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Path analysis of warning label effects on negative emotions and quit attempts: A longitudinal study of smokers in Australia, Canada, Mexico, and the US

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ABSTRACT

Background: Cigarette pack health warning labels can elicit negative emotions among smokers, yet little is known about how these negative emotions influence behavior change.

Objective: Guided by psychological theories emphasizing the role of emotions on risk concern and behavior change, we investigated whether smokers who reported stronger negative emotional responses when viewing warnings reported stronger responses to warnings in daily life and were more likely to try to quit at follow-up. **Methods:** We analyzed data from 5439 adult smokers from Australia, Canada, Mexico, and the US, who were surveyed every four months from September 2012 to September 2014. Participants were shown warnings already implemented on packs in their country and reported negative emotional responses (i.e., fear, disgust, worry), which were averaged (range = 1 to 9). Country-stratified logistic and linear generalized estimating equations were used to analyze the effect of negative emotional responses on self-reported responses to warnings in daily life (i.e., attention, risk concern, avoidance of warnings, forgoing planned cigarettes) and quit attempts at follow-up. Models were adjusted for socio-demographic and smoking-related characteristics, survey wave, and the number of prior surveys answered.

Results: Smokers who reported stronger negative emotions were more likely to make quit attempts at follow-up (Adjusted ORs ranged from 1.09 [95% CI 1.04 to 1.14] to 1.17 [95% CI 1.12 to 1.23]; $p < .001$) than those who reported lower negative emotions. This relationship was mediated through attention to warnings and behavioral responses to warnings. There was no significant interaction of negative emotions with self-efficacy or nicotine dependence.

Conclusion: Negative emotions elicited by warnings encourage behavior change, promoting attention to warnings and behavioral responses that positively predict quit attempts.

1. Introduction

The World Health Organization's Framework Convention on Tobacco Control (FCTC) calls for nations to implement pictorial health warnings on tobacco packaging. Compared to text-only health warnings, pictorial health warnings are more likely to promote attention,

recall, cognitive elaboration of risks, negative attitudes toward smoking, quit intentions (Noar et al., 2015), and quit attempts (Brewer et al., 2016). Pictorial health warnings, however, have not yet been implemented in many countries (Canadian Cancer Society, 2016), including the US. Some researchers argue that pictorial warnings that elicit strong negative emotions will lead to adverse consequences

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(Erceg-Hurn and Steed, 2011; Ruiter and Kok, 2005), which has been used to argue against pictorial warnings, especially those with strong, graphic imagery (Bayer et al., 2013). While pictorial warnings with graphic portrayals of smoking-related harms can elicit stronger negative emotions than text-only warnings (Brewer et al., 2016; Evans et al., 2016; Nonnemaker et al., 2015; Schneider et al., 2012), it remains unclear whether these negative emotions compromise the psychological and behavioral objectives of warning labels. This article examines how negative emotions aroused by health warnings are associated with key cognitive and behavioral responses to warnings.

1.1. Negative emotions and pictorial warnings

Negative emotions reported by smokers in response to warnings on cigarette packs include fear, disgust, and worry (Byrne et al., 2015; Emery et al., 2014; Hammond et al., 2004; Kees et al., 2010; Newman-Norlund et al., 2014; Nonnemaker et al., 2015; Yong et al., 2014). Fear refers to an emotion experienced when perceiving a serious and personally relevant threat (Yzer et al., 2012). Disgust is an emotion that functions as a mechanism to avoid diseases (Oaten et al., 2009) and is elicited by bodily excretions (e.g., blood) and body parts (e.g., intestines, wounds, and dead bodies) (Curtis and Biran, 2001). Worry is a cognitively oriented emotion that can stimulate constructive problem solving (Dijkstra and Brosschot, 2003; Magnan et al., 2009; McCauley et al., 2007). Whether to conceptualize these emotions as discrete or as a single dimension of negative valence is a classical scientific debate (Lindquist et al., 2013). Some researchers who support the natural kind hypothesis—a hypothesis that discrete emotions exist in nature—argue that different negative emotions produce different responses and have specific effects on behavior (Lench et al., 2011). In line with this hypothesis, some researchers suggest that the effects of fear on risk perceptions is the opposite as that found for anger (Lerner and Keltner, 2001). On the contrary, others support the psychological construction hypothesis, suggesting that different emotions are experienced as transformed forms of a core affect (Russell, 2003).

Dual-process information processing theories support the idea that negative emotions can promote desired responses to health warnings, such as risk perception and decision-making (E. Peters et al., 2016). These theories distinguish between slow, deliberative engagement with information and more automatic, intuitive engagement (Chaiken, 1980; Kahneman, 2011). For instance, affect heuristics (Slovic et al., 2007) play an important role in judgment, decision making, and behavior motivation. The Context, Executive and Operational Systems (CEOS) theory also emphasizes how strong negative affect motivates behavior change (Borland, 2014). According to the theory, however, the motivating role of negative affect on behavior change may be inhibited where the behavior to change also elicits competing positive affective responses, as is the case with smoking. Hence, action to avoid the harm of engaging in the behavior (e.g., attempting to quit) can depend on the relative strength of affective concerns and their impact on desire to smoke.

Consistent with dual-process theories, neurological studies showed that more emotionally arousing pictorial warnings produce stronger activation of brain regions associated with decision-making and memory formation among smokers (Green et al., 2016; Newman-Norlund et al., 2014; Wang et al., 2015). As found in fMRI research on smoking cessation ads (Falk et al., 2011), stronger brain activation prompted by graphic cigarette warnings predict decreases in smoking (Riddle et al., 2016). Similarly, in some experimental studies with self-reported measures, negative affective reactions provoked by warnings cued further processing of warning information (Evans et al., 2017) and, ultimately, motivated smoking cessation (Evans et al., 2015; E. Peters et al., 2016). Other studies also found that the stronger negative emotional responses to pictorial warnings mediate their effects on stronger risk perceptions and intentions to quit (Byrne et al., 2015; Emery et al., 2014; Evans et al., 2015, 2016; Kees et al., 2010).

A long history of work exists on the use of and potential concerns about fear appeals in persuasive messages to promote health protective behavior (Yzer et al., 2012). Early on, Janis (1967) hypothesized an inverted U-shaped relationship between fear and attitude change. However, challenging this, Sutton (1992) showed a positive, linear relationship between fear and acceptance of recommended behavior. The extended parallel process model (EPPM) built on this work but suggested that fear appeals are most effective for those with high self-efficacy to engage in the recommended behavior (Witte, 1994). Further, those with low self-efficacy may engage defensive avoidance by not attending to the messages, denying their relevance, or undermining message credibility (Witte, 1994). Researchers who suggest that pictorial warnings could backfire if they elicit negative emotions have used this theoretical approach to support their argument (G.-J. Y. Peters et al., 2013; Ruiter and Kok, 2005). Some laboratory experiments suggest that graphic warnings elicit reactance (Erceg-Hurn and Steed, 2011; Hall et al., 2016, 2017; LaVoie et al., 2017) and smokers avoid health warnings (Kessels and Ruiter, 2012; Maynard et al., 2014), both of which are argued to be maladaptive warning responses.

The experimental studies reviewed above, however, contrasts with a recent observational study finding that affective state reactance or warning avoidance has no adverse effect on subsequent quit attempts (Cho et al., 2016). This study, along with other observational studies, found that smokers who report avoiding warnings are more likely to make quit attempts (Fathelrahman et al., 2013; J. F. Thrasher et al., 2016b; Yong et al., 2014), although another study found that the relationship was not statistically significant when controlling for other psychosocial predictors of cessation (Borland et al., 2009a). Similarly, neurobiological research suggests that unpleasant stimuli elicit aversive emotions that characterize defensive motives (Bradley et al., 2001). According to Volchan et al. (2013), for instance, smokers perceived the most aversive cigarette pack warnings to be the most effective. While negative emotions might stimulate avoidance of warnings on specific occasions, taken together, the likelihood of maintaining avoidance over repeated exposures to warnings is limited. Moreover, emotionally arousing health warnings can stimulate smokers to forgo planned cigarettes, a desirable avoidance reaction that predicts quit attempts among adult smokers (Borland, 1997; Borland et al., 2009a; Li et al., 2015; Partos et al., 2014; James F Thrasher et al., 2016a; J. F. Thrasher et al., 2016b).

Further studies are needed to examine longer-term behavioral impacts of negative emotions elicited by health warnings under natural exposure conditions. Most previous studies of negative emotions elicited by pictorial warnings have documented only the short-term impacts of the negative emotions, using single session, experimental designs, where smokers are forced to view and evaluate warnings. The exception is one randomized field trial with a four-week follow-up (Evans et al., 2015). The study found that negative affect elicited by health warnings indirectly increased risk perceptions and quit intentions but did not assess behavioral responses. Two longitudinal, observational studies have found that negative emotions aroused by warnings can promote quit attempts (Hammond et al., 2004; Yong et al., 2014). These studies, however, relied on smokers' recall of affective responses to warnings in general. The current longitudinal study evaluated smokers' responses to specific warnings on packs over time, which may allow more detailed examination of this issue.

It is important to consider the moderating effect of nicotine dependence when evaluating the effect of smoking cessation messages for developing effective messages. Cessation messages often produce more desirable effects among less addicted smokers (Moorman & van den Putte, 2008; Szklo and Coutinho, 2010; James F Thrasher et al., 2007). Dependence is also inversely associated with quit attempts and maintenance (Vangeli et al., 2011). Furthermore, the information may help develop tailored cessation messages for specific groups of smokers in settings with limited resources.

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