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Associations Between Depressive Symptom Dimensions and Smoking Dependence Motives

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Abstract

Depressive symptoms are heterogeneous and can be parsed into four subdimensions (i.e., positive affect [PA], negative affect [NA], somatic features [SF], and interpersonal problems [IP]) that may have unique associations with the motivation to smoke. This study explored associations between depressive symptom dimensions and 13 theoretically distinct domains of smoking dependence motivation in current cigarette smokers ($N = 212$; 53% female, mean [M] age = 24 years). Results demonstrated substantial variability in the pattern of motivational correlates across depressive dimensions. Low PA exhibited the narrowest motivational profile, associating with only the tendency to prioritize smoking over other reinforcers. NA demonstrated a broader profile, associating with smoking for affect regulation and cognitive enhancement as well as prioritizing smoking. SF associated with prioritizing smoking and smoking because of cue exposure, craving, and weight control. IP demonstrated the broadest profile, associating with 7 of 13 motivational domains. These findings may assist the tailoring cessation interventions for smokers with depressive symptoms.

Keywords

depressive symptoms; smoking dependence motivation; positive affect; negative affect; somatic features; interpersonal problems

Depression is associated with persistent smoking behavior. Indeed, studies have consistently shown that higher levels of precessation depressive symptoms are associated with greater odds of relapsing during a subsequent cessation attempt (e.g., Brown et al., 2001; Cinciripini et al., 2003; Ginsberg, Hall, Reus, & Muñoz, 1995; Haas, Munoz, Humfleet, Reus, & Hall, 2004; Hitsman et al., 1999; Killen, Fortmann, Davis, Strausberg, & Varady, 1999; Niaura et al., 2001; Rausch, Nicholson, Lamke, & Matloff, 1990; Swan et al., 2003). Evidence suggests that even low, subclinical levels of depressive symptoms predict poorer outcomes in smokers without current major depression (al'Absi, Hatsukami, & Davis, 2005; al'Absi, Hatsukami, Davis, & Wittmers, 2004; Brown et al., 2001; Cinciripini et al., 2003; Ginsberg et al., 1995; Haas et al., 2004; Killen et al., 1999; Niaura et al., 2001; Swan et al., 2003).

Despite considerable research attempting to disentangle the processes through which depressive symptoms are associated with smoking (e.g., McChargue, Spring, Cook, &

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Neumann, 2004; Spring et al., 2008), the precise mechanisms underlying this relationship remain relatively unclear. A potential impediment to this research is that most investigations regard depression a homogenous construct that can be identified by computing the combined overall severity across all depressive symptoms. Depressive symptoms are highly heterogeneous and include sadness, anhedonia (i.e., diminished pleasure), concentration problems, feelings of worthlessness, changes in weight and sleep, and an array of other features (American Psychiatric Association [APA], 2000). Thus, depressive symptoms may be best characterized as a collection of several subdimensions that each include smaller sets of related symptoms that tend to cluster together (Shafer, 2006). Evidence suggests that depressive symptom subdimensions are psychometrically distinct, and each dimension may have unique etiological correlates (Shafer, 2006; Milak et al., 2005). Accordingly, understanding the unique relation of each depressive subdimension to smoking could shed light on the mechanisms linking depressive symptoms and smoking behavior.

One multidimensional model of depressive symptoms that has received considerable support is a 4-factor model based on the Center for Epidemiologic Studies Depression Scale (CESD; Radloff, 1977), which includes negative affect (NA; sadness, anxiety, and distress), somatic features (SF; appetite and sleep irregularities), low positive affect (PA; reduced positive emotions and diminished pleasure), and interpersonal problems (IP; poor social adjustment; Shafer, 2006). Using this conceptualization, Pomerleau Fagerstrom, Marks, Tate, and Pomerleau (2003) found that in comparison to nonsmokers, smokers reported lower PA, higher NA, and higher SF than nonsmokers but did not differ on IP (Pomerleau, Fagerstrom, Marks, Tate, & Pomerleau, 2003). Similarly, Leventhal, Ramsey, Brown, LaChance, and Kahler (2008a) demonstrated that low PA, high NA, and high SF each predicted greater likelihood of smoking relapse during a cessation attempt with low PA demonstrating the most robust effect, whereas IP did not predict outcome. Examination of baseline characteristics suggested that only SF associated with tobacco dependence severity and none of the dimensions associated with cigarettes per day. Overall, these findings indicate that different dimensions of depressive symptomatology may associate with different aspects of the tobacco dependence process.

One method to advance this area of research is to explore the specific motivational factors that are linked with each of the depressive symptom dimensions. Recently, Piper and colleagues (2004) developed the Wisconsin Inventory of Smoking Dependence Motives (WISDM). This measure goes beyond typical tobacco dependence measures, which define dependence as a single binary construct (e.g., *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition [DSM-IV]* nicotine dependence; APA, 2000) or severity dimension (e.g., Fagerström Test for Nicotine Dependence [FTND]; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) indicative compulsive physiologically driven tobacco use. Rather, the WISDM applies a multidimensional model to elucidate the complex and variable patterns on which smokers may differ from one another in their dependence syndrome. Additionally, the WISDM is unique because it indexes motivations that might lead to addictive tobacco use, rather than the actual compulsive tobacco use behavior per se. That is, the WISDM captures a smoker's disposition to respond to certain internal states, behaviors, or external situations with tobacco use. Review of the drug dependence literature of Piper et al. identified 13 unique theoretically derived motives for drug use, which can be assessed via separate individual subscales within the WISDM: Affiliative Attachment (strong emotional attachment to smoking and cigarettes), Automaticity (smoking without awareness or intention), Behavioral–Choice Melioration (smoking despite constraints on smoking or negative consequences and/or the lack of other options or reinforcers), Cognitive Enhancement (smoking to improve cognitive function), Craving (smoking in response to craving or experiencing intense and/or frequent urges to smoke), Cue Exposure-Associative Processes (frequent encounters with nonsocial smoking cues or a strong perceived link

between cue exposure and the tendency to smoke), Loss of Control (believing that one has lost volitional control over tobacco use), Negative Reinforcement (tendency or desire to smoke to ameliorate a variety of negative internal states [e.g., dysphoria, stress, withdrawal]), Positive Reinforcement (desire to smoke to experience a “buzz” or to enhance an already positive feeling), Social–Environmental Goads (high degree of social stimuli or contexts that either model or invite smoking), Taste and Sensory Processes (tendency to smoke to experience the orosensory and/or gustatory effects of smoking), Tolerance (need to smoke increasing amounts over time to experience the desired effects or the ability to smoke large amounts without acute toxicity), and Weight Control (use of cigarettes to control body weight or appetite).

The WISDM has proven useful in distinguishing the motivational profiles of different groups of smokers (Piper et al., 2008) and could be used to identify targets for smoking cessation treatment. In addition, this measure can be used to elucidate the psychological mechanisms linking depressive symptoms and tobacco dependence. Certain depressive symptom dimensions may lead to particular types of motivational drives to smoke. For example, smokers with high NA may be motivated to smoke for Negative Reinforcement purposes (i.e., smoking to alleviate negative internal states) and smokers with low PA may be driven to smoke for Positive Reinforcement purposes (i.e., smoking to enhance a positive feeling). It is also important to note that while the literature indicates that depression may play a role in determining smoking, there is also considerable evidence indicating that smoking may increase risk of depression (Breslau, Kilbey, & Andreski, 1993a 1993b; Martini, Wagner, & Anthony, 2002; Steuber & Danner, 2006), via physiological dysregulation of neural pathways involved in emotional processing (D’Souza & Markou, 2009) or depressogenic psychosocial processes tied with smoking (e.g., social stigma against smokers; Martini et al., 2002). Accordingly, one could postulate that certain motivational tendencies linked with smoking could perhaps lead to particular types of depressive symptoms. For instance, individuals who are driven to smoke because of tolerance (i.e., ability to smoke large amounts without acute toxicity) may experience greater dysregulation of neural reward pathways (D’Souza & Markou, 2009), which could result in anhedonia and lower PA. Individuals who feel socially and emotionally attached to their cigarettes (i.e., high Affiliative Attachment) may perhaps require less interpersonal contact, leading to social isolation and higher levels of IP.

Despite the potential promise of exploring links between depression and smoking dependence motivation, there has been limited investigation of these relationships. A recent application of this measure to a sample of middle-aged smokers found that lifetime history of depression was associated with all 13 domains of smoking dependence motivation assessed by the WISDM (Kahler et al., 2010). An investigation of heavy drinking treatment-seeking smokers that measured only three WISDM subscales (Tolerance, Positive Reinforcement, and Negative Reinforcement) found that both reinforcement scales were correlated with lower PA, and higher NA, SF, and IP, and Tolerance was associated with only NA and SF (Leventhal, Ramsey, Brown, LaChance, & Kahler, 2008a).

We sought to extend past findings by exploring the relationship between depressive subdimensions (PA, NA, SF, and IP) and all of the 13 WISDM subscales using a cross-sectional design in a sample of nontreatment-seeking young adult smokers. Using this sample allows us to potentially understand the link between depressive symptoms and motivational factors maintaining day-to-day smoking behavior early in the tobacco dependence process, during a high-risk period for developing long-term smoking habits (Patterson, Lerman, Kaufmann, Neuner, & Audrain-McGovern, 2004). Because of the paucity of prior research in this area, the cross-sectional nature of these data, and the possibility of bidirectional causal underpinnings between depressive symptoms and smoking

motives, we did not put forth any particular hypotheses nor specify a predicted model. Rather, this initial investigation sought to first identify which cross-sectional links between depressive subdimensions and smoking motivations are apparent, which could be of use for future studies seeking to identify the structural and temporal aspects of these relationships. Of particular interest was whether certain depressive symptom dimensions demonstrate a broader range of associations across multiple dependence motives than other symptom dimensions.

Method

Participants

Participants were 212 current smokers enrolled at a Southwestern University, who were participating in a more extensive study on the cognitive effects of tobacco deprivation (Leventhal et al., 2008b). Fliers, class announcements, and e-mail LISTSERV postings announcing the opportunity to participate in a study of cognition, emotion, and smoking were advertised and targeted the university's student population of daily smokers. The inclusion criteria were (a) report normal vision; (b) 18 years old; and (c) smoking 5 cigarettes per day for the past 2 years. Exclusion criteria included (a) plan to quit in the next 30 days; (b) were currently cutting down substantially on smoking; (c) current use of nicotine replacement; or (d) ability to read or speak Chinese (one of the cognitive tasks in the larger study required participants to rate Chinese ideographs which were intended to be novel).

The mean age was 24.3 ($SD = 6.4$) and 53.3% were female. The sample was ethnically diverse, with 9% self-identifying as African American, 15% Asian, 64% Caucasian, 7% Hispanic, and 3% Middle Eastern.

Participants received a \$15 voucher redeemable at a department store and course credit for completing the study. Participants provided written informed consent and the study was approved by the University's Institutional Review Board.

Procedure

Participants responding to study announcements corresponded with research staff that provided additional information about the study and queried potential participants about eligibility criteria. Potential participants who remained interested and met eligibility criteria were invited to attend an initial session at which they completed informed consent, were explained the study procedures, and filled out several questionnaires, including those listed below. On the subsequent day, they attended an experimental session involving a tobacco deprivation manipulation and cognitive tests. The current study focuses on the baseline session in which depressive symptoms, smoking characteristics, affective characteristics, and smoking dependence motives were assessed.

Measures

Smoking history questionnaire—This author-constructed measure assesses years of smoking, number of cigarettes smoked per day, and other smoking characteristics.

FTND—(Heatherton et al., 1991). The FTND is a widely used and well-validated measure of nicotine dependence severity.

The CESD—(Radloff, 1977). The CESD is a 20-item, well-validated, self-report scale that has been often used to assess depressive symptoms over the past week in nonclinical populations. Each item is a self-statement of a particular depressive symptom (e.g., "I had

crying spells”), and respondents indicated how often they felt that way in the past week, rarely or none of the time (0–1 days, 0 pts); some or a little of the time (1–2 days, 1 pt); occasionally or a moderate amount of the time (3–4 days; 2 pts); or most or all of the time (5–7 days; 3 pts). Prior studies have consistently found a 4-factor structure of the CESD that distinguishes PA, NA, SF, and IP as psychometrically distinct dimensions (Leventhal et al., 2008a; Radloff, 1977; Shafer, 2006; Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977). Thus, as in previous research (Leventhal et al., 2008a; Pettit et al., 2008), we computed sub-scale scores for each dimension by computing its respective items’ average score as well as computing the traditional total score. The items for each dimension are PA (hopeful about future, enjoyed life, felt as good as others, was happy), NA (felt sad, crying spells, could not shake blues, felt depressed, felt lonely, felt fearful, life is a failure), SF (appetite poor, restless sleep, could not get going, can’t keep mind on tasks, everything an effort, bothered by things, talked less than usual), and IP (people dislike me, people were unfriendly). These subscales have evidenced good reliability and validity in a prior sample of smokers (Leventhal et al., 2008a).

WISDM—(Piper et al., 2004). The WISDM is a 68-item scale that assesses 13 theoretically distinct tobacco dependence motives as unique traits using a subscale approach (Affiliative Attachment, Automaticity, Loss of Control, Behavioral Choice Melioration, Cognitive Enhancement, Craving, Cue Exposure-Associative Processes, Negative Reinforcement, Positive Reinforcement, Social-Environmental Goads, Taste and Sensory Processes, Tolerance, and Weight Control). WISDM subscales associate with biochemical and other self-report dependence assessments (Piper et al., 2004). A combined overall dependence severity score is also calculated by averaging all items.

Beck Anxiety Inventory—(BAI; Beck, Epstein, Brown, & Steer, 1988). The BAI is a 21-item symptom checklist that assesses self-reported levels of anxiety in the past week. An overall anxiety severity score is computed by summing responses to all 21 items (e.g., “Hands trembling,” “Nervous,” “Shaky”). This measure has been previously demonstrated to exhibit excellent psychometric properties, including discriminant validity from depression (Beck et al., 1988).

Positive and negative affect schedule—(PANAS; Watson, Tellegen, & Clark, 1998). The 20-item PANAS assesses affect during the past week by asking respondents to rate the degree to which they feel affective adjectives (e.g., positive: interested, proud, excited; negative: irritable, afraid, distressed). These scales have evidenced excellent reliability, convergent validity with relevant correlates, and discriminant validity from each other (Watson et al., 1998).

Data Analysis Plan

Preliminary analyses explored intercorrelations between each of the CESD subscales, and their associations with other affective characteristics (BAI scores, PANAS positive and negative affect scales) to elucidate the psychometric properties of the CESD subscales in this sample. To examine the factor structure of the two primary measures, confirmatory factor analyses were performed to compare whether 4- and 13-factor models for the CESD and WISDM, respectively, outperformed, nested single-factor models, using a chi-square model comparison (Steiger, Shapiro, & Browne, 1985).

For the primary analysis of relations between CESD subscales and WISDM scales, we initially considered a structural equation model that specified simultaneous unidirectional paths between depressive subdimensions and WISDM dimensions. We opted against this approach because we did not have clear hypotheses about the direction of relationships

between depressive symptom dimensions and smoking motivation and therefore could not specify which constructs should be modeled simultaneously as exogenous variables and which should serve as independent endogenous variables. Thus, for this initial investigation of CESD-WISDM relations, we used an exploratory and analytic approach involving computing linear regression models in which a single depression scale served as the predictor and a single smoking variable served as the outcome, with the primary aim of determining the magnitude of each CESD-WISDM bivariate association and testing whether each association was statistically significantly different from zero. Although it is of interest to explore whether certain associations demonstrate stronger relationships than others, we did not conduct formal tests to compare the size of associations across separate CESD-WISDM pairs because we had no a priori hypotheses about which relationships would be stronger than others. Separate models were performed for each depressive symptom scale (CESD-Total, CESD-PA, CESD-NA, CESD-SF, CESD-IP) and each WISDM scale. Similar models were tested using average number of cigarettes smoked per day (cig/day) and FTND scores as outcomes for descriptive purposes. Each model was adjusted for demographics (age, gender, and ethnicity). To examine whether depression–smoking motivation associations were moderated by gender, each model was retested after adding the gender by CESD scale interaction term. Analyses were performed using SPSS software, version 17.0 (SPSS Inc., An IBM Company, 2010). Because of the large number of tests performed, α level was set to .01.

Results

Smoking and Affective Characteristics of the Sample

On average, participants began smoking regularly at 17.7 years ($SD = 2.7$) of age and had been smoking regularly for 6.5 ($SD = 6.2$) years. Descriptive statistics on the FTND and cig/day are reported in Table 1 and indicate low-to-moderate levels of smoking heaviness.

The $M(SD)$ of depressive symptom and other affective measures are presented in Table 2 and were suggestive of moderate variability across the continuum of affective symptoms. Using Radloff's (1977) suggested cutoff of a CESD-Total score of 16 or greater to indicate at least mild-to-moderate levels of depressive symptoms, 42% of the sample screened positive for depressive symptoms. Using recommended cutoffs of Beck et al. (1988) for the BAI, 36% reported none or minimal anxiety (score 0–8), 33% reported mild-to-moderate anxiety (score 10–18), and 31% reported moderate or higher levels of anxiety (score 19).

Correlations Among Depressive Symptom Dimensions and With Affective Characteristics

The Cronbach α and intercorrelations of the CESD scales are presented in Table 2. The pattern of correlations suggested a moderate but not substantially large degree of intercorrelation among the CESD subscales (r s 0.39–0.62).

Correlation between the CESD subscales and the BAI and PANAS are also reported in Table 2 and suggested a moderate but not substantially large degree of association between the CESD subscales and BAI scores. In addition, the relative strength (and direction) of correlations between CESD subscales and PANAS-NA and -PA scales differed across the CESD subscales and tended to be consistent with construct convergence (e.g., CESD-NA correlation with PANAS-NA [$r = .68$] vs. CESD-NA correlation with PANAS-PA [$r = -.46$]; see Table 2).

Correlations Among WISDM Scales

The intercorrelations among WISDM scales are reported in Table 3.

Confirmatory Factor Analyses of CESD and WISDM

Confirmatory factor analyses of the 20 CESD items showed that the fit of the 4-factor model was $\chi^2(64) = 283.5$, compared to 1-factor model fit of $\chi^2(170) = 438.7$. The test for the model comparison indicated that the 4-factor model significantly outperformed the 1-factor model, $\Delta\chi^2(6) = 155.2, p < .0001$.

Confirmatory factor analyses of the 68 WISDM items demonstrated that the 13-factor model resulted in a fit statistic of $\chi^2(2132) = 3926.7$, whereas the 1-factor model exhibited a fit of $\chi^2(2210) = 7717.7$. The test for the model comparison demonstrated that the 13-factor model demonstrated significantly better fit than the 1-factor model, $\Delta\chi^2(78) = 3791, p < .0001$.

Associations Between Depression and Smoking Dependence Motives

The CESD-Total and WISDM-Total scales were significantly associated, and the CESD-Total was associated with a broad range of WISDM sub-scales. There was substantial variability in the pattern of significant associations between specific CESD subscales and specific WISDM subscales (see Table 1). PA exhibited the narrowest range of associations and was significantly and inversely related with only the Behavioral Choice Melioration scale. NA showed a slightly broader range of associations, demonstrating relations with four subscales (i.e., Behavioral Choice Melioration, Cognitive Enhancement, and both of the reinforcement smoking scales). SF was also significantly associated with four of the WISDM scales; however, the pattern was different from NA, as SF significantly associated with cue exposure, Craving, and Weight Control, in addition to Behavioral Choice Melioration. IP demonstrated the broadest range of associations, significantly relating to seven subscales, and being the only symptom dimension to significantly associate with Affiliative Attachment and Tolerance (see Table 1).

Associations Between Depressive Symptom Dimensions and Basic Smoking Characteristics

As noted in Table 1, the CESD-Total, PA, SF, and IP scales were significantly associated with FTND. None of the CESD scales were associated with cig/day.

Moderation by of Depression–Motivation Associations by Gender

None of the associations between CESD symptom dimensions and WISDM scales were significantly moderated by gender ($ps > .10$)

Discussion

The current study investigated the relationships between dimensions of depressive symptoms and domains of smoking dependence motivation. Consistent with previous research, CESD-Total score analyses suggest that a relatively wide variety of smoking dependence motivation domains may be associated with depression at the broad syndrome level (Kahler et al., 2010; Leventhal et al., 2008a). Perhaps more importantly, there was substantial variability in the pattern of associations found between dimensions of depression and particular domains of smoking dependence motivation (see Table 4 for a comparison between the current findings and results from Kahler et al., 2010 and Leventhal et al., 2008a).

Initial analyses of sample characteristics indicated moderate degree of variability across the continuum of affective distress in this sample with a sizeable portion screening positive for significant levels of depressive and anxiety symptoms. This level of affective disturbance is consistent with prior research of college student smokers (Patterson et al., 2004) and

suggests adequate between-person variability in depressive symptoms for examining covariation with smoking motivation. Confirmatory factor analyses and preliminary analyses of the pattern of correlations among the four CESD dimensions indicated that the subscales did not solely tap a common broad-based tendency to experience depressive symptoms. Rather, these scales appeared to tap unique facets of depressive symptoms that were relatively distinct from each other and, to a certain extent, also distinct from anxiety symptoms. Furthermore, the pattern of correlations with the PANAS suggested construct convergence and discrimination for the CESD subscales in relation to an alternate measure of affect.

PA exhibited a narrow motivational profile; it was significantly associated with only one motivational domain—Behavioral Choice Melioration (i.e., the tendency to place higher priority on smoking as a reinforcer in comparison to other reinforcers). This is consistent with previous research demonstrating that diminished capacity to experience pleasure was associated with this scale (Leventhal, Waters, Kahlter, Ray, & Sussman, 2009) and that people with low-PA may smoke to make up for the lack of reinforcement they receive from normal activities (Leventhal et al., 2009; Cook, Spring, McChargue, & Hedeker, 2004). Contrary to previous findings in a treatment-seeking sample (Leventhal et al., 2008a), the current study found that PA was not related to either positive or negative reinforcement smoking motivation (i.e., the tendency to smoke to regulate affect), suggesting that young adult smokers with no serious intention to quit, who exhibit low PA are not necessarily more likely to smoke for affect regulation.

NA was associated with a moderately broad motivational profile, exhibiting significant correlations with four domains of smoking dependence motivation: Behavioral Choice Melioration, Cognitive Enhancement, and notably, both of the reinforcement scales. Consistent with past research (Kahler et al., 2010; Leventhal et al., 2009), the associations of NA with both domains of reinforcement motivation and Behavioral Choice Melioration indicate that high-NA smokers may use tobacco to modulate appetitive or aversive affect and thus place high priority on smoking as a reinforcer. It should be noted that there was a very high correlation between the positive and negative reinforcement WISDM subscales in the current sample ($r = .85$), which raises doubt regarding the discriminant validity of these scales. The association between NA and Cognitive Enhancement is an interesting and could be interpreted as evidence that smokers with high NA may be prone to feeling uncomfortable when experiencing cognitive diminution and therefore could be motivated to smoke to alleviate this feeling. This finding appears somewhat consistent with a past study, showing that neuroticism (i.e., a trait closely linked with NA) is associated with a tendency to smoke prior to engaging in a cognitive task (Gilbert, Sharpe, Ramanaiah, Detwiler, & Anderson, 2000). However, neuroticism did not correlate with a measure tapping smoking for Cognitive Enhancement purposes in Gilbert, Sharpe, Ramanaiah, Detwiler, and Anderson (2000).

SF also evidenced a moderately broad motivational profile, demonstrating significant correlations with four dimensions. Like the other symptom dimensions, SF was significantly associated with Behavioral Choice Melioration. Unlike the other dimensions, SF was correlated with cue-exposure-associative processes and Craving indicating that smokers who reported difficulty with sleep, appetite, and motivation tend to smoke in response to cravings and smoking-related stimuli in their environment. Additionally, the SF scale, which includes the item “my appetite was poor,” was associated with the Weight Control WISDM subscale, suggesting a potential relationship between appetite disturbance related to depression and tobacco-induced weight suppression. Nonetheless, the pattern of association was somewhat divergent from results of a treatment-seeking sample of older adults in which SF correlated with reinforcement smoking and tolerance WISDM scales (Leventhal et al., 2008a).

IP demonstrated the broadest motivational profile, portraying significant associations with seven domains of smoking motivation. Although consistent with past research indicating that IP is associated with positive and negative reinforcement WISDM scales (Leventhal et al., 2008a), the broad pattern of associations between IP and smoking motivation domains is an unexpected finding. IP has not previously been associated with smoking status (Pomerleau et al., 2003), nicotine dependence (Leventhal, Kahler, et al., 2009; Leventhal, Waters, et al., 2009), or relapse (Leventhal et al., 2008a) in prior studies of older adult samples. The broad pattern of associations across WISDM scales as well as the association of IP with FTND scores and Tolerance may indicate that young adult smokers with interpersonal disturbance tend to be more addicted to cigarettes than their peer counterparts with less social dysfunction. Given the importance of social activities during the college years (Patterson et al., 2004), the broad linkages between IP and smoking motivational domains is not entirely without basis. Unique to this scale was a significant association with Affiliative Attachment (i.e., tendency to feel socially attached to smoking: “Sometimes I feel like cigarettes are my best friends”), which could suggest that smokers who report social dysfunction come to rely on cigarettes as a source of social attachment.

Women tend to have more severe depressive symptoms than men (APA, 2000). Furthermore, extant data indicate that the association between depression and smoking status is stronger among women than men (Husky, Mazure, Paliwal, & McKee, 2008), and women tend to experience more severe withdrawal-related NA during acute tobacco abstinence (Leventhal et al., 2007). Accordingly, we examined whether gender moderated the relationship between depressive symptoms and smoking motivation. Analyses showed that associations between depressive symptom dimensions and domains of smoking motivation did not significantly vary by gender. Taken together, these findings suggest that although women may perhaps have a greater tendency to smoke to manage affective distress, the extent to which depressive symptoms are associated with certain motivational drives to smoke may be equivalent across gender.

The limitations of this study should be noted. The sample was college-aged with a minimum of 2 years of regular smoking, which raises questions as to whether these findings will generalize to older, chronic smokers and individuals from different educational and social backgrounds. Indeed, some of the current findings differed from past studies of older smokers (see Table 4), which could be due in part to age differences across study samples. However, it is noteworthy that these data may be relevant to understanding affective and motivational aspects that play a role early in the tobacco dependence process, during a high-risk period for developing long-term smoking habits (i.e., college years; Patterson et al., 2004). In addition, only one self-report measure of depression was used. Including multiple self-report and clinician rating measures would have been preferable to assess whether findings were concordant across multiple assessment tools. Relatedly, while CESD and BAI scores provided some information regarding the level of psychopathology of this sample, the psychiatric status of participants was not formally evaluated using structured clinical interviews or other clinical assessment tools. Accordingly, it is not entirely clear how well the current findings will generalize to smokers with major depression, and whether similar findings would be obtained using validated clinical ratings of depressive symptom domains. This study was cross-sectional and correlational, which precludes causal and temporal interpretations of the relationships presented herein. Because of the paucity of prior research in this area, the primary analytic approach involved calculating the magnitude of each CESD-WISDM association and testing whether each was statistically significantly different from zero. Accordingly, conclusions about the relative strength between one set of CESD-WISDM associations versus another cannot be made. Similarly, the concomitant influence of multiple depressive symptom dimensions on smoking motivation or multiple smoking motivations on a depressive symptom dimension cannot be determined on the basis of these

data. Finally, although the significance level was set to .01, the large number of associations tested increased probability of type-I error.

Limitations notwithstanding, the current study provides an initial picture of the possible linkages between individual symptom dimensions and domains of smoking motivation in young adult smokers. It is anticipated that these findings will be of use for future investigations which build on these initial findings to clarify the causal and directional relations between depressive symptom domains and smoking motivation. Indeed, the current results may set the basis for future investigations that use longitudinal designs, test predictions regarding the relative strength of depression–motivation relationships, and explore whether the simultaneous relationships of multiple symptom dimensions and smoking motivation are unique, overlapping, or interactive with one another. Additionally, these results may potentially be useful to practitioners wishing to tailor interventions to a smoker's motivational profile on the basis of their depressive symptom patterns. For example, given that PA was linked to only Behavioral Choice Melioration, low-PA smokers may benefit most from treatments that enhance access and consumption of other reinforcing activities besides smoking. By contrast, smokers with NA and SF may benefit from broader treatments with multiple targets (e.g., high-NA smokers may benefit from affective and Cognitive Enhancement, high-SF smokers may benefit from weight management and coping skills treatment to buffer effects of cravings and smoking-related cues). Finally, smokers with a high degree of IP may require the broadest clinical management, given the wide range of motivational influences on their smoking.

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Table 1

Beta Weights From Adjusted Regression Models^a Predicting Smoking Characteristics and Motives From CESD Dimensions

	<i>M (SD)</i>	CESD-T	CESD-PA ^b	CESD-NA	CESD-SF	CESD-IP
WISDM Scales						
WISDM-Total	4.0 (1.1)	.26**	—	.21*	.22*	.26**
Affiliative Attachment	2.8 (1.6)	.21*	—	—	—	.23*
Automaticity	4.1 (1.6)	—	—	—	—	—
Behavioral Choice Melioration	3.2 (1.1)	.29***	-.26**	.24*	.19*	.30***
Cognitive Enhancement	3.2 (1.4)	.20*	—	.20*	—	—
Cue Exposure-	3.9 (1.7)	.19*	—	—	.23*	.19*
Associative Processes Craving	4.4 (1.5)	.25**	—	—	.23*	.27**
Loss of Control	5.0 (1.2)	.20*	—	—	—	—
Negative Reinforcement	4.5 (1.4)	.23*	—	.23*	—	.19*
Positive Reinforcement	4.2 (1.3)	—	—	.19*	—	.23*
Social-Environmental Goads	4.7 (1.8)	—	—	—	—	—
Taste and Sensory Processes	4.4 (1.3)	—	—	—	—	—
Tolerance	4.2 (1.6)	—	—	—	—	.22*
Weight Control	2.7 (1.7)	.20*	—	—	.23*	—
Basic smoking characteristics						
FTND	3.88 (2.12)	.22*	-.19*	—	.23*	.20*
Cig/day	14.91 (6.20)	—	—	—	—	—

Note. CESD = Center for Epidemiologic Studies Depression scale; Cig/day = average number of cigarettes smoked per day; FTND = Fagerström test for nicotine dependence; IP = interpersonal problems subscale; NA = negative affect subscale; PA = positive affect subscale; SF = somatic features subscale; Total = total scale; WISDM = Wisconsin inventory of smoking dependence motives. *N* = 212. Nonsignificant findings not displayed.

^aModel includes age, gender, and ethnicity as covariates

^bHigher scores indicate higher positive affect.

* *p* < .01.

** *p* < .001.

.1000
p < .0001

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Table 2
Correlation Matrix for CESD Scales and Measures of Other Affective Characteristics

Measure	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.
1. CESD-T	16.13 (10.43)	(.90)	-.78	.90	.84	.63	.69	.72	-.56
2. CESD-PA	2.09 (0.74) ^a		(.82)	-.62	-.49	-.39	-.43	-.49	.65
3. CESD-NA	0.63 (0.61)			(.84)	.61	.52	.61	.68	-.46
4. CESD-SF	1.02 (0.58)				(.72)	.44	.67	.62	-.43
5. CESD-IP	0.50 (0.71)					(.69)	.41	.43	-.18
6. BAI	15.1 (10.7)						(.90)	.73	-.27
7. PANAS-NA	2.3 (0.8)							(.86)	-.33
8. PANAS-PA	3.3 (0.8)								(.90)

Note. BAI = Beck Anxiety Inventory Total Score; CESD = Center for Epidemiologic Studies Depression scale; IP = interpersonal problems subscale; NA = negative affect subscale; PA = positive affect subscale; PANAS = positive and negative affect schedule; SF = somatic features subscale; Total = total scale. *N* = 212. Values in parentheses along the diagonal represent Cronbach α estimates. All associations were significant ($p < .01$).

^aHigher scores indicate higher positive affect

Table 3

Correlation Matrix of WISDM Scales

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. WISDM-Total	–													
2. Affiliative Attachment	.74	–												
3. Automaticity	.65	.44	–											
4. Behavioral Choice Melioration	.84	.78	.44	–										
5. Cognitive Enhancement	.74	.51	.38	.63	–									
6. Cue Exposure-Associative Processes	.80	.50	.47	.69	.56	–								
7. Craving	.80	.45	.49	.52	.56	.65	–							
8. Loss of Control	.76	.54	.58	.60	.52	.72	.59	–						
9. Negative Reinforcement	.84	.54	.40	.70	.70	.66	.72	.56	–					
10. Positive Reinforcement	.82	.59	.36	.71	.68	.57	.65	.51	.84	–				
11. Social-Environmental Goads	.40	.23	.15	.23	.18	.25	.39	.20	.31	.31	–			
12. Taste and Sensory Processes	.70	.51	.55	.48	.39	.44	.58	.48	.50	.60	.25	–		
13. Tolerance	.70	.44	.56	.57	.43	.66	.51	.60	.45	.42	.21	.51	–	
14. Weight Control	.48	.32	.27	.37	.30	.28	.36	.30	.38	.31	.04	.21	.19	–

Note. $N = 212$. WISDM = Wisconsin inventory of smoking dependence motives

For r_s .14, $p < .05$. For r_s .18, $p < .01$. For r_s .23, $p < .001$. For r_s .27, $p < .0001$.

Table 4
Comparison of Findings Across Studies Examining the Association Between Depression and WISDM Scales

Study and Measure	Sample	Age, <i>M</i> (<i>SD</i>)	WISDM Scale												
			Aff	Aut	BCM	Cog	Cue	Cra	LOC	NR	PR	Soc	TSP	Tol	WC
Kahler et al. (2010)	296 Community smokers	38.8 (1.9)													
Lifetime MDD			+	+	+	+	+	+	+	+	+	+	+	+	+
Leventhal et al. (2008a) ^a	157 Smokers wanting to quit	41.6 (11.4)													
CESD-Total										+	+			+	
CESD-PA										−	−			−	
CESD-NA										+	+			+	
CESD-SF										+	+			NS	
CESD-IP										+	+			NS	
Current study	212 College student smokers	24.3 (6.4)													
CESD-Total			+	NS	+	+	+	+	+	+	+	NS	NS	NS	+
CESD-PA			NS	NS	−	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CESD-NA			NS	NS	+	+	NS	NS	NS	+	+	NS	NS	NS	NS
CESD-SF			NS	NS	+	NS	+	+	NS	NS	NS	NS	NS	NS	+
CESD-IP			+	NS	+	NS	+	+	NS	+	+	NS	NS	+	NS

Note. - = study found evidence of a significant inverse association; + = study found evidence of a significant positive association; Aff = Affiliative Attachment; Aut = Automaticity; BCM = Behavioral Choice Melioration; CESD = Center for Epidemiologic Studies Depression scale; Cog = Cognitive Enhancement; Cue = Cue Exposure-Associative Processes; IP = interpersonal problems subscale; LOC = Loss of Control; MDD = major depressive disorder; NA = negative affect subscale; NR = Negative Reinforcement; NS = study found that association was non-significant; PA = positive affect subscale; PR = Positive Reinforcement; SF = somatic features subscale; Soc = Social-Environmental Goals; Tol = Tolerance; Total = total scale; TSP = Taste and Sensory Processes; WC = Weight Control; WISDM = Wisconsin inventory of smoking dependence motives

^aPR, NR, and Tol were the only WISDM scales included in that study.