

Original Investigation

Smoking-Related Correlates of Depressive Symptom Dimensions in Treatment-Seeking Smokers

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Abstract

Introduction: The symptomatic heterogeneity of depression poses a barrier to understanding the smoking–depression relationship. Different types of depressive symptoms have evidenced disparate relations to smoking. Yet, depression measures employed in past depression–smoking research yield symptom subdimensions, which may not be sufficiently comprehensive or distinct. The Inventory of Depression and Anxiety Symptoms (IDAS; Watson, D., O’Hara, M. W., Chmielewski, M., McDade-Montez, E. A., Koffel, E., Naragon, K., et al. (2008). Further validation of the IDAS: Evidence of convergent, discriminant, criterion, and incremental validity. *Psychological Assessment*, 20, 248–259. doi:10.1037/a0012570) produce 8 distinguishable depressive symptom dimensions: dysphoria (anhedonia, sadness, psychomotor disturbance, worthlessness, worry, and cognitive difficulty), lassitude (anergia and hypersomnia), suicidality (self-harm thoughts/behaviors), ill temper (anger), well-being (positive thinking), appetite loss, appetite gain, and insomnia. The present study examined common and unique relations of IDAS depression subdimensions to (a) smoking rate (cigarettes perday), (b) tobacco dependence, and (c) smoking motivation.

Methods: Secondary analysis of cross-sectional associations in baseline data collected from 338 daily smokers enrolled in a large cessation study.

Results: In individual models examining each symptom dimension in isolation, each symptom dimension was significantly with associated smoking rate, tobacco dependence, and/or various aspects of smoking motivation (e.g., subjective addiction, habit, appetite control, affect modulation). In combined models including all 8 dimensions as simultaneous regressor variables, dysphoria was the only dimension to retain most of its significant associations to smoking characteristics.

Conclusions: Relations of depressive symptoms to tobacco dependence, smoking rate, and motivation may be explained by (a) variance specific to dysphoria symptoms and (b) shared

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variance across depressive symptom subdimensions. Dysphoria symptoms, which contain core *DSM-IV* depression criteria, may be central to depression–smoking comorbidity, whereas other symptoms may play a less prominent role.

Introduction

The relation between depressive symptoms and cigarette smoking is of considerable scientific and clinical importance, yet the mechanisms underlying this association are not entirely clear. Most studies in the smoking literature typically consider depression as a unidimensional construct that can be assessed by calculating the combined overall severity across all depressive symptoms. However, depressive symptoms are phenomenologically heterogeneous and include sadness, anhedonia (i.e., diminished interest or pleasure), concentration problems, anergia, worthlessness, changes in weight and sleep, suicidality, and psychomotor disturbances as well as other peripheral features (e.g., anger, diminished subjective well-being; Watson et al., 2007). Accordingly, depression may be more aptly characterized as a multidimensional construct involving a collection of several discrete subdimensions. Given that depressive symptom subdimensions are psychometrically distinct and may have unique etiological correlates (Milak et al., 2005; Watson et al., 2007), understanding the unique relation of each depressive subdimension to smoking could shed light on the mechanisms underlying depression–smoking comorbidity.

One approach to parsing depressive symptomatology involves computing symptom subscales within existing measures of depression, such as the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) or Beck Depression Inventory—Second Edition (BDI-II). Studies using that approach in samples of psychiatric patients have found that neither overall symptom severity scores nor cognitive or somatic symptom subdimensions on the BDI-II were associated with stage of change in the smoking cessation process (Acton, Prochaska, Kaplan, Small, & Hall, 2001; Prochaska et al.,

2004). By contrast, studies using the CES-D have found that anhedonia/positive affect, negative affect, and somatic features symptom dimensions were significantly associated with smoking status, tobacco dependence, smoking motivation, or relapse in nonpsychiatric patient samples, with some evidence that different symptom dimensions exhibited disparate associations with smoking characteristics (Leventhal, Ramsey, Brown, LaChance, & Kahler, 2008; Mickens et al., in press; Pomerleau, Zucker, & Stewart, 2003). Although these findings are of interest, such studies utilized depression measures that (a) are not sufficiently comprehensive in symptom coverage and (b) are not designed to assess distinct subscales and therefore may have limited factor heterogeneity.

The present cross-sectional correlational study examined smoking-related correlates of the Inventory of Depression and Anxiety Symptomatology (IDAS; Watson et al., 2007), a recently developed scale designed to yield eight specific, distinguishable, and internally consistent symptom subdimensions of depression: dysphoria (anhedonia, sadness, psychomotor disturbance, loss of self-esteem, cognitive difficulty, and worry), lassitude (anergia and hypersomnia), suicidality (self-harm thoughts/behaviors), ill temper (anger, irritability), well-being (positive thinking and optimism), appetite loss, appetite gain, and insomnia. This report represents a secondary analysis of baseline prequit data collected from daily smokers enrolled in a larger ongoing cessation study.

Based on past research showing univariate relations of the CES-D negative affect, positive affect, and somatic features subscales to indices of tobacco dependence and smoking motivation (Leventhal et al., 2008; Mickens et al., in press), we expected that higher scores on the IDAS dysphoria, lassitude, appetite loss, and insomnia subscales and lower well-being scores would demonstrate consistent associations with smoking rate (cigarettes per day), tobacco dependence severity, and domains of smoking motivation in individual statistical models examining the effect of each IDAS subscale in isolation from one another. Given extant results indicating unique relations of the CES-D anhedonia/positive affect scale to poor smoking cessation outcomes over and above other subdimensions (Leventhal et al., 2008), we hypothesized that the IDAS dysphoria (which assesses anhedonia and other symptoms) and well-being scales would demonstrate unique associations to smoking characteristics that are incremental to the other IDAS scales. We did not have any predictions regarding relations involving lassitude, suicidality, appetite gain, and ill temper because of the paucity of prior research of these depressive symptoms.

Method

Participants and Procedure

Participants were daily smokers who responded to community-based advertisements (e.g., flyers, newspaper ads, radio announcements) to participate in a larger study examining the efficacy of a novel four-session smoking cessation behavioral intervention that focused on vulnerability to panic (panic-smoking program; PSP) in comparison with a standard smoking cessation program (Standard Program [SP]). Both treatments took place over four 90-min sessions occurring once per week and provided nicotine replacement therapy. The PSP

integrates interoceptive exposure, cognitive restructuring, and psychoeducation exercises developed for panic prevention and treatment programs with standard smoking cessation counseling. The SP includes only the smoking-related components of PSP as well as review of general health information not specific to anxiety or smoking (in order to equilibrate contact time across the two conditions). Follow-up assessments involved the collection of smoking outcome data as well as emotional symptomatology for both treatment groups, which occurred 1 week, 2 weeks, 1 month, 3 months, 6 months, 1 year, and 2 years following quit day.

Participants were recruited at two sites (University of Vermont, Burlington, VT and Florida State University, Tallahassee, FL) at which identical procedures were executed. Enrollment in the study and the collection of baseline data began December 2008 and ended August 2010. The collection of outcome data is currently ongoing as of January 2011. To participate, individuals had to report smoking eight or more cigarettes/day on average for at least one year, provide a carbon monoxide breath sample of 10 ppm or higher at the baseline session, and be at least 18 years old. Participants were excluded from participation if they were currently suicidal, psychotic, had an inability to give informed consent, or were currently using any other smoking cessation treatment.

The current report is based on secondary analyses of data collected during the study's baseline assessment session, which took place prior to randomization and the commencement of the intervention. These analyses have not been published or presented previously. At this session, participants were administered the measures described below. All participants provided informed consent, and the study protocol was approved by the universities' Institutional Review Boards.

Measures

Inventory of Depression and Anxiety Symptoms

The IDAS is a 64-item questionnaire that assesses symptom dimensions of major depression and anxiety disorders in the past two weeks (Watson et al., 2007). The IDAS contains seven specific depressive symptom scales, including lassitude (six items; e.g., "I felt exhausted," "I slept more than usual"), insomnia (six items; "I slept less than usual," "I woke up early and could not get back to sleep"), suicidality (six items; "I had thoughts of suicide," "I hurt myself purposively"), appetite loss (three items; "I did not have much of an appetite"), appetite gain (three items; "I ate when I wasn't hungry"), ill temper (five items; "Little things made me mad," "I felt like breaking things"), and well-being (eight items; "I felt optimistic"). The IDAS also has two broader depression subscales: General Depression (GD; which contains 20 items sampled from each of the other IDAS depression scales) and dysphoria (which has 10 unique items not found on the other scales). The dysphoria scale contains items reflecting most of the DSM-IV major depression criteria (anhedonia ["I had little interest in my usual hobbies or activities"]; depressed mood ["I felt depressed"]; psychomotor agitation ["I felt fidgety, restless"]; psychomotor retardation ["I talked more slowly than usual"]; worthlessness ["I felt inadequate"]; guilt ["I blamed myself for things"]; diminished concentration ["I had

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trouble concentrating”]; indecision [“I had trouble making up my mind”]) as well as an item measuring worry (“I found myself worrying all the time”). The IDAS subscales show strong stability and internal consistency as well as excellent convergent, discriminant, criterion, and incremental validity in community, college student, and psychiatric patient samples (Watson et al., 2007, 2008).

Beck Depression Inventory—Second Edition (BDI-II)

The BDI-II (Beck & Steer, 1996) is a widely used, well-validated self-report inventory of cognitive, affective, and neurovegetative depressive symptoms experienced in the past two weeks (Steer, Brown, Beck, & Sanderson, 2001). For comparative purposes, we also created a dysphoria symptoms subscale within the BDI-II, which was the sum of BDI-II items corresponding to comparable items on IDAS dysphoria scale (#1 “sadness,” #8 “self-criticalness,” #11 “agitation,” #12 “loss of interest,” #13 “indecision,” #14 “worthlessness,” #19 “concentration difficulty”).

Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I)

Diagnostic assessments were conducted using the SCID-I-NP (Non-Patient Version; First, Spitzer, Gibbon, & Williams, 1995) to yield DSM-IV current and past psychiatric disorder diagnoses. All SCID-I interviews were administered by trained research assistants or doctoral-level staff and supervised by independent doctoral-level professionals. Interviews were audiotaped, and the reliability of a random selection of 12.5% of interviews was checked (MJZ) for accuracy; no cases of (diagnostic coding) disagreement were noted.

Medical Screening Questionnaire

This author-constructed measure contains a variety of questions assessing medical history. Participants who reported being diagnosed with heart problems, hypertension, respiratory disease, or asthma on this questionnaire were coded as having a somatic (tobacco-related) disease.

Smoking History Questionnaire

The Smoking History Questionnaire (Brown, Lejuez, Kahler, & Strong, 2002) assesses smoking rate, age of onset of initiation, years of being a daily smoker, and other characteristics.

Fagerström Test for Nicotine Dependence

The Fagerström Test for Nicotine Dependence (FTND) is a six-item scale that assess gradations in tobacco dependence (Heatherton, Kozlowski, Frecker, & Fagerström, 1991) and exhibits good internal consistency, positive relations with key smoking variables, and high test–retest reliability (Heatherton et al., 1991; Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).

Reasons for Smoking Questionnaire

A 23-item version of the Reasons for Smoking Questionnaire (RFS; Ikard, Green, & Horn, 1969) was used to assess six domains (subscales) of smoking motives: habitual (e.g., “I’ve found a cigarette in my mouth and didn’t remember putting it

there”), addictive (“Between cigarettes, I get a craving only a cigarette can satisfy”), negative affect reduction (“When I feel uncomfortable or upset about something, I light up a cigarette”), pleasurable relaxation (“I find cigarettes pleasurable”), sensorimotor (“Part of the enjoyment of smoking a cigarette comes from the steps I take to light up”), and stimulation (“I like smoking when I am busy and working hard”). Items are rated on a 1 (*never*) to 5 (*always*) scale. The factor structure, internal consistency, and test–retest reliability of the RFS have been well established (Shiffman, 1993).

Smoking Consequences Questionnaire

The Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991) is a 50-item self-report measure that assesses tobacco use expectancies believed to underlie smoking motivation on a Likert-type scale, ranging from 0 (“*completely unlikely*”) to 9 (“*completely likely*”). The measure and its constituent factors have excellent psychometric properties (Brandon & Baker, 1991; Buckley et al., 2005). We analyzed the following SCQ subscales: positive reinforcement (e.g., “I enjoy the taste sensations while smoking”), negative reinforcement/negative affect reduction (“Smoking helps me calm down when I feel nervous”), and appetite control (“Smoking helps me control my weight”).

Cronbach’s α estimates of internal consistency for all depression and smoking measures are reported in Tables 1 and 2, respectively.

Data Analysis Plan

Analyses first involved calculating descriptive statistics and testing correlations among the depression scales and clinical and demographic variables.

For primary analyses, we used linear regression models to test relations of each IDAS depression subscale to two smoking descriptors (cigarettes per day, FTND), six RFS scales, and three SCQ scales. Two sets of models were tested for each smoking outcome: (a) an individual model that included only a single IDAS depression subscale as the sole regressor variable and (b) a combined model that included all eight IDAS subscales (with nonoverlapping items) as simultaneous regressor variables to examine their unique associations with smoking characteristics after controlling for their covariance. Each model was adjusted for demographic (sex, age, and ethnicity) and clinical (current anxiety, alcohol, and drug use disorder and history of somatic disease) variables. For comparative purposes, we calculated three additional individual models for each smoking outcome paralleling those described above, which incorporated the IDAS GD and BDI-II total and dysphoria scales as regressor variables, respectively.

Exploratory analyses paralleling the individual models described above examined whether gender and history of major depression moderated the relationship between the depressive symptom scales and smoking variables.

To examine whether data met assumptions for linear regression, we tested for normality of continuous variables using Shapiro–Wilk tests and inspection of distributions for normality and homoscedasticity of residuals using Shapiro–Wilk and White tests and visual inspection of residual plots and for

Table 1. Correlations Among Depressive Symptom Indicators and With Demographic Characteristics

	Range	Tot ^c	Intercorrelations (<i>r</i>) ^{ab}											
			1	2	3	4	5	6	7	8	9	10	11	
Depressive symptom scales, <i>M</i>(<i>SD</i>)														
1. IDAS—Dysphoria	10–46	.22	(.92)											
2. IDAS—Lassitude	6–26	.42	.72	(.79)										
3. IDAS—Insomnia	6–30	.42	.69	.50	(.87)									
4. IDAS—Suicidality	6–18	.66	.52	.35	.42	(.77)								
5. IDAS—Appetite loss	3–15	.53	.54	.42	.54	.34	(.91)							
6. IDAS—Appetite gain	3–14	.75	.32	.30	.25	.25	-.06	(.79)						
7. IDAS—Ill temper	5–23	.53	.64	.47	.51	.49	.37	.26	(.86)					
8. IDAS—Well-being	8–40	.70	-.48	-.30	-.23	-.25	-.26	-.03	-.24	(.91)				
9. IDAS—General depression	22–84	-	.96	.76	.76	.53	.66	.27	.61	-.54	(.93)			
10. BDI-II total score	0–51	-	.82	.61	.59	.47	.48	.26	.51	-.55	.82	(.94)		
11. BDI-II dysphoria symptoms	0–20	-	.80	.58	.55	.44	.47	.22	.51	-.51	.79	.95	(.87)	
Demographics														
Age, <i>M</i> (<i>SD</i>)	18–65	-	-.16**	-.32†	-.07	-.04	-.14**	.02	-.14*	.03	-.19***	-.10	-.14*	
Female, <i>n</i> (%) ^d	-	-	.11*	.13*	.08	.00	.02	.10	.06	-.03	.10	.08	.05	
Caucasian, <i>n</i> (%) ^e	-	-	.01	.07	-.05	-.06	-.14*	-.02	<.01	-.03	-.01	-.02	-.04	
Clinical characteristics, <i>n</i> (%)														
Current anxiety disorder	-	-	.37†	.26†	.38†	.23†	.19***	.20***	.26†	-.20***	.38†	.36†	.36†	
Current drug abuse/dependence	-	-	.17**	.17**	.10	.12*	.10	-.02	.16**	-.16**	.17**	.16**	.19***	
Current alcohol abuse/dependence	-	-	.11	.07	.13*	.06	-.002	.04	.14*	-.07	.10	.12*	.13*	
History of somatic disease	-	-	-.01	-.06	-.01	-.01	-.01	-.002	-.0002	-.02	-.03	.04	.05	

Note. *N* = 338. BDI-II = Beck Depression Inventory—Second Edition; IDAS = Inventory of Depression and Anxiety Symptoms.

^aCronbach's α estimates are reported on the diagonal.

^bAll intercorrelations significant $p < .0001$ except for correlations of IDAS-appetite gain with IDAS-appetite loss ($p = .31$) and with IDAS-well-being ($p = .59$).

^cTolerance estimates indicating the proportion of variance within IDAS subscale that is not explained by the other seven IDAS subscales (except for general depression), which provides an estimate of multicollinearity for the combined models presented in Table 3.

^dFemale coded as 1 and male coded as 0.

^eCaucasian coded as 1 and non-Caucasian coded as 0.

* $p < .05$, ** $p < .01$, *** $p < .001$, † $p < .0001$.

Table 2. Results of Linear Regression Models Examining Associations Between BDI-II Scales and Smoking Variables

	Descriptive statistics of smoking variables			BDI-II scales	
				Total	Dysphoria
	<i>M</i> (<i>SD</i>)	α^a	Range	β^b	β^b
Smoking descriptors					
FTND	5.1(2.3)	.64	0–10	.24†	.21***
Cigarettes/day past week	16.8(10.8)	–	1–85	.25†	.23†
RFS					
Addictive	3.3(0.8)	.79	1.4–5.0	.29†	.28†
Habitual	2.3(0.7)	.74	1.0–5.0	.30†	.27†
Negative affect reduction	3.4(0.8)	.88	1.3–5.0	.38†	.37†
Pleasure	3.7 (0.8)	.85	1.0–5.0	–	–
Stimulation	2.7 (0.9)	.80	1.0–5.0	.22***	.23***
Sensorimotor	2.5 (1.0)	.79	1.0–5.0	–	–
SCQ					
Appetite control	4.1 (2.3)	.89	0.0–9.0	.19***	.18***
Negative reinforcement	5.6(1.7)	.93	0.7–9.0	.32†	.32†
Positive reinforcement	5.7 (1.5)	.88	0.7–9.0	.20***	.21***

Note. *N* = 338 (sample sizes vary across analyses *N*s = 326–338 due to missing data). BDI-II = Beck Depression Inventory—Second Edition; FTND = Fagerström Test for Nicotine Dependence; RFS = Reasons for Smoking Scale; SCQ = Smoking Consequences Questionnaire.

^aCronbach's α estimate of respective smoking variable.

^bBeta weight for regressor variable in an individual model including only that regressor variable after adjusting for age, gender, ethnicity, current anxiety disorder, current alcohol abuse/dependence, current drug abuse/dependence, and history of somatic disease.

p* < .01, *p* < .001, †*p* < .0001, nonsignificant findings are not displayed.

linearity by inspecting scatter plots between regressor variables and outcomes. In cases where substantial departures from assumptions were identified, variable transformations were applied when appropriate. Primary results are reported as standardized beta weights (β s). Significance was set at *p* < .01 (two-tailed), consistent with previous approaches that used a .01 criterion to decrease the probability of Type I errors associated with multiple comparisons while not severely limiting statistical power (Leventhal, Kahler, Ray, & Zimmerman, 2009; Schmitz et al., 2000).

Results

Sample Characteristics and Correlations Among Depressive Symptom Dimensions

The demographic, clinical, and smoking characteristics of the sample are reported in the left-hand columns of Tables 1 and 2, respectively. On average, participants began smoking regularly at 17.5 (*SD* = 4.0) years of age. Rates of *DSM-IV*-defined current psychiatric disorders were as follows: major depressive disorder (*n* = 25, 7.4%), dysthymic disorder (*n* = 11, 3.3%), bipolar (I or II) disorder (*n* = 1, 0.3%), alcohol abuse/dependence (*n* = 25, 7.4%), drug abuse/dependence (*n* = 29, 8.6%), and anxiety disorder (*n* = 95, 28.1%). Prevalence of past psychopathology was major depressive disorder (*n* = 74, 21.9%), dysthymic disorder (*n* = 3, 0.9%), bipolar (I or II) disorder (*n* = 2, 0.6%), alcohol abuse/dependence (*n* = 111, 32.8%), drug abuse/dependence (*n* = 94, 27.8%), and anxiety disorder (*n* = 21, 6.2%).

As illustrated in Table 1, there was a wide range of intercorrelation among the depression scales and correlation with demographic and clinical covariates.

Relations of Depressive Symptom Dimensions and Smoking Characteristics

Individual Models

Each depression scale was significantly associated with at least 3 of the 11 smoking characteristics in individual models. More severe depression (or lower well-being) was generally related with higher smoking rate, dependence, and motivation (see Tables 2 and 3).

Combined Models

Other than the dysphoria scale, most associations between IDAS subscales and smoking characteristics were reduced to nonsignificance in combined models that simultaneously incorporated all eight IDAS subscales as regressor variables (see Table 3). Appetite gain and loss also retained significant associations with SCQ-appetite control. Insomnia was inversely associated with RFS-sensorimotor in the combined model.

Moderators of the Relation Between Depressive Symptom Dimensions and Smoking Characteristics

Gender did not significantly moderate the relation between any depressive symptom scale and smoking characteristic. The

Table 3. Results of Linear Regression Models Examining Associations Between IDAS Scales and Smoking Variables

Smoking descriptors	IDAS symptom subscales																		
	DYS		LASS		INSOM		SUIC		AP LOSS		AP GAIN		ILL TEMP		WELL BG		GD		
	β^a	β^b	β^a	β^b	β^a	β^b	β^a	β^b	β^a	β^b	β^a	β^b	β^a	β^b	β^a	β^b	β^a	β^b	
FTND	.21***	.28**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.19***
Cigarettes/day past week	.21***	.28*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.20***
RFS																			
Addictive	.33†	.39***	.21***	-	-	-	.18**	-	-	-	-	-	-	-	-	-	-	-	.29†
Habitual	.32†	-	.29†	-	.18**	-	.16**	-	.17**	-	.15**	-	.20***	-	.20***	-	.28†	-	.28†
Negative affect reduction	.41†	.29**	.31†	-	.20***	-	.20***	-	.18**	-	.16**	-	.31†	-	-.24†	-	.39†	-	.39†
Pleasure	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stimulation	.29†	.39***	.28†	-	-	-	-	-	-	-	.17**	-	-	-	-	-	-	-	.24†
Sensorimotor	-	-	.16**	-	-	-	-	-	-	-	.17**	-	.16**	-	-	-	-	-	-
SCQ																			
Appetite control	.16**	-	.16**	-	-	-	.16**	-	.21**	-	.18***	.21***	-	-	-	-	-	-	.19**
Negative reinforcement	.40†	.32**	.29†	-	.23†	-	.15**	-	.18***	-	.16**	-	.26†	-	-.22†	-	.39†	-	.39†
Positive reinforcement	.24†	.40***	.17**	-	-	-	-	-	-	-	.15**	-	-	-	-	-	-	-	.19**

Note. N = 338 (sample sizes vary across analyses Ns = 326–338 due to missing data). AP GAIN = appetite gain; AP LOSS = appetite loss; DYS = dysphoria; FTND = Fagerström Test for Nicotine Dependence; GD = general depression; IDAS = Inventory of Depression and Anxiety Symptoms; ILL TEMP = ill temperament; INSOM = insomnia; LASS = lassitude; RFS = Reasons for Smoking Scale; SCQ = Smoking Consequences Questionnaire; SUIC = suicidality; WELL BG = well-being.

^aBeta weight for regressor variable in an individual model including only that regressor variable after adjusting for age, gender, ethnicity, current anxiety disorder, current alcohol abuse/dependence, current drug abuse/dependence, and history of somatic disease.

^bBeta weight for regressor variable in a combined model simultaneously including all IDAS symptom subscales (except for GD) after adjusting for age, gender, ethnicity, current anxiety disorder, current alcohol abuse/dependence, current drug abuse/dependence, and history of somatic disease.

* $p < .01$, ** $p < .001$, *** $p < .0001$, † $p < .0001$, nonsignificant findings are not displayed.

only evidence of moderation by major depression history was found for relations of IDAS-appetite loss and ill temper to RFS-sensorimotor ($ps < .003$) and SCQ-positive reinforcement ($ps < .005$). In each case, the relation between depressive symptom severity and smoking motivation was stronger among participants with a history of major depression ($n = 91$, adjusted $\beta s > .23$, $ps < .002$) than those without ($n = 247$, $ps > .40$).

Discussion

This study found an assortment of significant associations of depressive symptom dimensions to smoking rate, tobacco dependence, and almost every domain of smoking motivation. With the exception of the IDAS dysphoria scale, the majority of these relationships were reduced to nonsignificance in combined models that accounted for overlapping variance across depressive subdimensions. Possible methodological accounts for this pattern are (a) all the IDAS subscales outside of dysphoria had substantial multicollinearity with one another, and therefore, their effects were cancelled out or (b) dysphoria exhibited higher reliability than the other IDAS scales, resulting in greater statistical power for detecting associations for that scale than the others. However, inspection of the pattern of tolerance estimates and Cronbach's αs of the IDAS subscales does not support either of these explanations. Indeed, dysphoria exhibited stronger multicollinearity relative to other subscales and comparable internal reliability to several other subscales that did not consistently associate with smoking characteristics (e.g., insomnia, appetite loss, ill temper, well-being). Together, these results suggest that most of the relations of depressive symptomatology to smoking rate, dependence, and motivation may be explained by (a) variance specific to dysphoria symptoms and (b) variance shared among the subdimensions.

Individuals scoring high on an IDAS depressive symptom subscale other than dysphoria may be experiencing severe disturbance and impairment in only a single narrow aspect of functioning (e.g., sleeping, energy, appetite, or anger control), which, by itself, may not be a sufficient cause or consequence of smoking. By contrast, individuals scoring high in dysphoria may be experiencing multifaceted impairment across multiple affective, motivational, cognitive, and psychomotor systems. Given the importance of smoking's effects on mood, cognition, and arousal for maintaining tobacco dependence (Piper et al., 2004), we speculate that smokers with higher IDAS dysphoria scores may be vulnerable to heavier and more dependent smoking in order to alleviate dysphoria-related symptoms through smoking's affect- and arousal-modulating properties. However, given this study's cross-sectional design, it also is plausible that individuals who come to rely on tobacco to regulate their affect and arousal may lack coping strategies, leaving them prone to the effects of environmental stressors on dysphoria symptoms.

Appetite gain and loss scales were uniquely related with smoking to regulate appetite. A speculative explanation of this finding is that individuals with appetite gain may have trouble limiting their food intake, which could precipitate motivation to use tobacco to assist with controlling their appetite, whereas individuals with appetite loss may represent those who have successfully diminished hunger via smoking. Because we controlled for somatic disease, it is unlikely that

these relationships are explained by appetite changes induced by a somatic (smoking-related) condition.

Unexpectedly, insomnia was inversely associated with motivation to smoke for sensorimotor stimulation in combined models. Given that these relations were not significant individual models, inclusion of the other subscales may have produced a suppressor effect, whereby the other IDAS subscales accounted for variance in insomnia scores that may have been clouding relationships. It is also possible that this is the result of a Type I error, although the significance value was somewhat extreme ($p = .001$). If this finding is reflective of a true relationship, its meaning is currently unclear.

The distribution of IDAS-suicidality scores illustrated that most participants reported little or no suicidality in this study. Still, a small subgroup indicated mild-to-moderate suicidality levels. Suicidality was significantly associated with other depressive symptoms, demographic variables, current anxiety disorder, and some smoking characteristics (although relationships with smoking characteristics were not significant after accounting for covariance with other depressive symptoms). These results provide preliminary evidence that the IDAS may be useful for assessing suicidality among treatment-seeking smokers, although further evaluation of the clinical utility of this scale in smokers is warranted.

Although analyses showed no evidence of moderation by gender, the relations of IDAS-appetite loss and ill temper to motivation to smoke for sensorimotor stimulation and positive reinforcement were significantly stronger among participants with a history of major depression. These findings raise the possibility that the effect of these two symptoms on smoking behavior may be amplified following a major depressive episode. However, because these analyses were exploratory, the results should be treated with caution prior to replication.

A number of caveats should be noted. First, the analyses are correlational, which precludes interpretations regarding the causal or temporal features of the relations demonstrated herein. Second, although the IDAS identifies empirically overlapping symptoms within each dimension (Watson et al., 2008), some symptoms are phenomenologically varied within a dimension. For example, the dysphoria scale has items assessing anhedonia, concentration difficulties, and sadness, which, despite demonstrating empirical cohesion, may represent distinct depressive phenotypes (Hasler, Drevets, Manji, & Charney, 2004). Third, given that the primary analyses focused on whether each association significantly departed from zero, firm conclusions about whether a smoking variable was more strongly associated with one depressive subdimension versus another cannot be made. Fourth, only self-report measures of smoking rate and the FTND were used to assess tobacco dependence, which primarily assess heavy smoking and compulsive physiologically driven tobacco use. It would have been informative to compare the results to multidimensional measures of tobacco dependence (e.g., Wisconsin Inventory of Smoking Dependence Motives, Piper et al., 2004; Nicotine Dependence Syndrome Scale, Shiffman, Waters, & Hickcox, 2004), which assess a variety of other psychological, social, and contextual factors that contribute to tobacco dependence in order to elucidate the complex and variable dependence profiles that are linked with depressive symptom dimensions. Fifth, the sample comprised

treatment-seeking smokers who were ready to quit, leaving unclear whether the results will generalize to smokers not interested in quitting. Sixth, even though the alpha level was set to .01, a large number of associations were tested, which elevates risk of a Type I error. However, several key findings were consistent across multiple smoking variables, which somewhat offsets these concerns. Finally, we did not analyze the prospective element of the data as of yet because these data are being collected. Thus, we did not examine other important smoking outcomes (e.g., withdrawal, cessation success). Given that there is overlap between depressive symptoms and nicotine withdrawal phenomena and depressive symptom severity is a risk factor for poor cessation outcomes, it will be of considerable interest to follow up this initial cross-sectional investigation with future prospective analyses.

To our knowledge, this is the first study in the nicotine and tobacco research literature to investigate the IDAS. The disparate relations with smoking characteristics demonstrated across the different IDAS scales highlight the utility of measurement approaches that distinguish depressive symptoms dimensions from each other. These results suggest that dysphoria symptoms, which contain core *DSM-IV* depression criteria (American Psychiatric Association, 1994), may be central to the comorbidity between depression and persistent smoking, whereas other symptoms may play a less prominent role. Thus, in cases in which assessment resources are limited, clinicians may benefit most from focusing depression measurement to dysphoria-related symptoms in the context of tobacco dependence treatment.

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Declaration of Interests

None declared.

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