



Main and interactive effects of emotion dysregulation and breath-holding duration in relation to panic-relevant fear and expectancies about anxiety-related sensations among adult daily smokers

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ABSTRACT

The current study investigated the main and interactive effects of emotion dysregulation and distress tolerance in relation to panic-relevant variables among daily smokers. The sample consisted of 172 adults (61.2% male; $M_{age} = 31.58$, $SD = 11.51$), who reported smoking an average of 15.99 cigarettes per day ($SD = 10.00$). Results indicated that both emotion dysregulation and distress tolerance were significantly related to interoceptive fear and agoraphobia. Additionally, emotion dysregulation, but not distress tolerance, was significantly related to anxiety sensitivity. All effects were evident above and beyond the variance accounted for by average cigarettes per day, tobacco-related physical illness, and panic attack history. The interaction between emotion dysregulation and distress tolerance significantly predicted interoceptive and agoraphobic fears as well as the cognitive component of anxiety sensitivity. Such findings underscore the importance of emotion dysregulation and distress tolerance in regard to panic-specific fear and expectancies about anxiety-related sensations among daily smokers.

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Approximately 50% of daily smokers have a lifetime history of a psychiatric disorder with such persons consuming a disproportionately large percentage of the overall volume of cigarettes (Lasser et al., 2000). Although smoking has historically been studied in relation to many co-occurring psychopathological conditions (e.g., schizophrenia, depressive disorders; Ziedonis et al., 2008), comparatively less scholarly attention has been focused on anxiety and its disorders. This limitation is unfortunate, as anxiety disorders are among the most common psychiatric conditions. Moreover, some studies indicate rates of smoking are higher among those with anxiety disorders relative to many other psychiatric conditions as well as those with no psychiatric illness (McCabe et al., 2004).

Notably, some of the most robust relations documented between smoking and anxiety disorders have been evident for panic psychopathology (Zvolensky, Feldner, Leen-Feldner, & McLeish, 2005; Zvolensky, Schmidt, & Stewart, 2003). For example, epidemiological (Farrell et al., 2001), community (Hayward, Killen, & Taylor, 1989), and clinical (Pohl, Yeragani, Balon, Lycaki, & McBride, 1992) studies have found individuals with panic attacks are more apt to have a history of smoking compared to individuals without a panic attack history. Numerous other investigations

suggest smoking often precedes and increases the subsequent risk for developing panic attacks and panic disorder with and without agoraphobia (Bernstein, Zvolensky, Schmidt, & Sachs-Ericsson, 2007; Breslau & Klein, 1999; Isensee, Wittchen, Stein, Höfler, & Lieb, 2003; Johnson et al., 2000; Zvolensky, Kotov, Antipova, & Schmidt, 2003). Additionally, panic psychopathology can impair success in quitting smoking. For example, Piper et al. (2010) recently found that smokers with a history of panic attacks, compared to smokers with no anxiety diagnoses, were significantly less likely to be abstinent at eight weeks and six months post-quit. These data collectively indicate clinically and statistically significant bidirectional relations between smoking and panic psychopathology.

Although there is an established link between smoking and panic psychopathology, little is known about the factors that are related to panic-relevant fear and expectancies about anxiety-related sensations among daily smokers (Ziedonis et al., 2008). This limitation is notable, as integrative models of smoking-panic co-occurrence and empirical evidence suggest that panic-relevant fear (degree of fear of internal and external events; Rapee, Craske, & Barlow, 1995) and expectancies about internal sensations (anxiety sensitivity or beliefs that anxiety-related sensations have negative personal consequences; Taylor, 1999) may each independently contribute to the tendency to be emotionally reactive to smoking-based cues (e.g., bodily sensations) and enhance motivation to smoke for emotion regulatory reasons (e.g., coping-motivated

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smoking in an effort to down regulate perceived or objective elevations in negative affect or hyperarousal; Zvolensky & Bernstein, 2005; Zvolensky, Kotov, et al., 2003; Zvolensky, Schmidt, et al., 2003). Specifically, smokers who perceive anxiety-related sensations as harmful or dangerous may be more apt to be fearful of, and emotionally reactive to, internal states that occur during smoking discontinuation. Consequently, a forward-feeding cycle may develop, whereby smoking is used as a coping strategy for managing aversive states in the short term, yet paradoxically confers longer-term risk for the development of panic symptoms. Thus, it is important to isolate the factors that are uniquely related to panic-relevant fear and expectancies about anxiety-related sensations among this population, in order to more effectively target these variables in specialized intervention programs for smokers with co-occurring vulnerabilities for, or existing problems with, panic psychopathology.

Emotion dysregulation represents a promising construct of increasing scholarly interest in anxiety psychopathology and substance use disorder comorbidity research and clinical work (Barlow, Allen, & Choate, 2004; Bonn-Miller, Vujanovic, & Zvolensky, 2008; Kashdan & Steger, 2006; Orsillo & Roemer, 2005). Emotion dysregulation reflects difficulties in the self-regulation of affective states and in self-control over affect-driven behaviors (Carver, Lawrence, & Scheier, 1996). Although there has historically been limited work on emotion dysregulation and anxiety psychopathology, recent studies have found that higher levels of emotion dysregulation are generally related to more frequent and intense anxiety symptoms (Tull, Barrett, McMillan, & Roemer, 2007; Tull & Roemer, 2007; Vujanovic, Zvolensky, & Bernstein, 2008). That is, emotion dysregulation is not-specific to particular anxiety phenotypes or symptoms, but rather, is broadly associated with various types of anxiety symptoms. However, the explanatory utility of emotion dysregulation has not yet been explored in relation to panic-specific fear or expectancies about anxiety-related sensations among daily smokers.

A second construct potentially relevant to bridging gaps in understanding about anxiety-tobacco comorbidity is distress tolerance (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005). Distress tolerance reflects the perceived and/or actual behavioral capacity to withstand exposure to aversive or threatening experiential states (e.g., negative emotions, uncomfortable physical sensations; Leyro, Zvolensky, & Bernstein, 2010). Distress tolerance has been conceptualized as: (a) the *perceived* capacity to withstand aversive emotional or physical states (assessed via self-report measures; e.g., Distress Tolerance Scale [DTS; Simons & Gaher, 2005]) and (b) the *behavioral act(s)* of withstanding distressing internal states elicited by some type of stressor (assessed via the latency to discontinue distressing tasks; e.g., breath-holding task; Zvolensky, Brandt, & Bernstein, 2011). In fact, numerous studies indicate that there is a minimal association between these two distress tolerance classes (Bernstein, Marshall, & Zvolensky, *in press*; Leyro et al., 2010; Marshall-Berenz, Vujanovic, Bonn-Miller, Bernstein, & Zvolensky, 2010; McHugh et al., *in press*). Within the area of smoking research, much of existing work has examined behavioral measures of distress tolerance (e.g., breath-holding duration) in relation to smoking relevant outcomes. Here, past work indicates that lower levels of behavioral distress tolerance are related to problems in abstaining from smoking (e.g., Brown et al., 2009). Other related work suggests that distress tolerance may be an important, yet underrecognized, explanatory factor in terms of emotional reactivity to interoceptive distress (Schmidt, Mitchell, Keough, & Riccardi, 2010). For example, lower levels of perceived distress tolerance for emotional distress and physical stress, and a lesser ability to withstand acute episodes of emotional stress, are significantly related to increased anxiety symptoms and panic attacks (Boelen & Reijntjes, 2009; Bonn-Miller, Zvolensky, & Bernstein, 2009; Daughters et al.,

2009; Marshall et al., 2008) as well as escape behavior in response to somatic arousal (Asmundson & Stein, 1994; Marshall et al., 2008; Telch, Jacquin, Smits, & Powers, 2003). There has not yet been a direct test, however, of the relation between behavioral measures of distress tolerance and panic-specific fear or expectancies about anxiety-related sensations, in general, or among a tobacco using population, in particular.

Beyond main effects for emotion dysregulation and distress tolerance among daily smokers, there is apt to be clinically relevant interplay between these factors. Indeed, smokers with higher levels of emotion dysregulation and lower tolerance for interoceptive distress (e.g., aversive physical sensations) may be more likely to manifest greater panic-specific fear and expectancies about anxiety-related sensations. That is, lower levels of tolerance for internal stress (e.g., bodily perturbation) may moderate the relation between emotion dysregulation and panic-specific fear and expectancies about anxiety-related sensations. Specifically, smokers experiencing greater levels of emotion dysregulation, who cannot as effectively tolerate such distress, may interpret distressing symptoms as more severe, thereby increasing reactivity to such symptoms and increasing panic-specific fear (interoceptive fear and agoraphobic fear) and future expectancies about internal sensations (anxiety sensitivity). Conversely, higher levels of an ability to tolerate emotion dysregulation may attenuate the relative risk for more severe panic-specific fear and expectancies about the negative consequences of anxiety-related sensations.

The current study investigated the main and interactive effects of emotion dysregulation and a behavioral measure of distress tolerance (breath-holding duration) in relation to panic-specific fear (interoceptive and agoraphobic fear) and expectancies about anxiety-related sensations (anxiety sensitivity) among a daily smoking population. There were three interrelated sets of hypotheses that were globally driven by the perspective that higher levels of an ability to tolerate emotion dysregulation may attenuate the relative risk for more severe panic-specific fear as well as heightened sensitivity to the physical and cognitive consequences of anxiety-related symptoms among daily smokers. First, it was hypothesized that the main effect of emotion dysregulation would be significantly related to specific fears and expectancies about anxiety-related sensations, as past work has suggested this construct is not specific to one disorder (Tull et al., 2007). Second, it was hypothesized that the main effect of a behavioral index of distress tolerance (breath-holding duration) would be significantly (negatively) related only to the panic-specific fear criterion variables (interoceptive and agoraphobic fear) and the physical and cognitive indices of anxiety sensitivity; thus, it would showcase explanatory specificity to panic-relevant indices (Schmidt et al., 2010). Finally, it was hypothesized that the significant main effects would be qualified by a significant interaction between emotion dysregulation and distress tolerance in terms of only panic-specific fear as well as the physical and cognitive indices of anxiety sensitivity. The hypothesized significant effects were expected to be evident above and beyond the variance accounted for by lifetime panic attack history, daily smoking rate, and lifetime history of tobacco-related medical illness; factors known to covary with emotion dysregulation and distress tolerance (Schmidt et al., 2010; Tull et al., 2007).

1. Method

1.1. Participants

Participants included 172 adult daily smokers (61.2% male; $M_{age} = 31.58$, $SD = 11.51$), who responded to advertisements (e.g. flyers, newspaper ads, radio announcements) to participate in a study examining the efficacy of a 4-session smoking-based behavioral intervention program focused on emotional vulnerability in

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