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Anxiety and Depressive Symptoms and Affective Patterns of Tobacco Withdrawal

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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-hours 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

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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.

Keywords

Depression; Anxiety; Smoking; Nicotine Withdrawal; Tobacco Abstinence

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 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 indices (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. In prospective designs of active quitters, many 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;” 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). Tobacco withdrawal severity during experimentally-induced abstinence 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. METHOD

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 < 10ppm at intake; (d) use of non-cigarette tobacco or nicotine products; and (e) currently pregnant. Participants were compensated \$200 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 Internal Review Board approved the protocol. 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.

2.2 Procedure

Following a baseline visit, participants attended two experimental visits (one abstinent and one nonabstinent; order counterbalanced) that began at 12pm. For abstinent visits, participants were instructed not to smoke after 8pm 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 = 10ppm indicates recent smoking (Leventhal et al., 2010; SRNT, 2002), participants with a CO = 10ppm at their abstinent session could return later that week for a second attempt to complete their abstinent session ($n = 13$). Those with CO = 10ppm on their second attempt were discontinued ($n = 2$). Subsequently, participants completed measures of affect, nicotine withdrawal, and smoking urge.

2.3 Baseline Visit Measures

Structured Clinical Interview for DSM-IV Non Patient Edition (First et al., 2002)

—Mood disorder, psychotic screen, and substance use disorder modules were used to assess psychiatric eligibility.

Fagerström Test of Nicotine Dependence (FTND; Heatherton et al., 1991)

—The FTND is a well-validated six-item measure of nicotine dependence severity.

Mood and Anxiety Symptom Questionnaire – Short Form (MASQ; Clark and Watson, 1991)

—The MASQ is a 62-item self-report measure of emotional symptoms based upon the tripartite model of anxiety and depression. Participants rate how much they experienced each symptom in the previous week (1=not at all; 5=extremely). The MASQ contains four symptom scales: (a) Anxious Arousal, which assesses somatic tension and arousal (17 items; e.g., “was trembling or shaking,” “felt dizzy or lightheaded”) specific to anxiety; (b) Anhedonic Depression, which assesses low interest, pleasure, and positive affect (22 items; e.g., “felt like there wasn't anything interesting or fun to do,” “felt like nothing was very enjoyable”), specific to depression; (c) General Distress-Anxiety, which assesses anxious/tense mood and other nonspecific anxiety symptoms (11 items; e.g., “felt nervous,” “felt uneasy”); and (d) General Distress-Depression, which assesses depressed/sad mood and other nonspecific depressive symptoms (12 items; e.g., “felt sad,” “felt like a failure”). Factor analyses of the MASQ have yielded three-factor solutions that correspond to the instrument's conceptually derived subscales and show that the Anxious Arousal and Anhedonic Depression subscales differentiated anxiety and depression better than the General Distress subscales (Watson et al., 1995). Though considered to be the part of a common overarching construct, the depression- and anxiety-related general distress scales are separated to provide different measures that correspond to traditional anxiety and depression diagnostic distinctions. Further, the MASQ-Anhedonic depression has exhibited good convergent validity with measures of loss of pleasure in non-clinical participants (Gilbert et al., 2002).

2.4 Measures on Experimental Visits

2.4.1 Manipulation Checks—We administered: (1) a breath CO assessment; (2) an 11-item variant of the Minnesota Nicotine Withdrawal Scale (MNWS; Hughes and Hatsukami, 1986), which assesses withdrawal symptoms experienced “so far today” on 6-point scales and produces a mean composite scale (0 – 5 range; Leventhal et al., 2010); and (3) the Brief Questionnaire of Smoking Urges (QSU; Cox et al., 2001), which measures urge to smoke “right now” and includes a total scale based on the average score per item (range 0 – 5).

2.4.2 The Profile of Mood States (POMS; McNair et al., 1971)—The POMS is a multidimensional affect scale, which served as the primary outcome. This study used a 72-item version in which participants rated affect adjectives based on how they were feeling “right now” (0-not at all; 4-extremely). The POMS yields several aversive affect scales, such as Anger (e.g., “angry,” “grouchy”), Anxiety (e.g., “shaky,” “panicky”), Confusion (e.g., “confused,” “forgetful”), Depression (e.g., “sad,” “hopeless”), and Fatigue (e.g., “worn out,” “fatigued”). The POMS also yields positive affective subscales, including Elation (e.g., “happy,” “satisfied”) and Vigor (e.g., “energetic,” “cheerful”). Each subscale score is computed as a mean score per item.

2.5 Data Analysis

For preliminary analyses, we calculated descriptive statistics, intercorrelations, and Cronbach’s alpha coefficients for each MASQ scale. To test the main effects of abstinence on experimental session measures, we calculated abstinence-induced change scores (Abstinent – Nonabstinent) for each outcome and then conducted single sample t-tests to test for significant departure from zero, which is equivalent to conducting a paired t-test with the raw data.

The primary analyses used linear regression models, in which a single MASQ scale served as a predictor and the abstinence-induced change score for each POMS scale served as the outcome. Separate models were calculated for each MASQ scale predictor and each POMS outcome. We considered combined models in which all MASQ scales were entered as simultaneous predictors; however, there was a high degree of intercorrelation among some MASQ scales (see Table 1), which precluded such analyses because of multicollinearity concerns. To control for baseline state affect, the corresponding nonabstinent outcome measure was included as a covariate in each model. Each model was recalculated after controlling for age, gender, and FTND score because age was significantly associated with MASQ-General Distress Anxiety and both gender and FTND were significantly associated with abstinence-induced changes in several outcomes. Additional post-hoc analyses in which the raw data for the abstinent score served as the dependent variable and the non-abstinent score was included as the covariate yielded equivalent results to those reported in the body of the article that relied on change scores.

Variables with non-normal distributions were transformed to approximate normality when appropriate. Results are reported as standardized regression coefficients (β s) and significance was set at $p < .05$ (two-tailed). We also report Benjamini-Hochberg corrected significance determinations (Keselman et al., 2002) to allow the reader to interpret the findings with respect to a more conservative type-I error protection due to multiple tests.

3. RESULTS

3.1 Preliminary analyses

3.1.1 Sample Characteristics—Participants were on average 43.7 ($SD=10.3$) years of age, 67% male, smoked 19.3 ($SD=5.3$) cig/day, began smoking at age 16.7 ($SD=6.6$), and had an FTND score of 5.3 ($SD=2.0$) indicating medium level of nicotine dependence on

average. The ethnic distribution was 55% African American, 36% Caucasian, and 9% other, with 15% self-identifying as Hispanic.

3.1.2 Anxiety and Depressive Symptoms—Each MASQ scale exhibited strong internal consistency (Table 1). On average, there was a low severity of anxiety and depressive symptoms and high between-participant variability, similar to those reported in prior general community samples (Gilbert et al., 2002). The proportion who surpassed clinical cutoffs for anxious arousal was 6%, anxiety-related general distress (10%), depression-related general distress (17%), and anhedonic depression (52%), based on cutpoints yielded from prior work (Schulte-van Maaren et al., 2012). There was a high degree of convergence between the two General Distress scales and comparatively lower correlations (and higher discriminant validity) of Anhedonic Depression to the other MASQ scales. Anxious Arousal exhibited sizeable correlations with the two General Distress scales, which is inconsistent with intended discrimination between this scale and non-specific distress.

3.1.3 Main Effects of Abstinence—Abstinence had a significant effect on each POMS scale, except Fatigue, as well as all of the manipulation check measures (Table 2).

3.2 Primary Analysis

Analyses examining MASQ subscales as predictors of abstinence-induced changes in POMS scales after adjusting for non-abstinent POMS scores are presented in Table 3. Anxious Arousal significantly predicted abstinence-induced increases on the POMS Depression and Fatigue Scales. General Distress-Anxiety significantly predicted abstinence-induced increases in each aversive affect state (Anger, Anxiety, Confusion, Depression, and Fatigue) and did not predict the two positive affect measures (Vigor and Elation). General Distress-Depression significantly predicted abstinence-induced increases in POMS Depression only. Anhedonic Depression predicted abstinence-induced decreases in the two positive affect scales (Vigor and Elation). Each of these findings remained statistically significant after controlling for demographics and nicotine dependence, yet only some remained significant after applying a type-I error correction (Table 3). Additional post-hoc analyses in which the raw data for the abstinent score served as the dependent variable and the non-abstinent score was included as the covariate yielded equivalent results to those reported in the body of the article that relied on change scores.

4. DISCUSSION

This study found that different domains of anxiety and depressive symptoms predicted different affective profiles during acute tobacco withdrawal. We found pathognomically-concordant findings for anhedonia, the emotional symptom component putatively specific to depression and distinct from anxiety. Anhedonia was associated with only abstinence-induced reductions in positive affect. Prior research has demonstrated that smokers with lower levels of trait hedonic capacity (i.e., ability to experience pleasure in response to rewarding stimuli) experience greater abstinence-induced reductions in vigor but not abstinence-induced changes on a composite measure of negative affect (Cook et al., 2004).

The current results cohere with and uniquely extend past work by: (a) using a symptom-based measure of anhedonia that assesses a broader array of features (i.e., diminished interest/motivation, pleasure, and positive affect); (b) demonstrating consistent effects on an additional positive affect outcome (i.e., elation); and (c) illustrating that anhedonia is not significantly associated with various negative affective expressions of withdrawal. Extant investigations have shown that higher precessation anhedonia, as measured by the MASQ-Anhedonic Depression and other anhedonia scales, predicts greater smoking relapse risk (Cook et al., 2010; Leventhal et al., 2008; Niaura et al., 2001; Zvolensky et al., 2009). These results are consistent with notions that high-anhedonia individuals may smoke in order to briefly and temporarily offset positive affect deficits (Cook et al., 2007), and these deficits may become expressed and exacerbated during acute tobacco withdrawal, which could in turn motivate the resumption of smoking following abstinence.

We hypothesized that both anxiety and depression-based measures of general distress would exhibit non-specific associations with a variety of aversive affect states during abstinence. The anxiety-based measure of general distress showed the predicted pattern, such that it associated with greater abstinence-induced increases across all aversive affect states (i.e., anger, anxiety, depression, confusion, and fatigue). Anxiety-related general distress symptoms are characteristic of generalized anxiety disorder, a syndrome defined by excessive worry, tension, fatigue, concentration problems, and irritability. Prior work illustrates that diagnostic measures of generalized anxiety disorder predict poorer short-term smoking cessation outcomes (Piper et al., 2010). The current findings raise the possibility that anxiety-related general distress symptoms may mark a more severe tobacco dependence phenotype characterized by a tendency to smoke for various negative affective reasons.

The depression-based measure of general distress, however, did not show the non-specific pattern of effects we hypothesized. Depression-related general distress predicted only abstinence-induced increases in state depression. The symptoms in the MASQ-General Distress-Depression scale focus on elements of self-critical and pessimistic cognitions, sadness, and other low-arousal negative affects. We speculate that smokers with these symptoms are disproportionately prone to smoke in order to temporarily alleviate these particular emotional features. Hence, upon acute abstinence, these types of features, which are represented on the POMS-Depression scale (e.g., “sad,” “hopeless,” “unworthy”) may be disproportionately expressed among smokers with depression-related general distress symptoms. It is unclear why, unlike anxiety-related general distress, depression-related general distress was not non-specifically associated with a variety of negative affective states during withdrawal. Depression-related general distress in this sample strongly covaried with anxiety-related general distress ($r=.78$), which is in line with respective correlations in some past research ($r_s .69$ to $.78$; Wacker et al., 2009; Watson et al., 1995) and prior psychometric work (Wardenaar et al., 2010). Methodologically, it is possible that the relatively low level of depression in this sample (due to screening out those with current major depression) may have limited the ability to detect certain relations to withdrawal effects, which may only be prominent among the more severely depressed.

Anxious arousal, the symptom component putatively specific to anxiety and distinct from depression, did not exhibit pathognomonically-consistent relations with withdrawal

symptoms. Anxious arousal predicted greater abstinence-induced changes in depression and fatigue only. Intercorrelations among the MASQ subscales illustrated that anxious arousal did not adequately separate from the measures of general distress, which raises questions about the discriminant validity of this scale in our sample. Perhaps these symptom domains cluster together more strongly in general community samples in which overall symptom levels are low, which could ultimately reduce phenotype differentiation across manifestations of emotional distress, as demonstrated previously in non-clinical samples (Wacker et al., 2009). Thus, these findings should be interpreted with this caveat in mind. Nonetheless, anxious arousal and anhedonic depression were only modestly correlated ($r = .34$), which is consistent with the primary tenet of the tripartite model that these two constructs reflect “pure” measures of anxiety and depression, respectively (Clark and Watson, 1991), and with correlations between these measures in past samples of smokers ($r_s = .33 - .40$; Gregor et al., 2007; Zvolensky et al., 2009).

Instead of relying on composite measures of negative affect or nicotine withdrawal as outcomes, we utilized outcome measures that differentiated qualitatively distinct subtypes of negative affect states (e.g., anger vs. anxiety) that could be expressed during acute tobacco withdrawal. This approach proved useful as it illustrated that certain domains of anxiety and depression predict qualitatively unique affective withdrawal profiles, which ultimately could advance treatment strategies that target particular affective subtypes. For instance, given that the current results suggest that smokers with depression-related general distress are characterized by a withdrawal profile involving elevated state depression only (and not other forms of negative affect), they may benefit from cessation strategies that specifically target low-arousal depressive emotions and cognitions (e.g., feeling “hopeless” and “unworthy” on POMS Depression scale) as emphasized in cognitive-behavioral depression-based smoking cessation treatments (Brown et al., 2007). Whereas, because smokers with anxiety-related general distress may be characterized by a withdrawal profile involving multiple negative affect elevations, they may benefit from a multi-faceted cessation treatment that targets both high-arousal (i.e., anger and anxiety) and low-arousal (i.e., depression) affective states as emphasized in acceptance and commitment based smoking cessation treatments (Brown et al., 2008).

Regarding study limitations, we excluded individuals who currently were taking psychiatric medications, in an acute mood disorder episode, or substance-dependent to limit the possible effects of psychoactive substances or substance withdrawal on tobacco withdrawal phenomena. Hence, it is unclear if these findings would generalize to individuals on the severe end of psychopathology continuum. Given that prior results indicate that higher levels of emotional psychopathology in those without an active emotional disorder is associated with more severe tobacco dependence and higher relapse risk (Leventhal et al., 2008; Niaura et al., 2001), the current results may nonetheless shed light on the clinical impact of subclinical emotional symptomatology in smokers. There are also limitations to ecological validity, including that this sample of participants did not wish to quit and that abstinence was not self-imposed. We used only one self-report measure of emotional symptomatology. It would be preferable to explore if effects are consistent across clinical ratings and diagnoses, yet we are unaware of any clinical rating tool comparable to the

MASQ that yields symptom indexes for each of the tripartite constructs. We confirmed abstinence with only CO and did not conduct a plasma nicotine analysis, which would have been preferable. Finally, when significance correction for multiple comparisons was applied, not all of the findings surpassed the significance threshold, which suggests that some of the findings should be interpreted with caution.

Overall, this study yields several scientific and clinical insights into the relation between emotional symptoms and tobacco dependence. For instance, utilizing standard depressive symptom measures that amalgamate all depressive symptoms into a composite index may obscure addiction-relevant variability among disparate symptomatic expressions of depression. Rather, it may behoove clinicians and researchers to assess anhedonic depressive symptoms, in particular, to identify the subgroup of smokers who experience disproportionate deficiencies in positive affect during tobacco withdrawal. Given that post-quit declines in positive affect increase risk of smoking relapse (Strong et al., 2009, 2011), anhedonic smokers may benefit from smoking cessation treatment strategies that emphasize bolstering positive affect. For instance, behavioral activation is a treatment that aims to teach individuals how to increase access to and mood enhancement from pleasant activities, which has recently shown promise for enhancing smoking cessation outcomes (MacPherson et al., 2010). Perhaps, this treatment may be warranted for anhedonic smokers who experience markedly diminished positive affect during treatment. In addition, measures of anxiety-related general distress symptoms may help to identify smokers who may be particularly prone to experiencing various forms of negative affect upon tobacco abstinence and benefit from cessation treatments focused on negative affect management. For example, behavioral interventions that teach smokers tolerance and acceptance of the affective distress associated with tobacco withdrawal by graduated exposure to abstinence may be useful for smokers with anxiety-related general distress (Brown et al., 2008). Broadly, this work illustrates that applying alternative models of emotional symptomatology rather than relying solely on standard unitary syndrome based models may promote a more refined understanding of the relation between emotional symptoms and tobacco dependence.

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Table 1
Descriptive Statistics, Internal Consistency and Intercorrelations for Anxiety and Depressive Symptom Scales

MASQ Scale	M(SD)	Intercorrelations			
		1.	2.	3.	4.
1. Anxious Arousal	20.78 (5.85)	(.88)			
2. General Distress-Anxiety	14.54 (4.93)	.85	(.86)		
3. Anhedonic Depression	52.26 (14.24)	.34	.35	(.90)	
4. General Distress-Depression	17.16 (6.52)	.70	.78	.46	(.91)

Note. N = 187. MASQ = Mood and Anxiety Symptoms Questionnaire—Short Form. Values in parentheses represent Cronbach α s for the respective MASQ scale. All intercorrelations significant at $p < .0001$.

Table 2**Main Effects of Abstinence on Affect States and Other Measures**

	<i>M(SD)</i> Nonabstinent	<i>M(SD)</i> Abstinent	<i>M(SD)</i> Abstinent- Nonabstinent	Cohen's <i>d</i> ^a
POMS Scales				
Anger	0.40 (0.66)	0.68 (0.82)	0.28 (0.78)	0.36 [†]
Anxiety	0.73 (0.74)	1.21 (0.96)	0.48 (0.92)	0.52 [†]
Confusion	0.80 (0.68)	0.96 (0.78)	0.16 (0.79)	0.20 ^{**}
Depression	0.43 (0.64)	0.53 (0.69)	0.10 (0.64)	0.16 [*]
Elation	1.95 (0.89)	1.45 (0.83)	-0.50 (0.82)	-0.61 [†]
Fatigue	0.85 (0.91)	0.87 (0.92)	0.01 (0.64)	0.02
Vigor	2.24 (1.01)	1.80 (0.97)	-0.44 (0.82)	-0.54 [†]
Manipulation Check measures				
CO ppm	28.25 (13.79)	5.54 (2.10)	-25.08 (12.07)	-2.08 [†]
MNWS	1.07 (1.00)	1.94 (1.12)	0.88 (1.07)	0.82 [†]
QSU	0.96 (1.11)	3.34 (1.07)	2.39 (1.25)	1.91 [†]

Note. *N* = 187.

^aEffect sizes (Cohen's *d*) and *p*-values for single sample t-tests of abstinent-nonabstinent change score for significant departure from zero;

MNWS = Minnesota Nicotine Withdrawal Scale; CO = Carbon Monoxide; POMS = Profile of Mood States; MNWS = Minnesota Nicotine Withdrawal Scale. QSU = Brief Questionnaire of Smoking Urges.

*
p < .05;

**
p < .01;

***
p < .001;

[†]
p < .0001

Table 3

Anxiety and Depressive Symptoms Predicting Abstinence-Induced Changes in Affect

POMS Outcome	MASQ Predictor					
	Anxious Arousal		General Distress-Anxiety		General Distress-Depression	
	β -Unadj ^a	β -Adj ^b	β -Unadj ^a	β -Adj ^b	β -Unadj ^a	β -Adj ^b
Anger	-	.26*** _c	.22*** _c	-	-	-
Anxiety	-	.25*** _c	.22*** _c	-	-	-
Confusion	-	.23*** _c	.19*	-	-	-
Depression	.24*** _c	.21*** _c	.33 [†] _c	.25*** _c	.24*** _c	-
Elation	-	-	-	-	-.17*	-.17*
Fatigue	.15*	.17*	.18*	-	-	-
Vigor	-	-	-	-	-.20***	-.20***

Note. N=187.

^a Predicting change score in respective outcome variable after controlling only for non-abstinence score

^b Predicting change score in respective outcome variable after controlling for nonabstinent score, gender, age, Fagerström Test of Nicotine Dependence Score.

^c Significant following Benjamini-Hochberg type-I error correction for multiple tests. Only significant findings ($p < .05$) displayed.

MASQ = Mood and Anxiety Symptoms Questionnaire—Short Form. POMS = Profile of Mood States.

* $p < .05$;

** $p < .01$;

*** $p < .001$;

[†] $p < .0001$