



Anxiety and depressive symptoms and affective patterns of tobacco withdrawal



Adam M. Leventhal^{a,b,*}, Katherine J. Ameringer^a, Elly Osborn^c, Michael J. Zvolensky^{d,e}, Kirsten J. Langdon^f

^a University of Southern California, Keck School of Medicine, Department of Preventive Medicine, Los Angeles, CA 90033, USA

^b University of Southern California, Department of Psychology, Los Angeles, CA 90033, USA

^c University of Washington School of Medicine, Seattle, WA 98105, USA

^d University of Houston, Department of Psychology, Houston, TX 77004, USA

^e University of Texas M.D. Anderson Cancer Center, Department of Behavioral Science, Houston, TX 77230, USA

^f Alpert Medical School of Brown University, Department of Psychiatry and Human Behavior, Providence, RI 02912, USA

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ABSTRACT

Background: The complex concordance and discordance across and within anxiety and depressive symptoms complicates understanding of the relation between emotional symptoms and manifestations of tobacco withdrawal. The goal of this study was to parse the broad variation in anxiety and depressive symptoms into conceptually discrete components and explore their relative predictive influence on affective patterns of acute tobacco withdrawal.

Methods: We employed a within-participant experimentally manipulated tobacco abstinence design involving: (i) a baseline visit at which past-week depression and anxiety symptoms were assessed and (ii) two counterbalanced experimental visits—one after ad lib smoking and one after 16-h of tobacco abstinence—at which state affect was assessed. Participants were community-dwelling adults ($N = 187$) smoking 10+ cig/day for at least two years without an active mood disorder.

Results: Anxiety-related general distress symptoms (e.g., tension, nervousness) predicted greater abstinence-induced increases in various negative affective states but not changes in positive affect (β s .17–.33). Depression-related general distress symptoms (e.g., sadness, worthlessness) predicted greater abstinence-induced increases in acute depressed affect only (β s .24–.25). Anhedonic symptoms (e.g., diminished interest, lack of pleasure) predicted larger abstinence-induced decreases in acute positive affect only (β s .17–.20). Anxious Arousal symptoms (e.g., shakiness, heart racing) predicted larger abstinence-induced increases in fatigue and depressive affect (β s .15–.24).

Conclusion: Different components of anxiety and depressive symptoms are associated with unique affective patterns of acute tobacco withdrawal. These results provide insight into the affective mechanisms underlying tobacco dependence and could inform smoking cessation treatment approaches tailored to individuals with emotional distress.

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1. Introduction

One hypothesis to explain the association between emotional distress and tobacco dependence is that individuals with elevated anxiety or depressive symptoms experience more severe tobacco withdrawal symptoms when abstaining from smoking. Tobacco withdrawal symptoms, which span various undesirable affective, cognitive, and somatic features (Hughes, 2007), may provoke

compulsive motivation to smoke to modulate such symptoms (Baker et al., 2004). Hence, tobacco withdrawal may underlie maintenance of smoking due to motivation to delimit or otherwise offset withdrawal that occurs during brief periods of abstinence (e.g., overnight, tobacco use restrictions). Tobacco withdrawal also could increase risk of relapse following a cessation attempt (Piper et al., 2011). Accordingly, elucidating the relation of anxiety and depressive symptoms to tobacco withdrawal could provide unique insight into the affective mechanisms underlying tobacco dependence and inform specialized smoking cessation treatment approaches tailored to individuals with emotional distress. Given that subclinical levels of emotional symptoms among those without an active mood disorder predict smoking cessation failure (Leventhal et al., 2008), understanding how emotional

* Corresponding author at: University of Southern California, Keck School of Medicine, 2250 Alcazar Street, CSC 240, Los Angeles, CA 90033, USA.
Tel.: +1 323 442 8222; fax: +1 323 442 2359.

E-mail address: adam.leventhal@usc.edu (A.M. Leventhal).

symptoms relate to tobacco withdrawal among non-psychiatric community-dwelling populations is clinically important.

Some prior work has found that smokers with elevated depressive and anxiety symptoms experience more severe withdrawal symptoms (e.g., Breslau et al., 1992; Johnson et al., 2012; Langdon et al., 2013; Leventhal et al., 2008; Piper et al., 2010; Pomerleau et al., 2000; Weinberger et al., 2010; Xian et al., 2005; Zvolensky et al., 2008), even among those without an active mood disorder (Leventhal et al., 2008). Nevertheless, critical gaps remain in this literature. Most notably, extant tobacco withdrawal research has mainly explored the effects of depression and anxiety symptoms using standard syndrome based measures (e.g., DSM-IV diagnoses or composite symptom indexes). This approach overlooks the complex concordance and discordance across and within anxiety and depressive syndromes. Anxiety and depressive symptoms are difficult to differentiate empirically due to their high rates of co-occurrence (Clark and Watson, 1991; Watson et al., 1995). Moreover, there is considerable symptomatic heterogeneity within depressive (Shafer, 2006) and anxiety (Ree et al., 2008) conditions. To address these barriers, Clark and Watson (1991) put forth a tripartite model of anxiety and depression which proposes that the heterogeneity in emotional symptoms can be parsimoniously explained by three distinct constructs. *General Distress*, a nonspecific factor that is indicative of negative emotions, includes symptoms such as sadness, irritability, worry, and concentration problems, cuts across both anxiety and depression and accounts for a considerable portion of anxiety–depression symptom overlap. *Anxious Arousal*, a specific factor for anxiety indicative of tension and autonomic arousal, includes panic-like symptoms and is putatively distinct from depression. *Anhedonia*, a specific factor for depression indicative of reduced interest/motivation, pleasure, and positive affect, and is putatively distinct from anxiety. Hence, the tripartite model could be leveraged to elucidate the relation of anxiety and depressive symptoms to tobacco withdrawal.

Another factor that complicates understanding of the relation of anxiety and depressive symptoms to tobacco withdrawal is the methodology frequently employed to study such processes. Retrospective designs which ask participants to report on withdrawal symptoms experienced during a past episode of abstinence are subject to recall bias (Shiffman et al., 1997). As one example, smokers may involuntarily overestimate their mood severity during a prior period of abstinence if they are currently in a poor mood state, which can spuriously inflate relations between emotional symptoms and tobacco withdrawal. Prospective designs of active quitters can avoid this problem; however, many smokers attempting to quit relapse back to smoking. Investigations that do not account for people who relapse are subject to confounding by nonabstinent status. Studies have addressed this problem by analyzing the subset of abstainers (e.g., Leventhal et al., 2008; Zvolensky et al., 2008); yet, this approach increases risk of selection bias, as those who relapse and are excluded from analyses may be the most dependent smokers.

The experimentally manipulated tobacco abstinence paradigm is less susceptible to limitations that affect these other methods because it: (a) utilizes prospective measurement of withdrawal while abstinence is occurring; (b) includes ad lib. smoking control conditions, which permits study of abstinence-induced changes from “baseline smoking levels;” and (c) reduces selection biases due to failure to maintain abstinence given the high rates of abstinence compliance with this method (Gilbert et al., 1999). Importantly, tobacco withdrawal severity during experimentally induced abstinence in the laboratory predicts withdrawal in a subsequent naturalistic self-initiated quit attempt (al’Absi et al., 2005), suggesting that findings from research employing this design may generalize outside the laboratory.

In this study of community smokers without an active mood disorder, we applied the tripartite model of anxiety and depression to investigate the disparate predictive effects of general distress, anxious arousal, and anhedonia symptoms on abstinence-induced expressions of tobacco withdrawal. We focused on affective manifestations of withdrawal because: (a) these symptoms may be more important determinants of smoking motivation in comparison to other symptoms (e.g., hunger; McCarthy et al., 2006) and (b) anxiety and depression may modulate the affective features of withdrawal more strongly than its other components. We suspect that individuals with anxiety and depressive symptoms are motivated to smoke, in part, because tobacco may briefly and temporarily offset their specific emotional symptoms. When they abstain from tobacco, their specific affective symptoms may become exacerbated by acute tobacco withdrawal in the short-term. Accordingly, we hypothesize pathognomonically consistent linkages between the tripartite constructs and particular affective patterns of withdrawal. We expect general distress symptoms to predict withdrawal in a non-specific manner, associating with greater abstinence-induced increases in all aversive affective states. We expect anxious arousal and anhedonia to predict withdrawal patterns in a feature-specific manner, such that anxious arousal will associate only with abstinence-induced increases in anxiety whereas anhedonia will associate with only abstinence-induced decreases in positive affect. Elucidating which facets of anxiety and depressive symptoms give rise to certain affective changes during tobacco withdrawal may inform: (1) clinical use of emotional symptom measures to identify patients at high risk for experiencing elevated state affective disturbance during a quit attempt and (2) tailored cessation treatment strategies that can be designed to offset the specific withdrawal symptoms that are especially prominent given a patient’s particular precessation emotional symptom profile.

2. Methods

2.1. Participants

Participants were community residents recruited via public announcements of opportunities to participate in a study on personality and smoking. Inclusion criteria were: (a) ≥ 18 years old; (b) report regular cigarette smoking for ≥ 2 years; (c) report currently smoking ≥ 10 cig/day; and (d) and fluent in English. Exclusion criteria were: (a) current DSM-IV dependence on substances other than nicotine; (b) current DSM-IV mood disorder or psychotic symptoms or use of psychiatric medications; (c) breath carbon monoxide (CO) levels < 10 ppm at intake; (d) use of non-cigarette tobacco or nicotine products; and (e) currently pregnant. Participants were compensated \$200 USD after completing the study. In total, 326 participants enrolled in the study after passing a phone screen. Of these, 104 individuals were ineligible due to low CO ($n = 64$), current psychiatric disorder ($n = 23$), other criteria ($n = 18$). Of the eligible participants, 33 dropped out after study entry (there were no significant differences in drop out versus completers on anxiety and depressive symptoms), and 2 twice failed to meet abstinence criteria at the abstinent session (see below), leaving a final sample of 187. The University of Southern California Institutional Review Board approved the protocol.¹

2.2. Procedure

Following a baseline visit, participants attended two experimental visits (one abstinent and one nonabstinent; order counterbalanced) that began at 12 pm. For abstinent visits, participants were instructed not to smoke after 8 pm the day before. For nonabstinent visits, they were instructed to smoke normally. The procedures were identical except that at the beginning of the nonabstinent visit and prior to CO assessment participants smoked a cigarette of their preferred brand in the laboratory to standardize recency of smoking. The abstinent session began with CO measurement. Following prior research and recommendations that a CO ≥ 10 ppm indicates recent smoking (Leventhal et al., 2010; SRNT, 2002), participants with a CO ≥ 10 ppm

¹ The sample in the current study ($n = 187$) partially overlaps with a prior publication ($n = 75$; Leventhal et al., 2012). The prior study did not analyze any predictors or outcomes overlapping with the predictors and outcomes reported in the current submission.

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