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Anxiety sensitivity and smoking motives and outcome expectancies among adult daily smokers: Replication and extension

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Abstract

The present investigation examined the incremental validity of anxiety sensitivity in the context of distress intolerance in terms of predicting smoking motives and outcome expectancies.

Participants were a community sample of 144 daily smokers (85 women, $M_{age}=29.72$ years, $SD=11.96$). Results indicated that above and beyond discomfort intolerance, Axis I diagnoses, gender, volume of alcohol consumption, and average number of cigarettes smoked per day, anxiety sensitivity significantly incrementally predicted habitual, addictive, and negative affect reduction motives to smoke, as well as negative reinforcement outcome expectancies. No such incremental effects were similarly evident for distress intolerance. Findings are discussed in relation to the role of anxiety sensitivity in smoking motives and outcome expectancies.

Introduction

An increased amount of scientific attention has focused on the role of affective vulnerability in terms of smoking behavior (Anda et al., 1999; Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Piasecki, Kenford, Smith, Fiore, & Baker, 1997; Quinn, Brandon, & Copeland, 1996; Zvolensky & Bernstein, 2005). In general, work has identified that both emotional vulnerability factors and psychiatric conditions are related to decreased success in quitting smoking, heavier rates of smoking, and greater perceived withdrawal symptoms during quit attempts (Brown & Wolfe, 1994; Feldner, Babson, & Zvolensky, 2007; Kalman, Morissette, & George, 2005; Koenen et al., 2005; Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007; Morrell & Cohen, 2006).

To delineate underlying mechanisms explaining relationships between emotion vulnerability and smoking, one promising line of research has focused on anxiety sensitivity (Zvolensky & Bernstein, 2005). Anxiety sensitivity is operationalized as the fear of anxiety and arousal-related sensations (McNally, 2002) that reflects a trait-like, cognitive predisposition for anxiety psychopathology (Bernstein & Zvolensky, 2007; Taylor, 1999). Specifically, when high anxiety-sensitive individuals experience anxiety and related perturbation, they become

“alarmed” by their own anxiety-related sensations, thereby intensifying their anxiety. Anxiety sensitivity is theoretically and empirically distinguishable from anxiety symptoms and other negative affect states (Rapee & Medoro, 1994). Over the past two decades, research has found that anxiety sensitivity is concurrently, incrementally, and prospectively associated with anxiety disorders, particularly panic and posttraumatic stress psychopathology (Hayward, Killen, Kraemer, & Taylor, 2000; Li & Zinbarg, 2007; Maller & Reiss, 1992; Schmidt, Lerew, & Jackson, 1997, 1999; Schmidt, Zvolensky, & Maner, 2006).

Empirical work also suggests anxiety sensitivity is related to clinically relevant smoking processes. Indeed, anxiety sensitivity has been significantly associated with early lapse and relapse during quit attempts among treatment-seeking and non-treatment-seeking adult smokers from the United States and Mexico (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001; Zvolensky, Bernstein et al., 2007). Zvolensky, Bonn-Miller, Bernstein, and Marshall (2006) found, for example, that anxiety sensitivity was significantly associated with increased risk of early smoking relapse among adult daily smokers. As another example, higher levels of anxiety sensitivity were related to greater intensity of nicotine withdrawal symptoms during past quit attempts (Zvolensky, Baker, et al., 2004) and increased levels of perceived barriers in quitting smoking (Zvolensky, Vujanovic, et al., 2007). Thus high, compared to low, anxiety-sensitive smokers evidence greater difficulties quitting, more intense withdrawal symptoms, and greater perceived barriers to cessation.

Efforts have also been increasingly directed toward the study of mechanisms linking the anxiety sensitivity construct to the motivational and cognitive-based beliefs about smoking behavior. Here, integrative models have suggested that clinically relevant linkages exist between anxiety sensitivity and affect regulatory motives and outcome expectancies (Zvolensky & Bernstein, 2005; Zvolensky, Schmidt, & Stewart, 2003). High, relative to low, anxiety-sensitive daily smokers, specifically, may be more apt to expect smoking to help alleviate aversive anxiety states and be motivated to smoke for affect regulation purposes despite also believing such behavior may yield negative personal consequences (e.g., respiratory irritation, physical illness). In the absence of other more adaptive (nonsmoking) affect-regulation skills, high anxiety-sensitive daily smokers may tend to rely on smoking to manage anxiety states and, paradoxically, fears about health status. Smoking among high anxiety-sensitive daily smokers also may be more likely to become an automatized drug response and predominant type of self-control strategy, because it is likely to become a frequent and reflexive means by which to manage psychological distress and well-being. Consistent with such theorizing, work has thus far indicated that anxiety sensitivity is associated with negative affect reduction smoking motives among adolescents (Comeau, Stewart, & Loba, 2001) and college student daily smokers (Novak, Burgess, Clark, Zvolensky, & Brown, 2003; Stewart, Karp, Pihl, & Peterson, 1997; Zvolensky et al., 2006). Also, anxiety sensitivity has been found to be related to smoking outcome expectancies for negative personal consequences (e.g., beliefs smoking will cause physical impairment such as cancer) as well as negative reinforcement (e.g., beliefs smoking will reduce negative affect) among adult treatment-seeking heavy smokers (>20 cigarettes/day; Brown, Kahler, et al., 2001) and college student daily smokers (Zvolensky, Feldner, et al., 2004). These findings suggest that fears of negative consequences may be related to smoking behavior to

dampen (perceived or real) negative affect, while ultimately and perhaps paradoxically increasing the risk for anxiety problems (Zvolensky & Bernstein, 2005).

Although past work on anxiety sensitivity and smoking motives and outcome expectancies has been promising, three central limitations to such work are in need of further empirical scrutiny. First, it remains unclear whether other theoretically-related individual difference factors exhibit similar types of relationships with motivational processes and outcome expectancies, and more specifically, whether such relationships are independent of anxiety sensitivity. Of the theoretically-relevant factors that could explain anxiety sensitivity effects, distress intolerance is a viable candidate (Bernstein & Zvolensky, 2007; Brown et al., 2005). A number of terms have been used to describe “affect tolerance processes,” including distress intolerance, distress tolerance, discomfort intolerance, and task persistence (Zvolensky & Otto, 2007). Although nuances between these labels exist, their conceptual underpinnings are generally the same (Brown et al., 2005). We use the term *distress intolerance* here because we believe it best captures the operative processes at play for this construct. Distress intolerance reflects a trait-like individual difference variable referring to the subjective interpretation of sensations as either tolerable or threatening (Schmidt, Richey, Cromer, & Buckner, in press; Schmidt, Richey, & Fitzpatrick, 2006). Distress intolerance is significantly related to both anxiety symptoms (Schmidt et al., in press; Schmidt, Richey, et al., 2006) and early lapse to smoking (Brown, Lejuez, Kahler, & Strong, 2002). Thus previously observed effects between anxiety sensitivity and affect-relevant motivational and outcome expectancy factors may simply be due to shared variance with distress intolerance rather than fear of anxious arousal and its consequences more specifically. Second, given that anxiety sensitivity is related to mood-related and substance use disorder psychopathology (Schmidt, Zvolensky, et al., 2006), and such psychological conditions are related to the maintenance of smoking (Brown & Wolfe, 1994; Feldner et al., 2007; Kalman et al., 2005), the previously observed effects for anxiety sensitivity may be attributable to preexisting clinical conditions. However, none of the previous research on smoking motives or outcome expectancies has examined whether anxiety sensitivity effects are apparent above and beyond the variance attributable to concurrent psychopathology. Finally, previous work on anxiety sensitivity and smoking motives and outcome expectancies has focused largely on college student samples (Novak et al., 2003; Stewart et al., 1997; Zvolensky et al., 2006). The ability to generalize past work needs to be evaluated by extending sampling strategies to focus on daily smokers from the general community. This segment of society represents a large percentage of those persons who ultimately seek treatment for quitting smoking, and about whom it is particularly important to understand mechanisms underlying tobacco use and dependence (Orleans, Woolf, Rothemich, Marks, & Isham, 2006).

Overall, the present investigation sought to replicate and extend past research by evaluating the incremental validity of anxiety sensitivity in regard to smoking motivational and outcome expectancy factors among a community-recruited sample of daily smokers. It was hypothesized that higher levels of anxiety sensitivity would be significantly related to smoking for habitual, addictive, and negative affect reduction motives, for use above and beyond the shared variance with distress intolerance, Axis I diagnoses, gender, concurrent

weekly alcohol use, and daily smoking rate. Additionally, it was hypothesized that higher levels of anxiety sensitivity would similarly be incrementally related to smoking outcome expectancies for negative personal consequences and negative reinforcement beyond the covariates.

Method

Participants

The sample consisted of 144 daily smokers (85 women, $M_{\text{age}}=29.72$ years, $SD=11.96$). The racial distribution of the sample generally reflected that of the Vermont population (State of Vermont Department of Health, 2007): 92.4% of the total sample identified as White, 2.8% identified as Black, 3.4% identified as Hispanic, 0.7% identified as Black/Hispanic, and 0.7% identified as “other.” In terms of educational status, 2.9% of participants did not complete high school/GED, 16.4% completed high school/GED, 57.9% completed some college, 15.7% graduated from college, 2.1% completed some graduate work, 4.3% attained a graduate degree, and 0.7% did not report educational status. Participants were daily smokers, averaging 16.12 cigarettes/day ($SD=7.54$), and had a mean age at onset of daily cigarette use of 16.62 years ($SD=5.03$). The average score on the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) was 3.15 ($SD=1.82$), indicating a relatively low level of dependence. Approximately 65.5% of the sample reported using alcohol at least two to four times per month, averaging three to four alcoholic drinks per occasion.

Of the sample, 57.1% met criteria for at least one current Axis I disorder, while 41.9% of the participants did not meet criteria for any current Axis I disorders. Among all participants, 33.6% met criteria for posttraumatic stress disorder, 22.8% for generalized anxiety disorder, 19.2% for panic disorder (14.2% met criteria for panic disorder without agoraphobia, 5.0% with agoraphobia), 20.7% for major depression, 17.8% for social phobia, 6.4% for specific phobia, 2.8% for dysthymia, and 0.7% for bipolar disorder. Of the total sample, 15.3% met criteria for at least two Axis I disorders, 29.2% for three or more Axis I disorders, and 6.4% for four or more Axis I disorders.

Exclusionary criteria for the investigation included (a) limited mental competency or the inability to provide informed, written consent, (b) current suicidal or homicidal ideation, (c) current or past history of psychotic-spectrum symptoms, (d) current major medical problems (e.g., heart disease, cancer), (e) current use of nicotine replacement therapy, (f) current use of tobacco products other than cigarettes (e.g., cigars, chewing tobacco), and (g) pregnancy.

Measures

Anxiety Disorders Interview Schedule for DSM-IV: Client Interview Schedule (ADIS-IV; Brown et al., 1994)—The ADIS-IV is a semistructured diagnostic interview used to assess DSM-IV anxiety, mood, somatoform, and substance use disorders as well as to screen for the presence of psychotic disorders. Reliability of this measure has shown good to excellent interrater agreement for the majority of anxiety and mood disorders among participants who were given two independent administrations of the ADIS-IV (Brown, Di

Nardo, Lehman, & Campbell, 2001). The presence of current Axis I psychopathology was assessed using the ADIS-IV in the present study by trained doctoral-level administrators. For the present investigation, diagnostic reliability ratings by an independent rater (MJZ) were completed on a random selection of 20% of the protocols, with no cases of disagreement being noted.

Smoking History Questionnaire (SHQ; Brown et al., 2002)—The SHQ is a continuous self-report questionnaire used to assess smoking history and pattern. The SHQ includes 20 items pertaining to smoking rate, age at onset of smoking initiation, and years of being a daily smoker. The response format varies by individual question. The SHQ has been used successfully in previous studies as a measure of smoking history (Zvolensky, Lejuez, Kahler, & Brown, 2004).

Fagerström Tolerance Questionnaire (FTQ; Fagerström, 1978; Heatherton et al., 1991)—The FTQ was used as a continuous self-report measure of nicotine dependence and cigarettes smoked per day. The response format varies by individual question. Specifically, the FTQ was administered, and it was scored as the FTND. The FTND has shown good internal consistency, positive relationships with smoking variables (e.g., salivary cotinine; Heatherton et al., 1991; Payne, Smith, McCracken, McSherry, & Antony, 1994), and high degrees of test-retest reliability (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994). For the current investigation, item 2 on the FTND was used to determine the average number of cigarettes smoked per day.

Alcohol Use Disorders Identification Test (AUDIT; Babor, de la Fuente, Saunders, & Grant, 1992)—The AUDIT is a 10-item self-report screening measure developed by the World Health Organization to assess frequency of alcohol consumption and to identify individuals with alcohol problems (Babor et al., 1992). A large body of literature attests to the psychometric properties of the AUDIT (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). As in past work (Stewart, Zvolensky, & Eifert, 2001), the frequency and quantity items of the AUDIT were used to index weekly alcohol consumption (an average weekly-based frequency by quantity per occasion composite score).

Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986)—The ASI is a 16-item self-report measure rated on a 4-point Likert-type scale (0=very little to 4=very much) administered to assess the degree to which participants fear negative consequences stemming from anxiety symptoms. The ASI shows adequate test-retest reliability ($r=.75$ for 2 weeks) and criterion validity (e.g., individuals with agoraphobia score higher than those with other anxiety disorders and those with no disorder), and is distinct from trait anxiety (Peterson & Reiss, 1992). In the present investigation, the total ASI score was used because it represents the global-order anxiety sensitivity factor and therefore takes into account different types of fears, including fears of panic-related somatic, cognitive, and social cues.

Discomfort Intolerance Scale (DIS; Schmidt, Richey, et al., 2006)—The DIS is a five-item self-report measure rated on a 7-point Likert-type scale (0="not at all like me" to 6="extremely like me") that was used to assess discomfort intolerance (the ability to tolerate

physically aversive stimuli), which has been hypothesized as a risk factor for anxiety. Factor analysis has shown that the DIS contains an intolerance factor ($\alpha=.91$), comprising two items, and an avoidance factor ($\alpha=.72$), comprising three items. The intolerance factor measures intolerance of discomfort and pain, and the avoidance factor measures avoidance of physical discomfort. The DIS has shown strong criterion validation, when tested against established measures of psychopathology such as the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988) and the Beck Depression Inventory (BDI; Beck, Steer, & Garbin, 1988), and also has shown construct validation (Schmidt, Richey, et al., 2006). In the present investigation, the DIS total score was used as a primary predictor variable, as it reflects the global distress intolerance construct.

Reasons for Smoking (RFS; Ikard, Green, & Horn, 1969)—The RFS is a self-report measure consisting of 23 items, rated on a 5-point Likert-type scale (1=never to 5=always), used to assess smoking motives. The psychometric properties of this scale, including measures of factor structure, internal consistency, and test-retest reliability, have been well established (Shiffman, 1993). For the present investigation, the following RFS scales were used owing to their theoretical relevance to the study objectives: habitual (e.g., “I’ve found a cigarette in my mouth and didn’t remember putting it there”), addictive (e.g., “Between cigarettes, I get a craving only a cigarette can satisfy”), and negative affect reduction (e.g., “When I feel uncomfortable or upset about something, I light up a cigarette”).

Smoking Consequences Questionnaire (SCQ; Brandon & Baker, 1991)—The SCQ is a 50-item self-report measure that assesses smoking expectancies on a 10-point scale for likelihood of occurrence (0=“completely unlikely” to 9=“completely likely”). The entire measure and its constituent factors have demonstrated sound psychometric properties (Brandon & Baker, 1991; Buckley et al., 2005; Downey & Kilbey, 1995). In the present investigation, the negative personal consequences subscales (e.g., “The more I smoke, the more I risk my health”) and negative reinforcement (e.g., “Smoking helps me calm down when I feel nervous”) of the SCQ were used to measure theoretically relevant outcome expectancies for smoking.

Procedure

Participants were recruited from the greater Burlington, Vermont, community, for participation in a smoking cessation study via placement of flyers throughout marketplaces and well-traveled locations, and posting of printed advertisements in local newspapers. Data for the present investigation were gathered at the baseline appointments, before participants set a smoking cessation date. During this baseline appointment, participants (a) provided verbal and written informed consent, (b) underwent a diagnostic evaluation (ADIS-IV) conducted by trained doctoral-level students to determine if any exclusion criteria were met, (c) provided carbon monoxide analysis of breath samples to biochemically verify their smoking status, and (d) completed an initial battery of self-report assessments, including those used in the present investigation. For all participants, the baseline evaluation occurred 2–3 weeks prior to their scheduled quit day. All participants received US\$25 for completion of the baseline assessment session; participation in all eight appointments of the cessation

study yielded a total compensation amount of \$225. Only the baseline component of the data was used in the present report.

Data analyses

Five hierarchical multiple regression analyses were conducted using SPSS version 13.0 to examine the incremental validity of anxiety sensitivity (ASI–total score) and discomfort intolerance (DIS–total score), entered concurrently, in relation to the following criterion variables: (a) RFS–habitual, (b) RFS–addictive, (c) RFS–negative affect reduction, (d) SCQ–negative personal consequences, and (e) SCQ–negative reinforcement. These dependent variables were identified on an *a priori* basis for their theoretical relevance in terms of the present study objectives. At step 1 of each of the models, total number of Axis I diagnoses (up to three), gender, alcohol consumption (weekly alcohol consumption volume), and average number of cigarettes smoked per day were entered as covariates. At step 2 of each of the models, the main effects of anxiety sensitivity and discomfort intolerance were entered simultaneously. Overall, this analytic model ensured that any variance accounted for by the main effects at step 2 was not attributable to covariates at step 1 of the models (Sechrest, 1963). Furthermore, simultaneous entry of anxiety sensitivity and discomfort intolerance at step 2 ensured that any variance accounted for by the main effect of either putative predictor was not attributable to shared variance with the other.

Results

Zero-order association among theoretically relevant variables

See Table 1 for a summary of zero-order relations and descriptive data among all studied variables. The ASI–total score was significantly associated with the DIS–total score ($r=.38$, $p<.01$, 14% shared variance). Both the ASI–total score ($r=.74$, $p<.01$) and the DIS–total score ($r=.37$, $p<.01$) were significantly correlated with number of Axis I diagnoses, but not with any other covariates (i.e., gender, alcohol consumption, or average number of cigarettes smoked per day). Furthermore, the ASI–total score was significantly associated with each of the five criterion variables, including RFS–habitual ($r=.34$, $p<.01$), RFS–addictive ($r=.44$, $p<.01$), RFS–negative affect reduction ($r=.47$, $p<.01$), SCQ–negative personal consequences ($r=.35$, $p<.01$), and SCQ–negative reinforcement ($r=.49$, $p<.01$). Additionally, the DIS–total score was significantly correlated with four of the criterion variables, including RFS–habitual ($r=.24$, $p<.01$), RFS–addictive ($r=.26$, $p<.01$), RFS–negative affect reduction ($r=.33$, $p<.01$), and SCQ–negative reinforcement ($r=.28$, $p<.01$). The DIS–total score was not significantly related to SCQ–negative personal consequences.

Hierarchical regression analyses

Table 2 summarizes the hierarchical regression analyses. In terms of the RFS–habitual subscale, step 1 of the model accounted for 17% of the variance, with number of Axis I diagnoses ($p<.05$) and average number of cigarettes smoked per day ($p<.01$) as significant univariate predictors. The second step of the model accounted for an additional and significant 5% of unique variance in predicting the RFS–habitual subscale. Anxiety

sensitivity (ASI–total score) ($p<.05$), as expected, was the only unique significant predictor at step 2 of the model.

For the RFS–addictive subscale, step 1 of the model accounted for 28% of the variance, and both number of Axis I diagnoses ($p<.01$) and average number of cigarettes smoked per day ($p<.01$) were significant predictors. The second step of the model accounted for an additional and significant 6% of unique variance; anxiety sensitivity (ASI–total score) was the only significant incremental predictor ($p<.01$).

In regard to the RFS–negative affect reduction, step 1 of the model predicted 38% of the variance; gender ($p<.01$), number of Axis I diagnoses ($p<.01$), and number of cigarettes smoked per day ($p<.01$) were significant univariate predictors. The second step of the model accounted for an additional and significant 4% of variance. Anxiety sensitivity (ASI–total score) ($p<.05$) was, again, the only unique predictor at step 2 of the model.

For the SCQ–negative personal consequences subscale, step 1 of the model predicted 17% of the variance; number of Axis I diagnoses ($p<.01$) was the only significant univariate predictor. The second step of the model did not significantly predict any additional variance in terms of this criterion variable.

Finally, in terms of the SCQ–negative reinforcement subscale, step 1 of the model predicted 32% of the variance; number of Axis I diagnoses ($p<.01$) and average number of cigarettes smoked per day ($p<.05$) were significant univariate predictors. The second step of the model accounted for an additional and significant 4% of unique variance. As hypothesized, anxiety sensitivity (ASI–total score) was the only unique predictor at step 2 of the model ($p<.05$).

Discussion

Consistent with prediction, in terms of smoking-motivational processes, anxiety sensitivity was significantly and incrementally related to habitual, addictive, and negative affect reduction motives for smoking among the present sample of adult daily smokers. The observed effects were evident above and beyond the statistically significant amount of variance accounted for by Axis I diagnoses, gender, weekly alcohol consumption, and daily cigarette usage. Moreover, the incremental effect of anxiety sensitivity was not due to shared variance with distress intolerance as indexed by discomfort intolerance. The present results provide novel evidence that anxiety sensitivity is associated with habitual and addictive motivational smoking processes. These findings also extend past work on anxiety sensitivity and its association with negative affect reduction motives (Comeau et al., 2001; Novak et al., 2003; Stewart et al., 1997; Zvolensky et al., 2006). These findings are collectively consistent with the conjecture that high, relative to low, anxiety-sensitive daily smoking adults have a multifaceted motivational profile for their smoking behavior, including reasons related to habitual patterns of use, self-control-oriented addictive reasons, and coping with negative affect stressors. These linkages between anxiety sensitivity and smoking motives may help explain the lower rates of success in quitting among high anxiety-sensitive smokers (Brown, Kahler, et al., 2001; Zvolensky, Bernstein, et al., 2007; Zvolensky et al., 2006). Specifically, in the absence of other more adaptive (nonsmoking) coping strategies,

high anxiety-sensitive daily smokers may rely on smoking to manage aversive mood states in a largely reflexive and self-control-oriented fashion. When attempting to quit, for example, such physical and emotional distress is highly probable, and lapse and relapse to smoking may become increasingly likely among high anxiety-sensitive smokers.

A second series of analyses focused on clarifying the relationships between anxiety sensitivity and smoking outcome expectancies for negative personal consequences and negative reinforcement. Here, the hypotheses were supported only partially. Although past work documented an association between anxiety sensitivity and negative personal consequences (Zvolensky, Feldner, et al., 2004), the present study suggests that such an effect may be attributable to co-occurring psychopathology rather than anxiety sensitivity per se, indicating that daily smokers with greater levels of psychopathology may be more likely to believe that smoking is a personally dangerous activity. Given that daily smokers with psychopathology often have difficulty quitting (Brown & Wolfe, 1994; Kalman et al., 2005; Koenen et al., 2006), it may be useful for future research to explore relationships between psychopathology and motivation to quit smoking. To the extent that psychopathology is related to smoking outcome expectancies for negative personal consequences, it presumably would be related to enhanced motivation to quit (Rundmo, Smedslund, & Gö testam, 1997). Yet, as expected, anxiety sensitivity was significantly related to negative reinforcement outcome expectancies; the incremental effect of anxiety sensitivity was not due to shared variance with distress intolerance or Axis I diagnoses, gender, weekly alcohol consumption, or daily cigarette usage. These findings offer novel empirical evidence for an association between anxiety sensitivity and negative reinforcement outcome expectancies. This observation helps clarify that past findings (Zvolensky, Feldner, et al., 2004) were not likely attributable to these other theoretically relevant factors such as level of Axis I psychopathology or distress intolerance. Moreover, such results suggest that daily smokers with high, compared to low, anxiety sensitivity tend to expect that smoking will relieve negative affect states. Thus, for these high-risk smokers to quit smoking successfully, interventions may need to target such beliefs through specialized psychoeducational activities.

Distress intolerance was not significantly incrementally predictive of any of the dependent variables after accounting for shared variance with anxiety sensitivity. Such findings are intriguing given that distress intolerance has been related to shorter duration of smoking abstinence among daily smokers (Brandon et al., 2003; Brown et al., 2002; Hajek, 1991; Hajek, Belcher, & Stapleton, 1987; West, Hajek, & Beltcher, 1989). The present results suggest that distress intolerance, as measured by the DIS, does not maintain robust relationships with smoking-relevant habitual, addictive, or negative affect reduction smoking motives, or negative personal consequences and negative reinforcement smoking outcome expectancies. Based on the present findings, it may be fruitful for future work to evaluate the incremental validity of distress intolerance in regard to smoking outcomes of interest, after accounting for variance explained by anxiety sensitivity.

Overall, the present study supports the hypothesized association between anxiety sensitivity and specific smoking motives and outcome expectancies. The main implication of the present work is that it may be clinically useful to integrate anxiety sensitivity into smoking

cessation programs as a way to tailor interventions to yield more success for certain difficult-to-treat groups of daily smokers (e.g., daily smokers with anxiety disorders or high levels of anxiety sensitivity). For example, by providing psychoeducation about the motives and expectancies related to smoking behavior among high anxiety-sensitive smokers, it may be possible to facilitate a better understanding of their reasons for smoking and beliefs about smoking. Such knowledge could prompt more sophisticated efforts to understand and presumably alter smoking behavior among individuals who want to quit smoking. As a second example, by using cognitive restructuring and interoceptive exposure exercises to aversive internal cues (e.g., chair spinning, voluntary hyperventilation) specifically targeting anxiety sensitivity, it may be possible to reduce levels of anxiety sensitivity prior to a cessation attempt and, by extension, alter the tendency to use smoking for habitual, addictive, or negative affect reduction reasons (Zvolensky, Bernstein, Yartz, McLeish, & Feldner, et al., in press). Finally, acceptance-based therapies (e.g., acceptance and commitment therapy) could perhaps be usefully applied to target high anxiety-sensitive smokers to facilitate smoking cessation (Hayes, Strosahl, & Wilson, 1999). Again, such efforts could theoretically offer greater probabilities of success during quitting by disrupting the interconnection between anxiety sensitivity and specific motives, and expectancies about smoking behavior.

The present study has a number of limitations. First, although the present study's cross-sectional design provided an initial test of the associations between anxiety sensitivity and smoking motives and outcome expectancies, such an approach cannot shed light on processes over time or isolate causal or directional relationships between these variables. Future work could extend the present findings by using prospective methodologies to model anxiety sensitivity and smoking motivational and expectancy relationships over time.

Second, self-report measures were used as the primary assessment methodology. Self-report methods do not protect against reporting errors and may inflate observed relationships via shared method variance. Future studies could build on the present work by using alternative assessment instruments such as cognitive science tasks that tap implicit and automatic smoking motives and expectancies. Third, the present sample comprised a relatively homogenous group of daily smokers who were regular but not "heavy" smokers (i.e., low levels of nicotine dependence; Pomerleau, Majchrzak, & Pomerleau, 1989). Thus, the results may be related to a self-selection bias and the corresponding smoking history characteristics of the present sample. It will be useful for researchers to draw from a more diverse group of heavy smokers to determine whether the observed findings may be generalized to other populations.

Fourth, we used the DIS as a measure of distress intolerance. Although the DIS is a psychometrically sound self-report index of a theoretically important dimension of distress intolerance (for physical-based stress), other smoking work has used other indices of the construct (e.g., the behavioral latency to terminate an aversive event; Brown et al., 2002). Future work could therefore usefully replicate and extend the present findings through the use of tasks such as behavioral indices of intolerance for psychological and physical stress (Brown et al., 2002). For example, work could ascertain whether alternative measures of distress intolerance for psychological stressors (e.g., negative affect) may play a unique

explanatory role in terms of smoking expectancies and motivational processes. Overall, the present results may best capture the explanatory relevance of distress intolerance for physical stress, but may not be fully applicable to psychological stressors.

Finally, although the present study covaried for psychopathology in tests of anxiety sensitivity and discomfort intolerance, the rates of specific disorders was not equally represented. Specifically, there were more persons with posttraumatic stress disorder than other disorders. Although all participants were recruited from the community for the same study, differential base rates of specific disorders were apparent. Future work could benefit by replicating and extending the present study among smokers with a more diverse and balanced psychopathology profile.

Together, the present investigation provides novel empirical data pertaining to the association between anxiety sensitivity and specific smoking motives and outcome expectancies. Findings suggest that anxiety sensitivity is uniquely related to negative affect reduction motives and expectancies, as well as habitual and addictive motives for use among daily adult smokers. Such effects were not accounted for by shared variance with level of distress intolerance or psychopathology, concurrent weekly alcohol, daily tobacco use, or gender.

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Table 1
Descriptive data and zero-order correlations among theoretically relevant variables ($N=144$).

Variable	1	2	3	4	5	6	7	8	9	10	11	Mean	SD
1 Anxiety sensitivity (total) ^a	–	.38**	.74**	.14	–.04	.06	.34**	.44**	.47**	.35**	.49**	21.6	13.1
2 Discomfort intolerance (total) ^b	–	–	.37**	–.09	–.11	.17	.24**	.26**	.33**	.17	.28**	12.3	5.2
3 Axis I diagnoses (up to 3) ^c	–	–	–	.20*	–.13	.14	.30**	.43**	.54**	.39**	.53**	1.3	1.3
4 Gender ^d	–	–	–	–	–.12	–.08	.13	.12	.29**	.20*	.24**	–	–
5 Alcohol consumption (AUDIT) ^e	–	–	–	–	–	–.17*	–.11	–.22**	–.26**	–.14	–.12	5.1	5.1
6 Cigarettes smoked/day (FTQ) ^f	–	–	–	–	–	–	.34**	.32**	.30**	.13	.24**	16.1	7.6
7 RFS–habitual ^g	–	–	–	–	–	–	–	.58**	.44**	.32**	.46**	2.1	0.68
8 RFS–addictive ^h	–	–	–	–	–	–	–	–	.59**	.34**	.53**	3.1	0.82
9 RFS–negative affect reduction ⁱ	–	–	–	–	–	–	–	–	–	.31**	.75**	3.3	0.87
10 SCQ–negative personal consequences ^j	–	–	–	–	–	–	–	–	–	–	.35**	5.4	1.9
11 SCQ–negative reinforcement ^k	–	–	–	–	–	–	–	–	–	–	–	6.5	1.4

Note.

^a Anxiety Sensitivity Index–total score.

^b Discomfort Intolerance Scale–total score.

^c number of current Axis I diagnoses (up to 3)–ADIS-IV.

^d Gender (1=male, 2=female).

^e Alcohol Use Disorders Identification Test (frequency × quantity).

^f cigarettes smoked/day, Fagerström Tolerance Questionnaire.

^g Reasons for Smoking Questionnaire–habitual subscale.

^h Reasons for Smoking Questionnaire–addictive subscale.

ⁱ Reasons for Smoking Questionnaire–negative affect reduction subscale.

^j Smoking Consequences Questionnaire–negative personal consequences subscale.

^k Smoking Consequences Questionnaire–negative reinforcement subscale.

.10>*p*
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;50>*p*
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Table 2

Summary of hierarchical regression analyses.

	<i>R</i> ²	<i>t</i>	<i>β</i> ²	<i>sr</i> ²	<i>p</i> value
(each predictor)					
Criterion variable: RFS–habitual ^a					
Step 1	.17				<.01
Axis I diagnoses ^f		2.63	.22	.05	<.05
Gender ^g		.99	.08	.01	<i>ns</i>
Alcohol consumption ^h		.10	.01	.00	<i>ns</i>
Cigarettes smoked/day ⁱ		3.58	.30	.09	<.01
Step 2	.05				<.05
ASI–total ^j		2.35	.28	.04	<.05
DIS–total ^k		.90	.08	.01	<i>ns</i>
Criterion variable: RFS–addictive ^b					
Step 1 ^{f–i}	.28				<.01
Axis I diagnoses		4.81	.38	.16	<.01
Gender		.42	.03	.00	<i>ns</i>
Alcohol consumption		1.70	.13	.02	<i>ns</i>
Cigarettes smoked/day		3.14	.25	.07	<.01
Step 2 ^{j,k}	.06				<.01
ASI–total		3.19	.35	.08	<.01
DIS–total		.12	.01	.00	<i>ns</i>
Criterion variable: RFS–negative affect reduction ^c					
Step 1 ^{f–i}	.38				<.01
Axis I diagnoses		5.95	.44	.22	<.01
Gender		2.66	.20	.05	<.01
Alcohol consumption		1.82	.13	.03	<i>ns</i>
Cigarettes smoked/day		3.02	.22	.07	<.01
Step 2 ^{j,k}	.04				<.05

R^2		(each predictor)		β^2	sr^2	t	p value
ASI-total				.21	.03	2.10	<.05
DIS-total				.12	.02	1.56	<i>ns</i>
Criterion variable: SCQ-negative personal consequences ^d							
Step 1 ^{f-i}		.17					<.01
Axis I diagnoses				.34	.11	3.99	<.01
Gender				.12	.02	1.41	<i>ns</i>
Alcohol consumption				.09	.01	1.02	<i>ns</i>
Cigarettes smoked/day				.07	.01	.79	<i>ns</i>
Step 2 ^{j,k}		.01					<i>ns</i>
ASI-total				.10	.01	.85	<i>ns</i>
DIS-total				.03	.00	.30	<i>ns</i>
Criterion variable: SCQ-negative reinforcement ^e							
Step 1 ^{f-i}		.32					<.01
Axis I diagnoses				.47	.23	6.12	<.01
Gender				.14	.03	1.85	<i>ns</i>
Alcohol consumption				.00	.00	.02	<i>ns</i>
Cigarettes smoked/day				.18	.04	2.37	<.05
Step 2 ^{j,k}		.04					<.05
ASI-total				.27	.05	2.50	<.05
DIS-total				.06	.00	.77	<i>ns</i>

Note. β =standardized beta weight, sr^2 =squared semi-partial correlation.

- ^aReasons for Smoking Questionnaire-habitual subscale.
- ^bReasons for Smoking Questionnaire-addictive subscale.
- ^cReasons for Smoking Questionnaire-negative affect reduction subscale.
- ^dSmoking Consequences Questionnaire-negative personal consequences subscale.
- ^eSmoking Consequences Questionnaire-negative reinforcement subscale.
- ^fNumber of current Axis I diagnoses (up to 3)–ADIS-IV.

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- g Gender (1=male, 2=female).
- h Alcohol Use Disorders Identification Test.
- i Cigarettes smoked/day (Fagerström Tolerance Questionnaire).
- j Anxiety Sensitivity Index–total score.
- k Discomfort Intolerance Scale–total score.

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