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Pain-related anxiety and smoking processes: The explanatory role of dysphoria

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HIGHLIGHTS

- We examined the relation between pain-related anxiety and smoking processes through dysphoria.
- Pain-related anxiety has an indirect on observed smoking processes through dysphoria.
- Smokers with pain-related anxiety may endorse greater dysphoric symptoms.
- These smokers may use smoking to reduce symptoms of their pain-related anxiety and dysphoria.

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ABSTRACT

Scientific evidence suggests that pain-related anxiety may contribute to the maintenance of tobacco addiction among smokers with varying levels of pain. Yet, no work has investigated the relation between pain-related anxiety and cognitive-based smoking processes within an indirect effect model. Dysphoria may explain the relation between pain-related anxiety and cigarette smoking, as it is a construct that relates to both pain and smoking outcomes. Thus, the current cross-sectional study examined the indirect effect of pain-related anxiety and three clinically significant smoking processes: perceived barriers to cessation, negative affect reduction motives, and negative mood abstinence expectancies via dysphoria. Participants included 101 (M_{age} = 32.74 years, SD = 13.60; 35.6% female) adult tobacco cigarette smokers with low cigarette dependence. Results indicated that pain-related anxiety had an indirect effect on all dependent variables through dysphoria. The current findings provide evidence that dysphoria may serve to maintain maladaptive smoking processes in smokers who experience pain-related anxiety. This study furthers research on pain-smoking relations by providing initial evidence for a conceptual model in which smokers with elevated pain-related anxiety endorse greater dysphoric symptoms and use smoking to reduce or escape symptoms of their pain-related anxiety and dysphoria, thus contributing to the maintenance of tobacco dependence.

1. Introduction

Cigarette smoking is the leading cause of preventable death and disability in the United States, contributing to over 480,000 deaths each year (Health and Human Services [HHS], 2010, 2014; Mack & Centers for Disease Control and Prevention [CDC], 2013). Smoking kills more people than obesity, substance abuse, infectious diseases, firearms, and traffic accidents combined, and increases the risk for coronary heart disease, stroke, lung cancer, and respiratory and cardiovascular disease (HHS, 2014). Despite widespread recognition of the health consequences of smoking (HHS, 2014), roughly 36.5 million Americans still smoke (Jamal, 2016), and thousands more become daily smokers each year (HHS, 2014). Extensive work has been devoted to understanding socioeconomic and psychological factors, including

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psychiatric disorders and symptoms, that contribute to the onset and maintenance of tobacco smoking (Grant, Hasin, Chou, Stinson, & Dawson, 2004; Leventhal & Zvolensky, 2015; Mathew, Hogarth, Leventhal, Cook, & Hitsman, 2017). Yet, within this body of literature, pain, a potentially clinically important risk factor for smoking, has received comparatively less scholarly attention.

Pain and pain-related processes frequently co-occur with and contribute to maladaptive smoking (Ditre, Brandon, Zale, & Meagher, 2011). Indeed, smoking is significantly more prevalent among individuals with chronic pain relative to the general population (Zvolensky, McMillan, Gonzalez, & Asmundson, 2009), and such differences may be a consequence of increased motivation to smoke cigarettes for pain coping (Ditre & Brandon, 2008; Patterson et al., 2012). Consequently, individuals who experience pain are at greater risk for smoking (Shi, Weingarten, Mantilla, Hooten, & Warner, 2010) and difficulty quitting (Ditre, Kosiba, Zale, Zvolensky, & Maisto, 2016; Zale & Ditre, 2014). Indeed, numerous experimental studies have found that pain induction increases smoking urge and behavior, and these relations are stronger among individuals with expectancies that smoking will serve to aid in coping with pain (Ditre & Brandon, 2008; Parkerson & Asmundson, 2016). In addition to pain being linked to more maladaptive smoking patterns and cognitions, tobacco smoking has been identified as a causal agent in the development of numerous painful chronic health conditions, including chronic low back pain and rheumatoid arthritis (Shiri, Karppinen, Leino-Arjas, Solovieva, & Viikari-Juntura, 2010; Sugiyama et al., 2010). Thus, there are likely bidirectional pathways by which pain and smoking contribute to and maintain each other (Zale, Maisto, & Ditre, 2016). These pathways carry several public health implications, including increased negative health consequences and greater financial burden placed on individuals and health care systems (Ditre et al., 2011; Zale et al., 2016). The clinical importance and public health relevance of this work supports further scientific inquiry into the association between pain and tobacco cigarette smoking.

To more clearly elucidate the pain and smoking relation, researchers have begun to examine cognitive-affective process that relate to both conditions (Gonzalez, Hogan, McLeish, & Zvolensky, 2010; LaRowe, Langdon, Zvolensky, Zale, & Ditre, 2017). One such cognitive-affective pain process of interest is pain-related anxiety. Pain-related anxiety is the tendency for an individual to respond to actual or potential experiences of pain with anxiety or fear (McCracken, Zayfert, & Gross, 1992). Self-reported pain-related anxiety has been cross-sectionally and prospectively implicated as a unique predictor of smoking outcome expectancies, perceived barriers to quitting, tobacco dependence, and early lapse and relapse (Ditre, Langdon, Kosiba, Zale, & Zvolensky, 2015; Ditre, Zale, Kosiba, & Zvolensky, 2013; Gonzalez et al., 2010). Importantly, these relations have been observed even in the absence of co-occurring *chronic* pain (Abrams, Carleton, & Asmundson, 2007; LaRowe et al., 2017). Thus, pain-related anxiety may contribute to the maintenance of tobacco addiction among smokers who experience varying levels of pain. Although pain-related anxiety appears to be a clinically important construct in relation to smoking, this work is in its infancy. Indeed, while the relation between pain-related anxiety and smoking is increasingly well established, no research has identified underlying mechanisms that may explain these associations.

One promising transdiagnostic factor that may contribute to the pain-related anxiety-smoking relation is dysphoria. Dysphoria is a core symptom cluster of depression characterized by anhedonia, sadness, psychomotor disturbance, loss of self-esteem, cognitive difficulty, and worry (Leventhal, Zvolensky, & Schmidt, 2011). Dysphoria is associated with multiple aspects of smoking behavior, including higher levels of tobacco dependence, greater perceived barriers to cessation, and more severe withdrawal symptoms (Bakhshaie et al., 2017; Buckner et al., 2015). Among depressive symptoms, dysphoria holds the strongest association to smoking outcomes and is theorized to play a central role in the development and maintenance of maladaptive smoking (Leventhal et al., 2011; Leventhal & Zvolensky, 2015). Additionally, while not dysphoric symptoms per se, research on depressive symptoms, more broadly, supports a robust association between pain and depressive symptoms, such that smokers who experience chronic pain endorse greater levels of depressive symptoms (Linton, 2013; Shi et al., 2010; Zale et al., 2016). Indeed, depressive symptoms have been found to mediate the relation between pain and smoking (Goesling, Brummett, & Hassett, 2012). Despite the evidence for the association between pain constructs, depressive symptoms, and smoking, no research has examined the role of a specific symptom cluster of depression, such as dysphoria, in the association between pain-related anxiety and smoking processes. Thus, a clinically important extension of extant empirical work would be to evaluate dysphoric symptoms in the relation between pain-related anxiety and smoking.

Theoretically, smokers who experience greater pain-related anxiety may avoid activities that may cause them pain, leading to self-isolation and, consequently, increased symptoms of dysphoria. Thus, as a by-product of fear or anxiety related to anticipated or experienced pain, these individuals may experience greater levels of dysphoric symptoms. Subsequently, consistent with negative reinforcement models of addiction (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004), these smokers may use smoking as a method to reduce or escape dysphoric states. The negative reinforcement cycle experienced by smokers with elevated pain-related anxiety, and subsequently increased dysphoria, may lead to more strongly held maladaptive beliefs about smoking, including greater perceived barriers to quitting (Macnee & Talsma, 1995), motivation to smoke to relieve negative affect symptoms (Piper et al., 2004), and negative mood-related abstinence expectancies (Abrams, Zvolensky, Dorman, Gonzalez, & Mayer, 2011). Thus, dysphoria may, in part, explain the effect of pain-related anxiety on smoking processes. These outcomes are of interest because, when conceptualizing quitting as a dynamic process (Shiffman, 2005; Swan & Denk, 1987), they represent a continuum of processes that maintain tobacco use and therefore impede smoking cessation (Brandon, 1994; Copeland & Brandon, 2000; Zvolensky et al., 2007). Indeed, these processes tap into focused attention on the immediate mood-regulating effects of smoking (i.e., negative affect reduction), the potential challenges and difficulties that would arise if one attempted to quit, and beliefs that quitting will have negative consequences, all of which contribute to maladaptive smoking behaviors (Abrams et al., 2011; Baker et al., 2004; Gonzalez, Zvolensky, Vujanovic, Leyro, & Marshall, 2008). To date, however, no work has examined the explanatory pathway from pain-related anxiety through dysphoric symptoms to these clinically-relevant smoking processes. Elucidating these relations would provide a more thorough conceptual understanding for how pain-related constructs and dysphoria uniquely relate to barriers to quitting, motives for use, and negative expectations about quitting.

Together, the current study explored the explanatory role of dysphoria in the relation between pain-related anxiety and smoking outcomes (i.e. perceived barriers to cessation, negative reinforcement smoking motives, and smoking abstinence expectancies related to negative mood). Specifically, we hypothesized that smokers with elevated pain-related anxiety would experience greater barriers to cessation, endorse greater motivation to smoke to relieve negative internal states, and expect higher levels of negative mood during periods of smoking abstinence through dysphoria. Consistent with previous research, all effects were examined adjusting for gender, presence of a psychiatric disorder, cigarette dependence, and severity of recently experienced pain (Ditre et al., 2011; Ditre et al., 2015; Gonzalez et al., 2010).

2. Material and Methods

2.1. Participants

Of the 105 current, daily smokers potentially eligible to be included