic chemicals in cigarette smoke (intervention) or messages about not littering cigarette butts (control) for three weeks in 2016 and 2017. Negative affect included fear, anxiety, disgust, sadness, and guilt. Reactance included perceived threat to freedom, anger, and counter-arguing.

*Results:* Intervention messages led to greater message avoidance in both trials (both $p < .001$). In Trial 1, intervention messages elicited greater negative affect, which in turn was associated with greater avoidance (mediated effect = 0.21, $p < .001$). In contrast, reactance explained only a small part of the effect in Trial 1 (mediated effect = 0.03, $p < .001$). Similarly, in Trial 2, intervention messages elicited greater negative affect, which was associated with more avoidance (mediated effect = 0.12, $p < .001$); reactance did not explain any of the effect. In both trials, avoidance was associated with more forgoing or butting out of cigarettes ($ps < .001$).

*Conclusions:* Smokers may avoid cigarette pack risk messages because they evoke aversive types of emotion. These studies add to a growing body of evidence that, in the context of cigarette pack messages, avoidance is not a form of defensive processing but instead a sign of *deeper* processing.

## 1. Introduction

Tobacco use is the leading cause of disease and death worldwide (World Health Organization, 2012). Health warnings on cigarette packs are a promising, low-cost solution for combating the tobacco epidemic. Cigarette pack warnings can attract attention (Noar et al., 2017) and inform smokers (Brewer et al., 2018a; Noar et al., 2016). The addition of images to text-only warnings enhances their effectiveness; pictorial warnings increase cigarette quit attempts (Brewer et al., 2016) and, once implemented in the US, could help prevent more than 650,000 deaths over the next 50 years (Levy et al., 2016).

Health behavior and health communication theories suggest that risk communications such as cigarette pack messages may sometimes cause avoidance, an unintended outcome that is unlikely to lead to beneficial effects. For example, the Extended Parallel Process Model (Witte, 1992) posits that under some conditions, fear communications can lead to maladaptive coping and ultimately generate defensive motivation including avoidance, suggesting the risk message is being rejected and is ineffective. Similarly, the Transtheoretical Model (DiClemente et al., 1991; Prochaska and DiClemente, 1986) views consciousness raising (e.g., information seeking) as a sign of increased readiness to change behavior, with those not ready to change actively avoiding information about health behavior change.

Avoidance itself can take many forms. In the context of cigarette pack risk messages, avoidance typically includes behaviors such as putting the pack out of sight, or trying to avoid looking at the risk

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message when the pack is in sight (Borland et al., 2009a; Osman et al., 2017; Thrasher et al., 2016). Avoidance can also include cognitive strategies to divert attention away from the message (McQueen et al., 2013), such as putting the message out of one's mind and avoiding thinking about what the message says. We conceptualize these behavioral and cognitive actions as components of avoidance.

Research from qualitative (Hardcastle et al., 2015), observational (Borland et al., 2009b; Hammond et al., 2004; Noar et al., 2017), eye tracking (Maynard et al., 2014), and experimental studies (Brewer et al., 2018b; McCloud et al., 2017; McQueen et al., 2015) indicate that some smokers avoid cigarette pack warnings after initial exposure. Studies from Canada, the U.S., Australia, and Mexico suggest that about 30% of smokers regularly attempt to avoid looking at or thinking about cigarette pack warnings (Cho et al., 2016; Hammond et al., 2003; Thrasher et al., 2016). However, in contrast with the Extended Parallel Process Model's predictions, avoidance of cigarette pack warnings may not be a maladaptive response. Research shows that avoidance does not appear to undermine the effect of cigarette pack warnings (Borland et al., 2009a; Cho et al., 2016), and may instead be a marker for beneficial effects on behavior (Brewer et al., 2018b; Cho et al., 2016; Thrasher et al., 2016). For instance, two longitudinal studies have found avoidance of cigarette pack warnings to be associated with more subsequent quit attempts (Cho et al., 2016; Thrasher et al., 2016). Ironic Process Theory offers one explanation for this finding: efforts to avoid thoughts often fail and make these thoughts even more pronounced (Wegner, 1994). Moreover, cigarette pack risk messages appear on products that regular smokers see and use very frequently, potentially making them harder to fully ignore.

Understanding *why* smokers avoid risk messages on their cigarette packs may shed light on the counterintuitive finding that avoidance of messages does not detract from, and may instead be a marker of, message effectiveness. However, studies to date have not explored the reasons why smokers avoid risk messages on cigarette packs. Using data from two large trials, we aimed to determine whether exposure to risk messages on smokers' own cigarette packs increased message avoidance. We also sought to explore the reasons why smokers avoided cigarette pack risk messages to investigate whether avoidance is a result of adaptive or maladaptive responding. Specifically, we examined whether smokers avoided risk messages because of negative affect, which is an adaptive response shown to promote quitting (Brewer et al., 2018b). We also examined whether smokers avoided risk messages because of message reactance (a maladaptive response, hypothesized (Brehm, 1966; Brehm and Brehm, 1981) and shown to undermine quitting (Brewer et al., 2018b)). We expected that negative affect and message reactance would both be positively associated with avoidance, but that the effect of negative affect would be stronger based on previous work showing avoidance being associated with greater message impact (Brewer et al., 2018b; Cho et al., 2016; Thrasher et al., 2016). Finally, we examined whether avoidance was associated with greater forgoing or butting out of cigarettes. We expected that avoidance would be associated with more forgoing or butting out, based on prior work showing avoidance is a marker for greater cigarette pack warning effectiveness (Brewer et al., 2018b; Cho et al., 2016; Thrasher et al., 2016).

## 2. Method

### 2.1. Trial 1

*Participants.* From September 2014 to August 2015, we recruited a convenience sample of 2149 adult smokers in North Carolina and California, U.S., to participate in a randomized trial comparing the impact of pictorial versus text-only warnings. Details of the trial including the protocol, survey development, and participant recruitment have been previously published (Brewer et al., 2016; Brodar et al., 2016); the University of North Carolina Institutional Review Board approved the procedures for both trials. Other studies using this dataset have explored the impact of pictorial warnings on quit attempts (Brewer et al., 2016) and reactance (Hall et al., 2017a), mediators (including avoidance) of the impact of pictorial cigarette pack warnings (Brewer et al., 2018b), the frequency and content of social interactions (Morgan et al., 2017), trajectories of pictorial warnings' impact (Parada et al., 2017), and attitudes toward regulation of tobacco products (Hall et al., 2018; Kowitt et al., 2017). Participants were age 18 or older, proficient in English, and current smokers, defined as having smoked at least 100 cigarettes during their lifetime and now smoking every day or some days. Exclusion criteria included pregnancy, current enrollment in a smoking cessation trial, smoking only roll-your-own cigarettes, smoking fewer than seven cigarettes per week, and living in the same household as another trial participant.

*Procedures.* Smokers received warnings on their own cigarette packs for four weeks using a protocol developed by our research team whereby participants brought in an eight-day supply of cigarettes weekly (Brewer et al., 2015). They were randomly assigned to have one of four pictorial warnings applied to the top half of the front and back panels of their cigarette packs (intervention), or one of four text-only warnings applied to the side of their cigarette packs placed over the current Surgeon General's warning (control), for the duration of the trial (Fig. 1). Randomization created groups that did not differ on demographic characteristics (Table 1, all $ps > .05$).

Participants completed two computer surveys at the first visit (at baseline and immediately after seeing their assigned warning on their cigarette packs), and one survey at each visit thereafter. Participants received a cash incentive at the end of each visit, totaling up to $185 in North Carolina and $200 in California. Participation incentives were higher in California due to higher cost of living. At the end of the final follow-up appointment, participants received information about local smoking cessation programs.

*Measures.* The baseline survey assessed participant demographics and smoking behavior. The second baseline survey assessed negative affect and message reactance immediately after participants first saw their assigned warnings (Table 2). To measure negative affect (i.e., anxious, disgusted, guilty, sad, scared), we adapted items from several sources (Keller and Block, 1996; Nonnemaker et al., 2010; Watson et al., 1988). We originally planned to examine fear alone as a mediator given its importance in the Extended Parallel Process Model (Witte, 1992), but our previously-reported confirmatory factor analysis supports treating negative affect as a single latent factor (Hall et al., 2017a). We used the validated Brief Reactance to Health Warnings Scale to measure message reactance (Hall et al., 2016, 2017b). The final follow-up survey (four weeks after the start of the trial) assessed message avoidance using items adapted from two large-scale longitudinal studies (Table 2) (International Tobacco Control Policy Evaluation Project, 2003; Population Assessment of Tobacco and Health Study, 2018; Yong et al., 2014). The final follow-up survey also assessed the number of times participants reported forgoing or butting out a cigarette in the past week (Li et al., 2014). The items read: “In the last week, how often have you stopped yourself from having a cigarette because you wanted to smoke less?” and “In the last week, how often have you butted out a cigarette before you finished it because you wanted to smoke less?” Response options were never (coded as 0), 1–2 times (coded as 1.5), 3–4 times (coded as 3.5), 5–9 times (coded as 7), and 10 or more times (coded as 10). To create a composite variable, we summed participants' responses to these the two items, ranging from 0 to 20.

*Data Analysis.* Analyses used Stata/SE version 14.1 and Mplus version 8 with two-tailed tests and a critical alpha of .05. We report most results as standardized coefficients ($\beta$s). First, we created a composite score representing the average of the three message avoidance items and conducted between-group *t*-tests to compare message avoidance by trial arm.

Next, we examined the associations between items and their latent

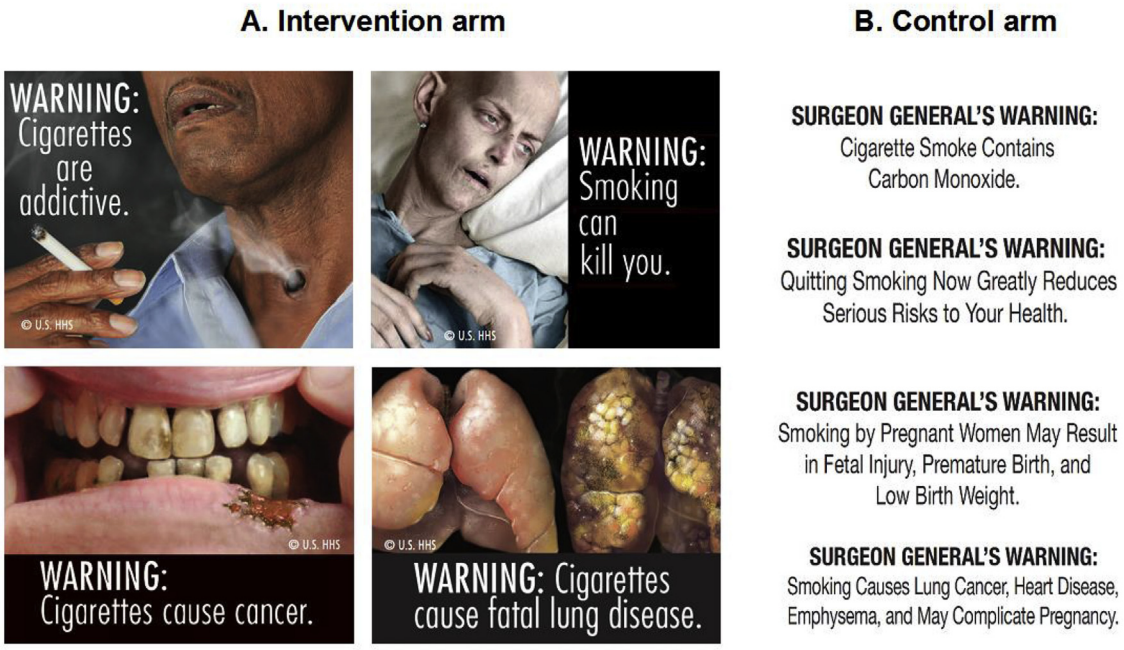


**Fig. 1.** Labels placed on smokers' cigarette packs in intervention arm (Panel A) and control arm (Panel B) in Trial 1.

constructs using a measurement model that included negative affect, message reactance, and message avoidance. Analyses treated indicators for these three variables as ordinal. This model exhibited adequate fit, with Root Mean Square Error of Approximation (RMSEA) = .058 (Steiger, 1990), Bentler Comparative Fit Index (CFI) = 0.995 (Bentler, 1990), and Tucker-Lewis Index (TLI) = 0.994 (Tucker and Lewis, 1973). Then, we used a structural equation model to examine the impact of trial arm on message avoidance; this model was just-identified and therefore did not produce fit statistics (Bollen, 1989). The final structural equation model, used to examine our mediation hypotheses and the association between avoidance and forgoing or butting out a cigarette, employed full information maximum likelihood estimation to handle missing data (Bollen, 1989; Kline, 2011; Peters and Enders, 2002; Sidi and Harel, 2018). This model used bootstrapped 95% confidence intervals with 1000 repetitions (Hayes, 2009) and also exhibited acceptable fit (RMSEA = 0.051, CFI = 0.994, TLI = 0.993).

### 2.2. Trial 2

*Participants.* We recruited a convenience sample of 784 adult smokers from the general population in the Bay Area in California, U.S. from September 2016 to March 2017 to participate in a trial comparing the impact of messages about toxic chemical versus messages about not littering. We randomized 719 participants who returned to Visit 2. We have previously reported that chemical messages did not lead to higher quit intentions, but did inform smokers of the chemicals in cigarettes and harms of smoking (Brewer et al., 2018a). Eligibility and exclusion criteria were the same as Trial 1, except that participants had to be 21 years or older, the legal age for buying tobacco products in California at the time of the study. Demographics did not differ by trial arm (Table 1, all $p > .05$). Additional details on participant recruitment and the trial including the protocol and surveys have been previously published (Brewer et al., 2018a).

*Procedures.* Participants attended 5 visits, each 1 week apart, at the trial office in San Francisco, California, U.S. Smokers brought in an eight-day supply of cigarettes to Visits 1–4. At Visit 2, we randomly assigned participants to receive either labels with chemical messages (intervention) or litter messages (control) on the sides of their cigarette packs (i.e., on the side opposite from the existing Surgeon General's warning; Fig. 2). Participants received a new label, in random order, at each visit for a total of three new messages during the trial.

Participants completed computer surveys at the baseline visit and at each subsequent weekly visit. While participants completed the surveys, research staff placed the assigned labels on participants' cigarette packs. At the end of each visit, upon completion of the survey, participants received a cash incentive that totaled up to $300 across the trial. At the end of the final visit, we offered participants information and resources about smoking cessation.

*Measures.* The baseline survey assessed participant demographics and smoking behavior. The final follow-up survey assessed negative affect, message reactance, message avoidance, and forgoing or butting out a cigarette using items that were nearly identical to Trial 1 (see Table 2 for exact wording). Frequencies of the avoidance items appear in Supplementary File 1.

*Data Analysis.* Trial 2 used the same analytic approach as Trial 1. The measurement model (RMSEA = 0.083, CFI = 0.983, TLI = 0.997) and the mediation model (RMSEA = 0.067, CFI = 0.983, TLI = 0.979) both exhibited adequate fit.

## 3. Results

Trial 1 participants had a mean age of 40 years and smoked an average of nine cigarettes per day (Table 1). The mean age of Trial 2 participants was 42; they smoked an average of 11 cigarettes per day. Both trials included a substantial number of sexual minority, African American, low-education, and low-income smokers.

In Trial 1, exposure to intervention messages led to greater avoidance than the control messages (mean [*SD*] = 2.3 [1.2] vs. 1.7 [1.0], $p < .001$). Negative affect mediated this effect (mediated effect = 0.21, $p < .001$; Table 3). Intervention messages increased negative affect ($\beta = 0.41$, $p < .001$; Fig. 3), which, in turn, was associated with greater avoidance of the warnings ($\beta = 0.51$, $p < .001$). Intervention messages also increased message reactance ($\beta = 0.24$, $p < .001$) and message reactance was subsequently associated with greater avoidance ($\beta = 0.10$, $p < .05$). Message reactance mediated the effect of intervention messages on avoidance, but the effect was small (mediated effect = 0.03, $p < .001$). Finally, message avoidance was associated with more forgoing or butting out of cigarettes in the

**Table 1**
Participant characteristics.

| | Trial 1 ($n$ = 2149) | | | | Trial 2 ($n$ = 719) | | | |
|---|---|---|---|---|---|---|---|---|
| | Control ($n$ = 1078) | | Intervention ($n$ = 1071) | | Control ($n$ = 359) | | Intervention ($n$ = 360) | |
| | $n$ | (%) | $n$ | (%) | $n$ | (%) | $n$ | (%) |
| Age | | | | | | | | |
| 18–20 years | 48 | (4.5) | 51 | (4.9) | – | – | – | – |
| 21–29 years | 268 | (25.2) | 278 | (26.5) | 81 | (22.6) | 83 | (23.1) |
| 30–39 years | 232 | (21.9) | 221 | (21.1) | 86 | (24.0) | 78 | (21.7) |
| 40–49 years | 211 | (19.9) | 188 | (17.9) | 59 | (16.4) | 75 | (20.8) |
| 50–59 years | 229 | (21.6) | 229 | (21.8) | 90 | (25.1) | 91 | (25.3) |
| 60 + years | 74 | (7.0) | 82 | (7.8) | 43 | (12.0) | 33 | (9.2) |
| Mean (*SD*) | 39.7 | (13.4) | 39.8 | (13.7) | 42.8 | (13.6) | 42.1 | (13.2) |
| Gender | | | | | | | | |
| Male | 507 | (47.4) | 532 | (50.1) | 172 | (47.9) | 196 | (54.4) |
| Female | 548 | (51.2) | 512 | (48.2) | 169 | (47.1) | 151 | (41.9) |
| Transgender [a] | 15 | (1.4) | 19 | (1.8) | 18 | (5.0) | 12 | (3.6) |
| Gay, lesbian, or bisexual | 173 | (16.3) | 195 | (18.8) | 88 | (24.5) | 93 | (25.8) |
| Hispanic | 92 | (8.6) | 89 | (8.5) | 56 | (15.6) | 44 | (12.2) |
| Race | | | | | | | | |
| American Indian or Alaska Native | 7 | (.7) | 11 | (1.1) | 17 | (4.7) | 17 | (4.7) |
| Asian | 28 | (2.7) | 42 | (4.0) | 29 | (8.1) | 31 | (8.6) |
| Black or African American | 484 | (45.8) | 510 | (48.9) | 124 | (34.5) | 133 | (36.9) |
| Native Hawaiian/other Pacific Islander | 11 | (1.0) | 6 | (.6) | 11 | (3.1) | 12 | (3.3) |
| Other/multiracial | 134 | (12.7) | 117 | (11.2) | 42 | (11.7) | 35 | (9.7) |
| White | 393 | (37.2) | 358 | (34.3) | 136 | (37.9) | 132 | (36.7) |
| Education | | | | | | | | |
| High school graduate or less | 333 | (31.1) | 344 | (32.5) | 67 | (18.7) | 89 | (24.7) |
| Some college | 519 | (48.5) | 502 | (47.4) | 151 | (42.1) | 124 | (34.4) |
| College graduate | 156 | (14.6) | 156 | (14.7) | 114 | (31.8) | 122 | (33.9) |
| Graduate degree | 63 | (5.9) | 58 | (5.5) | 27 | (7.5) | 25 | (6.9) |
| Low income [b] | 570 | (53.0) | 589 | (55.3) | 197 | (54.9) | 216 | (60.0) |
| Household income, annual | | | | | | | | |
| $0-$24,999 | 566 | (53.3) | 589 | (55.8) | 154 | (42.9) | 170 | (47.2) |
| $25,000-$49,999 | 272 | (25.6) | 266 | (25.2) | 88 | (24.5) | 89 | (24.7) |
| $50,000-$74,999 | 110 | (10.4) | 92 | (8.7) | 53 | (14.8) | 35 | (9.7) |
| $75,000+ | 115 | (10.8) | 109 | (10.3) | 64 | (17.8) | 66 | (18.3) |
| Trial site | | | | | | | | |
| California | 594 | (55.1) | 592 | (55.3) | 359 | (100.0) | 360 | (100.0) |
| North Carolina | 484 | (44.9) | 479 | (44.7) | – | – | – | – |
| Cigarettes smoked per day, mean (*SD*) | 8.8 | (6.6) | 8.7 | (7.3) | 9.97 | (12.2) | 11.62 | (16.9) |
| Quit intentions, mean (*SD*) | 2.2 | (.9) | 2.3 | (.9) | 2.4 | (1.0) | 2.4 | (0.9) |

Note. Characteristics did not differ by trial arm in either trial (all ps > .05).
[a] For Trial 2, includes other gender identity.
[b] Trial 1 ≤ 150% of federal poverty level. Trial 2 ≤ 200% federal poverty level.

past week ($\beta = 0.30$, $p < .001$).

The pattern of findings in Trial 2 was nearly identical (Fig. 3). Intervention messages led to greater avoidance than the control messages (mean [*SD*] = 2.1 [1.0] vs. 1.8 [1.0], $p = .0013$). Negative affect mediated the effect of intervention messages on avoidance of the messages (mediated effect = 0.12, $p < .001$). Intervention messages increased negative affect ($\beta = 0.18$, $p < .001$), which, in turn, was associated with greater avoidance ($\beta = 0.68$, $p < .001$). In contrast with Trial 1, reactance explained none of the effect of intervention messages on avoidance (mediated effect = 0.01, $p = .65$). Intervention messages did not change message reactance ($\beta = 0.02$, $p = .64$), but like Trial 1, message reactance was associated with greater avoidance ($\beta = 0.24$, $p < .001$). As in Trial 1, message avoidance was associated with more forgoing or butting out of cigarettes in the past week ($\beta = 0.40$, $p < .001$).

## 4. Discussion

In two large trials with smokers, exposure to cigarette pack risk messages led to greater message avoidance compared to control messages. Most prior studies on this topic have used observational data to examine avoidance of warnings in a real-world context (Borland et al., 2009a; Fathelrahman et al., 2013; Wardle et al., 2010; Yong et al., 2013; Zacher et al., 2014; Zhang et al., 2011). These studies show that policy changes to strengthen cigarette pack warnings are followed by increases in warning avoidance (Noar et al., 2017). Experimental data from our two trials corroborate these observational studies, supporting the findings that some smokers avoid cigarette pack messages after initial exposure, and that stronger risk messages lead to greater avoidance. We also found that avoidance was associated with more forgoing or butting out of cigarettes. These behaviors predict cessation attempts in longitudinal studies in several countries (Borland et al., 2009b; Cho et al., 2016, 2018; Li et al., 2014; Partos et al., 2014). Our findings add to this growing body of evidence that avoidance may be indicative of greater message effectiveness (Brewer et al., 2018b; Cho et al., 2016; Thrasher et al., 2016). However, more theoretical and empirical work is needed to understand why avoidance predicts smoking cessation.

Our studies also explored the counterintuitive phenomenon that avoidance of cigarette pack risk messages is a marker for behavior change (Brewer et al., 2018b; Cho et al., 2016; Thrasher et al., 2016) by examining the psychological mechanism motivating smokers to avoid cigarette pack risk messages. In both trials, negative emotions such as anxiety, disgust, guilt, sadness, and fear were associated with message avoidance. We consider negative affect to be a sign of adaptive processing in the context of cigarette pack risk messages based on strong

**Table 2**
Latent variables used in the measurement and structural equation models (Trial 1 $n = 2148$; Trial 2 $n = 704$).

| Latent variable<br>Trial 1/Trial 2 | Indicator item wording [response scale] | Factor loading<br>Trial 1/Trial 2 |
|---|---|---|
| Negative affect Cronbach's $\alpha = .92/.91$ | How much did the warning on your cigarette packs make you feel … | |
| | Anxious? | .86/85 |
| | Disgusted? | .88/.88 |
| | Guilty? | .88/.87 |
| | Sad? | .85/.86 |
| | Scared? | .93/.87 |
| | [not at all (coded as 1), a little (2), somewhat (3), very (4), extremely (5)] | |
| Message reactance Cronbach's $\alpha = .75/.78$ | Say how much you agree or disagree with each statement below about the warning we put on your packs. | |
| | This warning annoys me. | .79/.89 |
| | This warning is trying to manipulate me. | .79/.66 |
| | The health effect on this warning is overblown.[a] | .77/.80 |
| | [strongly disagree (1), somewhat disagree (2), neither agree nor disagree (3), somewhat agree (4), strongly agree (5)] | |
| Message avoidance Cronbach's $\alpha = .90/.83$ | In the last week … | |
| | How often have you tried to avoid looking at the warning label on your cigarette packs? | .98/.92 |
| | In the last week, how often have you tried to avoid thinking about the warning label on your cigarette packs? | .95/.89 |
| | In the last week, how often have you put your cigarettes away because you didn't want others to see the warning label on the pack? | .83/.81 |
| | [never (1), rarely (2), sometimes (3), often (4), all of the time (5)] | |

*Note.* Analyses excluded $n = 1$ Trial 1 and $n = 15$ Trial 2 participants with missing data on all items in the model. Survey items in the table are from Trial 1; Trial 2 used identical items but used the word "labels" instead of "warning" or "warning label." In Trial 1, the correlation of negative affect with message reactance was 0.05 ($p = .07$), negative affect with message avoidance was 0.54 ($p < .001$), and message reactance with message avoidance was 0.18 ($p < .001$). In Trial 2, the correlation of negative affect with message reactance was 0.01 ($p = .90$), negative affect with message avoidance was 0.66 ($p < .001$), and message reactance with message avoidance was 0.26 ($p < .001$).

[a] Trial 2 wording: "The labels are overblown."

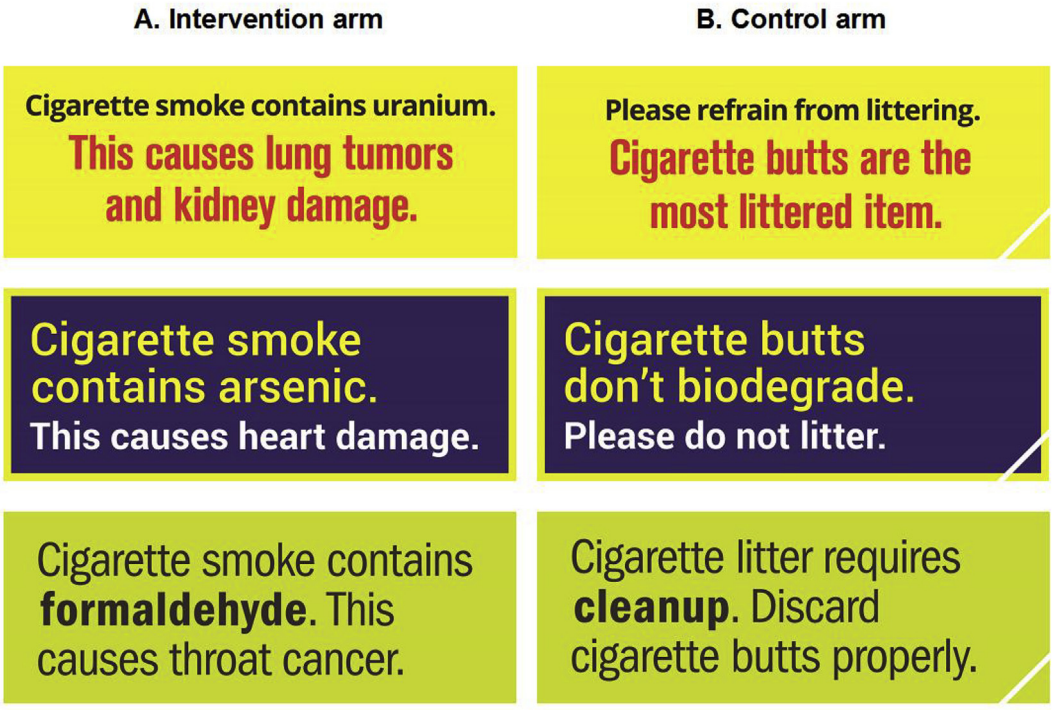


**Fig. 2.** Labels placed on smokers' cigarette packs in intervention arm (Panel A) and control arm (Panel B) in Trial 2.

evidence showing that negative affect leads to health-promoting changes in attitudes and behavior (Brewer et al., 2018b; Cho et al., 2018; Emery et al., 2014; Evans et al., 2015; Hall et al., 2017a; McCaul et al., 1996; Peters et al., 2014, 2016; Sheeran et al., 2014). Thus, our studies show that an adaptive response (i.e., negative affect) explains most of why smokers avoid messages.

In contrast with negative affect, we found that message reactance did not have much impact on avoidance. In Trial 1, reactance explained a small part of the effect of risk messages on avoidance, and in Trial 2, it did not explain any of the effect. Prior studies have found that reactance has small associations with lower perceived message effectiveness (Hall et al., 2016), quit intentions (Hall et al., 2017a) and policy support (Hall et al., 2018); one study found null effects of reactance on behavioral intentions (Blanton et al., 2014). The undermining effects on cessation behavior are even less pronounced (Brewer et al., 2018b) or nonexistent (Cho et al., 2016; Thrasher et al., 2016). Our studies build

**Table 3**
Multiple mediation of intervention messages' impact on message avoidance (Trial 1 $n = 2149$; Trial 2 $n = 719$).

| Mediator variable | *a* pathway | | *b* pathway | | Mediated effect | |
|---|---|---|---|---|---|---|
| | $\beta_a$ | *p* | $\beta_b$ | *p* | $\beta_{a*}\ \beta_b$ (95% CI) | *p* |
| Negative affect | | | | | | |
| Trial 1 | .41 | < .001 | .51 | < .001 | .21 (.18, .24) | < .001 |
| Trial 2 | .18 | < .001 | .68 | < .001 | .12 (.07, .17) | < .001 |
| Message reactance | | | | | | |
| Trial 1 | .24 | < .001 | .10 | < .05 | .03 (.01, .04) | < .001 |
| Trial 2 | .02 | .64 | .24 | < .001 | .01 (−.02, .03) | .65 |

*Note*. Table reports standardized path coefficients and mediated effects. *a* pathways are the associations between intervention message exposure and the mediators. *b* pathways are the associations between the mediators and message avoidance, controlling for intervention message exposure and the other mediators. Analyses excluded $n = 1$ Trial 1 and $n = 15$ Trial 2 participants with missing data on all items in the model.

on these findings, demonstrating that reactance does not have large effects in the context of cigarette pack risk messages because reactance explained little (Trial 1) or none (Trial 2) of smokers' avoidance behaviors.

Our findings suggest that the *motivation* for avoidance might help to shed light on the consequences of avoidance. In our studies, we observed two possible pathways for generating avoidance. In one pathway, smokers who engage in avoidance due to negative affect may actively try to avoid the warnings because of feeling scared or guilty about the harms of smoking (which may mean they are more likely to quit smoking). In the other pathway, smokers who report avoiding warnings because of reactance may avoid thinking about the warnings except to denigrate the warnings and reinforce their own views and biases (which may mean they are less likely to quit smoking). The specific communication context is likely to determine which of these pathways is more important and thus whether the avoidance reflects message engagement or rejection. In our studies, fear was associated with avoidance and avoidance was associated with subsequent quitting behaviors (Brewer et al., 2018b), perhaps because pack messages were ever present and tied directly to the behavior of smoking. In other contexts, reactance could drive message avoidance, perhaps when the behavior is not widely believed to be threatening or the message reflects a threat to personal freedom (e.g., "cigarette use by youth is dangerous and illegal"). Future studies should examine whether avoidance that is primarily driven by reactance is adaptive or maladaptive with respect to motivating healthier behavior. Qualitative research may shed light on additional reasons why people avoid risk messages, as well as possible explanations for why avoidance is, at least sometimes, a marker for message effectiveness.

Finally, when countries enrich tobacco risk messages with aversive images, message avoidance tends to increase (Noar et al., 2016). This may lead policymakers and others to conclude that such warnings are ineffective because smokers are actively avoiding them, but our data suggest otherwise. After the implementation of plain packs and larger pictorial warnings in Australia in 2012, for example, smokers were more likely to place their packs face down and to conceal the new warnings using cases and other means (Zacher et al., 2014). Contrary to the conclusion that these actions render the warnings ineffective, the current studies coupled with prior research suggests quite the opposite – that these actions are likely markers for the warnings having impact.

### 4.1. Study strengths and limitations

Study strengths include the experimental design allowing us to assess the causal impact of risk messages on avoidance, the inclusion of diverse samples of smokers, and the use of a psychometrically strong measure of avoidance. However, Trial 1 examined the effect of adding pictorial warnings to cigarette packs, as well as implementing other label formatting changes required by the 2009 Tobacco Control Act, in comparison with the present text-only warnings in the U.S. While the trial aimed to compare the current warning policy to the new one in the Act, the use of this research design leaves open the possibility that the observed effects on mediators and avoidance may be due to the combination of adding pictures and other changes (e.g., location, size, and content). In Trial 2, the intervention labels were text-only on the side of the pack, and the mediators and outcome were assessed at the final

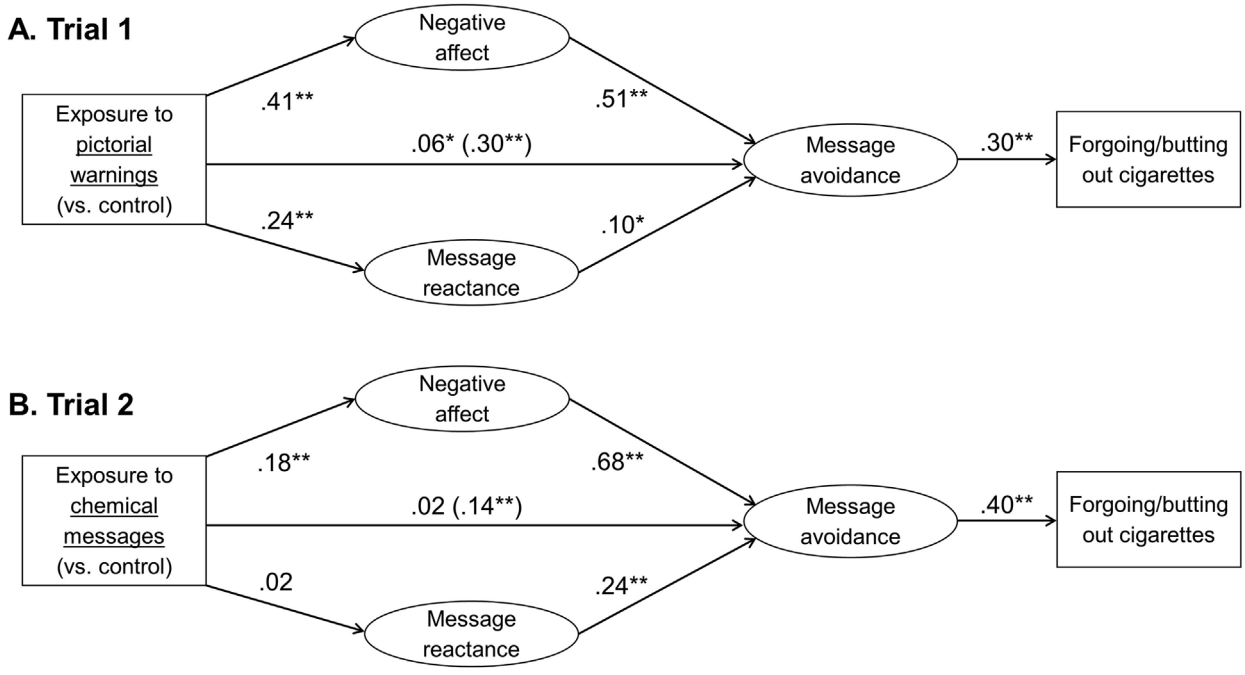


**Fig. 3.** Structural equation models assessing the impact of intervention messages on message avoidance in Trial 1 ($n = 2,149$, Panel A) and Trial 2 ($n = 719$, Panel B). Values in parentheses show bivariate association between intervention messages and avoidance.*$p < .05$. **$p < .001$.

study visit, making it harder to confirm the temporal ordering of effects. These differences between the trials may affect the comparability of the results. However, the similar findings between Trial 1 and Trial 2 suggest that the findings are robust to differences in the timing of measurement. The associations between the mediators and avoidance, as well as avoidance and forgoing or butting out cigarettes, were based on observational data, limiting our ability to assume causal associations between those variables. Thus, these correlational results should be interpreted with caution and future studies should attempt to replicate these results by experimentally manipulating the observed variables. Finally, these analyses were exploratory in nature; as such, we did not pre-register these hypotheses or analyses.

## 5. Conclusions

Policymakers should be encouraged by evidence showing that strong cigarette pack risk messages, especially those with images, are likely to encourage smoking cessation (Brewer et al., 2016; Cappella, 2016; Noar et al., 2016) and therefore prevent death and disease (Levy et al., 2016). However, some smokers will inevitably avoid health warnings and other cigarette pack risk messages. We argue that, in the context of cigarette pack risk messages, avoidance is not maladaptive defensive processing but instead a sign of *deeper* processing. In other words, smokers avoid warnings precisely *because* they are hard-hitting and elicit productive types of negative emotions, and avoidance is associated with more quitting-related behaviors. Future research should explore the role of avoidance of other types of health communications – such as mass media campaigns – where risk messages are not displayed on the product itself, as well as among different populations (youth, non-smokers).

## Conflicts of interest

Noel T. Brewer has served as a paid expert consultant in litigation against the tobacco industry. The other authors declare that they have no conflicts of interest.

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## Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.socscimed.2018.07.049.

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