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Original Investigation

Anxiety sensitivity and anxiety and depressive symptoms in the prediction of early smoking lapse and relapse during smoking cessation treatment

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Abstract

Introduction: The present investigation examined whether anxiety sensitivity, relative to anxiety and depressive symptoms, was related to duration to early smoking lapse and relapse (during first 2 weeks postquit) among daily smokers receiving smoking cessation treatment.

Methods: Participants included 123 daily cigarette smokers (84 women; $M_{age} = 45.93$ years, $SD = 10.34$) living in the Halifax Regional Municipality in Nova Scotia, Canada.

Results: Anxiety sensitivity was significantly associated with an increased risk of early smoking lapse (i.e., any smoking behavior) at days 1, 7, and 14 following the quit day. Such effects were evident above and beyond the variance accounted for by gender, nicotine dependence, and nicotine withdrawal symptoms, as well as the shared variance with prequit (baseline) anxiety and depressive symptoms. In contrast to expectation, anxiety sensitivity was not related to smoking relapse (i.e., seven consecutive days of smoking) during the first 2 weeks of quitting.

Discussion: Results are discussed in terms of better understanding the role of anxiety sensitivity, along with other affective vulnerability processes, in early problems encountered during a quit attempt.

Introduction

Anxiety sensitivity reflects individual differences in the fear of anxiety and arousal-related sensations (McNally, 2002; Taylor, 1999). When anxious, individuals high in anxiety sensitivity become acutely fearful due to beliefs that these anxiety sensations have harmful physical, psychological, or social consequences (Bernstein & Zvolensky, 2007). Although anxiety sensitivity has been studied predominately in relation to better understanding the etiology and maintenance of anxiety and its disorders (Feldner, Zvolensky, Schmidt, & Smith, 2008; Hayward, Killen, Kraemer, & Taylor, 2000; Li & Zinbarg, 2007; Maller & Reiss, 1992; Schmidt, Lerew, & Jackson, 1997, 1999; Schmidt, Zvolensky, & Maner, 2006), it has been linked increasingly to a variety of substance use disorders (Lejuez, Paulson, Daughters, Bornovalova, & Zvolensky, 2006; Norton, Rockman, Luy, & Marion, 1993; Stewart, Karp, Pihl, & Peterson, 1997; Stewart & Kushner, 2001).

In fact, a growing body of empirical work indicates that anxiety sensitivity is associated with numerous aspects of cigarette smoking (Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007; Zvolensky & Bernstein, 2005; Zvolensky, Schmidt, & Stewart, 2003). Some of the earliest and now most well-documented studies in this domain, for example, have found that cigarette smokers who are high, but not low, in anxiety sensitivity were more apt to report smoking because they believe (perceive) that smoking can serve a coping function to downregulate negative affective states (e.g., anxiety, depression; Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001; Comeau, Stewart, & Loba, 2001; Novak, Burgess, Clark, Zvolensky, & Brown, 2003; Stewart et al., 1997; Zvolensky, Bonn-Miller, Feldner, et al., 2006). More recent study has found that such anxiety sensitivity–smoking motive relations also are evident for habitual and addictive smoking motives, as compared with other smoking motives (Leyro, Zvolensky, Vujanovic, & Bernstein, 2008). Other studies have found that anxiety sensitivity is related to smoking outcome expectancies for negative affect reduction (beliefs that smoking will reduce negative affect; Brown et al., 2001; Gregor, Zvolensky, McLeish, Bernstein, & Morissette, 2008; Zvolensky, Feldner, et al., 2004). Additionally, smokers high in anxiety sensitivity report perceiving

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the prospect of quitting as both a more difficult and personally threatening experience (Zvolensky, Vujanovic, et al., 2007), possibly due to a hypersensitivity to aversive internal sensations such as nicotine withdrawal symptoms (Zvolensky, Baker, et al., 2004) or elevated state anxiety (Mullane et al., 2008). Both aversive states routinely occur upon abstinence from smoking (Hughes, Higgins, & Hatsukami, 1990). These findings collectively suggest that individual differences in anxiety sensitivity may be related to affect-relevant smoking motives (e.g., coping-oriented patterns of use) and expectancies (e.g., beliefs about the expected effect of smoking on mood) as well as perceived barriers to quitting.

Beyond work on smoking motives, outcome expectancies, and perceived barriers to quitting, some limited work suggests that anxiety sensitivity may be related to problems in quitting. One study found that anxiety sensitivity to be associated with an increased rate of smoking lapse (any smoking behavior) during the first week of a quit attempt (Brown et al., 2001). Another prospective investigation found that anxiety sensitivity was related to increased relapse among adult daily smokers by 1 month following cessation (Mullane et al., 2008). Additionally, daily smokers with higher levels of anxiety sensitivity reported their longest (lifetime) quit attempts as consisting of relapse within 1 week postcessation (Zvolensky, Bernstein, et al., 2007; Zvolensky, Bonn-Miller, Bernstein, & Marshall, 2006).

Available work on the association between anxiety sensitivity and early lapse and relapse is promising, but it is limited in a number of keyways. First, only one investigation has explored anxiety sensitivity and early smoking *lapse* relations (Brown et al., 2001). Although a significant relationship exists between anxiety sensitivity and smoking lapse during the first week following cessation, it is unclear how specific those findings are to the first week of quitting. Since aversive interoceptive cues routinely occur during the first 2 weeks of quitting (Hendricks, Ditre, Drobes, & Brandon, 2006; Hughes et al., 1990), a putative anxiety sensitivity and early lapse relationship might be apparent for up to 2 weeks or more during a quit attempt. Thus, future work would benefit by examining anxiety sensitivity and smoking lapse effects across a larger conceptually relevant timeframe in order to replicate and extend past findings in this domain. Second, none of the past work has explored relationships between anxiety sensitivity and both lapse (any smoking behavior) and relapse (more complete return to precessation smoking behavior) during the early stages of a quit attempt (first 2 weeks) in the same study using a prospective measurement protocol. The previously reported relationships between anxiety sensitivity and early relapse may have been influenced by reporting error (e.g., recall biases). Accordingly, it would be advisable to distinguish lapse and relapse effects in the same design to ascertain whether anxiety sensitivity is related more robustly to one or both of these early smoking cessation difficulties.

Third, it is unclear whether the reported anxiety sensitivity effects for early lapse and relapse are better explained by anxiety or depressive symptoms. Given that anxiety sensitivity is related to increased risk for anxiety symptoms and disorders (Hayward et al., 2000; Schmidt et al., 2006), it is possible that anxiety symptoms, rather than anxiety sensitivity, may account for previously observed relationships between this cognitive factor and early lapse and relapse. This type of account is particularly in need of empirical evaluation because smokers with anxiety disorders (compared with those without) are at increased risk of early lapse and relapse in controlled prospective work (Zvolensky, Gibson, et al., 2008). Similarly, depressive symptoms may explain previously noted anxiety sensitivity–early lapse and –relapse effects. There is a sizeable empirical literature on depressive symptoms and disorders and difficulties with smoking cessation (e.g., Breslau, Novak, & Kessler, 2004; Covey, Bomback, & Yan, 2006; Hitsman, Borrelli, McChargue, Spring, & Niaura, 2003). Although history of major depressive disorder is not a significant risk factor for poor cessation outcome in the majority of available studies (Hitsman et al., 2003), depressive symptoms prior to smoking cessation treatment, as well as increases in such symptoms during treatment, have been reliable predictors of relapse (Burgess et al., 2002; Covey, Glassman, & Stetner, 1990; Kahler et al., 2002; Zelman, Brandon, Jorenby, & Baker, 1992). Moreover, anxiety sensitivity is related to depressive symptoms and disorders (Cox, Borger, & Enns, 1999; Otto, Pollack, Fava, Uccello, & Rosenbaum, 1995; Schmidt et al., 2006), albeit to a lesser extent than to anxiety symptoms and psychopathology (Schmidt, Lerew, & Joiner, 1998).

The present investigation examined the relations of anxiety sensitivity to duration of time to lapse and time to relapse during the first 2 weeks of a quit attempt among daily smokers receiving smoking cessation treatment. Since persons with higher levels of anxiety sensitivity should theoretically be more vulnerable to lapsing earlier in their quit attempt (Zvolensky & Bernstein, 2005), we hypothesized that higher levels of anxiety sensitivity would be associated with shorter time to first smoking lapse (i.e., defined as smoking any amount following the quit day; Shiffman et al., 1996) at three distinct measurement timepoints (day 1, day 7, and day 14) during the first 2 weeks of a quit attempt. Moreover, as an extension of past work (Brown et al., 2001), we hypothesized that such effects would be unique from variance explained by gender, nicotine dependence, and nicotine withdrawal symptoms (quit day) as well as shared variance with anxiety and depressive symptoms. Following similar logic, we hypothesized that anxiety sensitivity would be associated with shorter duration of time to smoking relapse (i.e., defined as smoking any amount for at least seven consecutive days following the quit day; Ossip-Klein et al., 1986). This hypothesis was driven by the idea that, to the extent that higher levels of anxiety sensitivity are related to early lapse, those prone to such lapses in the absence of more adaptive coping strategies may be less apt to "recover" and may therefore experience a full relapse to smoking.

Methods

Participants

Participants included 123 daily cigarette smokers (84 women; $M_{age} = 45.93$ years, $SD = 10.34$) living in the Halifax Regional Municipality in the Canadian province of Nova Scotia. Daily smokers were recruited for participation from among those attending a structured 4-week group Tobacco Intervention Program offered through Addiction Prevention and Treatment Services, Capital District Health Authority. All the daily smokers participating in the program were invited to participate. Participants reported attaining the following levels of education: 40.7% completed high school, 30.9% completed college (community college or technical schooling), 13.0% completed university (traditional 4-year schooling), 10.6% completed junior high school, 4.1% completed elementary school, and 0.8% did not report educational status. With regard to marital/relationship status, 48.0% of the sample reported being married/cohabiting

with a partner, 35.0% reported being separated/divorced/widowed, and 17.1% reported being single.

Participants reported smoking an average of 19.71 cigarettes/day (SD=7.57) and endorsed relatively high levels of nicotine dependence (M=6.25, SD=2.17), as indexed by the Fagerström Test for Nicotine Dependence (FTND; Fagerström, 1978; Heatherton, Kozlowski, Frecker, & Fagerström, 1991) at treatment outset. Participants reported initiating daily smoking at a mean age of 16.60 years (SD=4.77) and smoking regularly for an average of 28.28 years (SD=10.64). In terms of smoking cessation, participants endorsed an average of 2.95 (SD=2.85) "serious" lifetime quit attempts and 5.77 (SD=12.57) lifetime quit attempts lasting longer than 12 hr. The longest average lifetime period of smoking abstinence after a quit attempt among participants was 1.14 years (SD=2.74).

Participants had the option of using nicotine replacement therapy (NRT) during the study (see Measures and Procedure), and all accepted the optional NRT. Data regarding NRT use are reported here for only those participants with smoking calendar log data at or following the quit day appointment (n=106) as only these participants are included in the analyses (see Results). Upon enrollment in the study (approximately 2 weeks prior to quit day), 8 participants requested only nicotine gum, 6 participants requested only the nicotine patch, 90 participants requested the nicotine gum and patch, 1 participant did not request NRT during the first week (but at week 2 of the study, this participant requested both nicotine gum and patch), and 1 participant's NRT data were missing for the first week (but at week 2 of the study, this participant requested both nicotine gum and patch). Participants' NRT regimens were modified throughout the study, as based on individual requests or expressed need.

Measures

Descriptive baseline measures. Participants provided demographic and background information such as age, gender, marital status, educational attainment, and annual income during the first session. At this time, participants also were asked to indicate if they were accepting the NRT provided, and whether they were accepting the gum, the patch, or both. All participants were offered at least one form of NRT as part of the treatment research program.

Smoking History Questionnaire. The Smoking History Questionnaire (SHQ; Brown, Lejuez, Kahler, & Strong, 2002) is a self-report questionnaire used to assess smoking history and pattern. The SHQ includes items pertaining to smoking rate, age at onset of smoking initiation, and years of being a daily smoker. The SHQ has been used successfully in previous studies as a measure of smoking history (e.g., Zvolensky, Lejuez, Kahler, & Brown, 2004).

Fagerström Test for Nicotine Dependence. The FTND (Fagerström, 1978; Heatherton et al., 1991) is a six-item scale designed to assess gradations in tobacco dependence (Heatherton et al., 1991). The FTND has shown good internal consistency, positive relations with key smoking variables (e.g., salivary cotinine; Heatherton et al., 1991), and high degrees of test–retest reliability (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).

Minnesota Nicotine Withdrawal Scale. The Minnesota Nicotine Withdrawal Scale (MWS; Hughes & Hatsukami, 1986) is a reliable and sensitive seven-item self-report scale that was used to measure nicotine withdrawal symptoms on the quit day. Participants were asked to rate their symptoms on a 4-point Likert-type scale (0 = not present to 3 = severe).

Mood and Anxiety Symptom Questionnaire. The Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al., 1995) is a 62-item self-report measure of affective symptoms. Participants indicate how much they have experienced each symptom on a 5-point Likert-type scale (1 = not at all to 5 = extremely). The Anxious Arousal scale (MASQ-AA) measures the symptoms of somatic tension and arousal (e.g., "felt dizzy"). The Anhedonic Depression scale (MASQ-AD) measures a loss of interest in life (e.g., "felt nothing was enjoyable"), with reverse-keyed items measuring positive affect. Consistent with past work (Zvolensky, Solomon, et al., 2006), only the MASQ-AA and MASQ-AD subscales were used in the present investigation because they provide psychometrically sound and empirically specific composites for "pure" anxiety and "pure" depression symptoms, respectively (Watson et al., 1995).

Anxiety Sensitivity Index. To assess sensitivity to, and discomfort with, anxiety and related internal states, we used the 16-item Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). The ASI is a self-report measure on which respondents indicate, on a 5-point Likert-style scale, the degree to which they fear the potential negative consequences of anxiety-related symptoms and sensations. The ASI is unique from, and demonstrates incremental predictive validity relative to, trait anxiety (McNally, 2002) and negative affectivity (Zvolensky, Kotov, Antipova, & Schmidt, 2005).

Smoking calendar logs. Participants were asked to record their daily smoking behavior both 2 weeks prior to and following the cessation date, including whether or not they smoked each day. If they smoked, participants were asked to specify the number of cigarettes smoked per day, the time of each cigarette, the perceived need for each cigarette (on a 10-point scale), their context or behavior at the time they smoked (i.e., what they were doing, who they were with), and the reason for smoking. This method of tracking smoking patterns has been used successfully in past prospective work on smoking behavior (McLeish, Zvolensky, & Bucossi, 2007; Zvolensky, Gibson, et al., 2008). In the present study, we made use of the Smoking Calendar Logs for two weeks starting at the quit date. Here, we coded whether or not participants smoked each day during this two week period, as well as the total number of cigarettes smoked on each day that smoking was reported.

Procedure

The initial phase of this study recruited smokers attending an information session about the Tobacco Intervention Program offered through Capital Health. Potential participants were informed about the nature and purpose of the study and were invited to participate in the research portion of the program. Participants were given a daily monitoring journal, which contained the smoking calendar for 2 weeks prior to and 2 weeks postquit attempt, and they were instructed on how to prospectively complete the daily smoking calendar logs.

The smoking cessation program began approximately 2 weeks after the information session. During the first session, participants completed a demographics questionnaire, the SHQ,

the FTND, the MASQ, and the ASI. In addition, participants were offered the chance to receive NRT. The program consisted of one 90-min group session per week for 4 weeks, including clinical time (1-hr group), as well as the time for the research component (half an hour). Each session was delivered by a trained addictions counselor in a group format. The manualized treatment included both evidence-based behavioral and cognitive strategies and NRT. During this program, participants selected their own quit date within the 4-week window of treatment. The intervention and a 4-week supply of NRT were provided to program participants free of charge. All participants were provided with a US$10 movie pass as compensation, and an additional $25 gift certificate to a large local grocery store was provided to those participants who completed more than 80% of the smoking calendar logs.

The type of NRT was determined, in part, by knowledge of past history of allergies to the patch (to nicotine or glue). At each session, participants were asked to turn in their completed smoking calendar logs and to indicate their current NRT allocation.

Data analysis

First, we examined zero-order correlations among theoretically relevant variables. Second, we used logistic regression analyses (for day 1 lapse and relapse outcomes) or Cox proportional hazards regression modeling (for day 7 and day 14 lapse and relapse outcomes) to test concurrently the effects of anxious arousal (MASQ-AA), anhedonic depression (MASQ-AD), and anxiety sensitivity (ASI-Total) on survival to (a) a lapse (i.e., defined as smoking any amount following the quit day; Shiffman et al., 1996) and (b) relapse (i.e., defined as smoking any amount for at least seven consecutive days following the quit day; Ossip-Klein et al., 1986) to smoking during the 2 weeks following the quit day. For day 1 lapse and relapse outcomes, we used logistic regression because these analyses were not longitudinal per se. For day 7 and day 14 lapse and relapse outcomes, we used Cox proportional hazards regression modeling to examine the cumulative effect over time of several risk factors on "survival." Each model included gender, nicotine dependence (FTND-Total), and nicotine withdrawal–quit day (MWS-Total) as theoretically relevant covariates.

Results

Only those participants with smoking calendar data at or following the quit day appointment ($n = 106$) were included in the analyses. Of the 123 participants enrolled in the study, 17 dropped out during the cessation treatment program or did not attend any postquit day appointments. We found no significant group differences between participants who dropped out ($n = 17$) and those who remained in the study ($n = 106$) on any key variables, including gender, age, number of smoking years, daily smoking rate, nicotine dependence, baseline anxious arousal, baseline anhedonic depression, or baseline anxiety sensitivity. Of the 106 participants with smoking calendar data at or following the quit day, two participants did not record smoking data until day 2 postcessation, one participant did not record smoking data until day 7 postcessation, and one participant did not record smoking data until day 8 postcessation. These participants were not included in corresponding descriptive analyses or analyses of lapse or relapse. Overall, according to the aforementioned definitions of lapse and relapse, a total of 74.5% ($n = 79$) of participants lapsed and 45.7% ($n = 48$) relapsed by day 14 postcessation. At day 1 postcessation, 54 participants (52.9%) lapsed and 25 participants (24.5%) relapsed; and by day 7 postcessation, a total of 71 participants (68.3%) lapsed and 29 participants (28.2%) relapsed. Lapse and relapse were independently defined and coded; therefore, the noted rates are not mutually exclusive and reflect the total number of participants who met criteria for lapse and relapse, respectively, at any given timepoint.

Descriptive data and zero-order correlations among theoretically relevant variables at baseline

Table 1 summarizes the descriptive data and zero-order correlations of the theoretically relevant variables. FTND-Total was significantly associated with MWS-Total ($p < .01$), MASQ-AA ($p < .01$), and MASQ-AD ($p < .05$) but not with ASI-Total. MWS-Total was significantly correlated with MASQ-AA ($p < .01$), MASQ-AD ($p < .01$), and ASI-Total ($p < .05$). MASQ-AA was significantly associated with MASQ-AD ($p < .01$) and ASI-Total ($p < .01$). MASQ-AD was not significantly associated with ASI-Total.

Lapse and relapse

Lapses to smoking during first 2 weeks postcessation. Logistic regression analyses or Cox proportional hazards regression models were used to test the effects of MASQ-AA, MASQ-AD, and ASI-Total on the risk of an initial lapse to smoking during the first 2 weeks following the quit day. Specifically, we examined days 1, 7, and 14 postcessation to evaluate lapses to smoking within each time period (Table 2).

In terms of day 1, the overall logistic regression model was significant, $\chi^2(6) = 15.59$, $p < .05$. None of the covariates were significantly associated with lapse during the first day postcessation. Furthermore, MASQ-AD (odds ratio [*OR*] = 1.04, *Wald* = 4.40, $B = .04$, $p < .05$) and ASI-Total (*OR* = 1.04, *Wald* = 4.55, $B = .04$, $p \leq .05$) were both significantly associated with lapse during the first day following cessation.

In terms of day 7, the overall proportional hazards regression model was significant, $\chi^2(6) = 13.08$, $p < .05$. Of the covariates, only FTND-Total (hazard ratio [*HR*] = 1.19, $p = .01$) was significantly

Table 1. Descriptive data and zero-order correlations among theoretically relevant variables

Variable	1	2	3	4	5	Mean	*SD*
1. FTND-Total		.32**	.29**	.21*	.04	6.36	2.1
2. MWS-Total			.52**	.28**	.25*	12.49	5.8
3. MASQ-AA				.40**	.35**	28.07	8.7
4. MASQ-AD					.08	57.77	13.1
5. ASI-Total						26.39	13.9

Note. $n = 106$ (all participants with any postcessation data). FTND, Fagerström Test for Nicotine Dependence; MWS, Minnesota Nicotine Withdrawal Scale (quit day); MASQ-AA, Mood and Anxiety Symptom Questionnaire-Anxious Arousal; MASQ-AD, Mood and Anxiety Symptom Questionnaire-Anhedonic Depression; and ASI, Anxiety Sensitivity Index.

*$p < .05$; **$p < .01$.

associated with increased odds of lapsing during the first 7 days postcessation. In addition, ASI-Total ($HR = 1.02$, $p < .05$) was associated with significantly increased odds of lapsing during the first week following cessation.

In terms of day 14, the overall proportional hazards regression model was significant, $\chi^2(6) = 13.69$, $p < .05$. Of the three covariates, only FTND-Total ($HR = 1.20$, $p < .01$) was significantly associated with increased odds of lapsing during the first 2 weeks postcessation. ASI-Total ($HR = 1.02$, $p < .05$) also was associated with significantly increased odds of lapsing during the first 2 weeks following cessation.

Relapse to smoking during first 2 weeks postcessation. We used logistic regression analyses or Cox proportional hazards regression models to test the effects of MASQ-AA, MASQ-AD, and ASI-Total on the risk of relapse to smoking during the first 2 weeks following the quit day. Specifically, days 1, 7, and 14 postcessation were examined to evaluate relapses to smoking within each corresponding time period. As per Ossip-Klein et al. (1986), the first day of the relapse episode (i.e., seven consecutive days of smoking) was considered the day of relapse. When relapse was defined according to the Shiffman et al. (1996) definition (i.e., smoking at least 5 cigarettes/day on at least three consecutive days following the quit day; Shiffman et al., 1996), the pattern of findings yielded by the current model was slightly different. Logistic regression was again used to examine day 1 relapse, whereas Cox proportional hazards regression modeling was again used to examine day 7 and day 14 relapse. Only FTND-Total was significantly (marginally) associated with increased odds of relapse on the first day ($\chi^2 = 9.14$, $p = ns$, $OR = 1.97$, $Wald = 3.83$, $B = .68$, $p = .05$) postcessation and during the first 2 weeks ($\chi^2 = 6.81$, $p = ns$, $HR = 1.20$, $p < .05$) postcessation, though the overall models were not significant. Furthermore, only depressive symptoms (MASQ-AD) were significantly associated with increased odds of relapse during the first week postcessation ($\chi^2 = 6.81$, $p = ns$, $HR = 1.05$, $p < .05$), although again the overall model was not significant (see Table 2).

In terms of day 1, the overall logistic regression model was significant, $\chi^2(6) = 13.13$, $p < .05$. None of the covariates were significantly associated with relapse during the first day postcessation. MASQ-AD ($OR = 1.07$, $Wald = 7.65$, $B = .07$, $p < .01$) was the only factor significantly associated with relapse during the first day postcessation.

In terms of day 7, the overall proportional hazards regression model was significant, $\chi^2(6) = 13.49$, $p < .05$. Only MASQ-AD ($HR = 1.05$, $p < .01$) was significantly associated with increased odds of relapse during the first week postcessation.

In terms of day 14, the overall proportional hazards regression model was only marginally significant, $\chi^2(6) = 11.57$, $p = .07$. FTND-Total ($HR = 1.18$, $p < .05$) and MASQ-AD ($HR = 1.03$, $p = .01$) were both significantly associated with increased odds of relapse during the first 2 weeks postcessation.

Discussion

The present investigation examined the explanatory value of anxiety sensitivity relative to anxiety and depressive symptoms in terms of early smoking lapse and relapse during smoking cessation treatment among daily smokers.

Consistent with prediction, anxiety sensitivity was associated with an increased risk of early smoking lapse, defined as any smoking at days 1, 7, and 14 following the quit date. Such effects were evident above and beyond the variance accounted for by gender, nicotine dependence, and nicotine withdrawal symptoms, as well as the shared variance with prequit (baseline) anxiety and depressive symptoms. The size of the anxiety sensitivity effects was nearly identical for each measurement timepoint, generally as robust as those observed for nicotine dependence (at days 1, 7, and 14) and essentially identical to those observed for depressive symptoms (at day 1). These findings, which are in accord with integrated theoretical anxiety smoking models (Zvolensky & Bernstein, 2005; Zvolensky et al., 2003), replicate and uniquely extend past prospective work on anxiety sensitivity and early smoking lapse (Brown et al., 2001). The present findings suggest that anxiety sensitivity–early lapse effects are indeed evident within a 2-week time span and that such effects are not better explained by shared variance with anxiety or depressive symptoms. Such results, in conjunction with past work (Brown et al., 2001), suggest that anxiety sensitivity may be an important and unique emotional risk factor for early smoking lapse.

In contrast to prediction, anxiety sensitivity was not significantly related to early smoking relapse, defined as seven consecutive days of smoking. These findings help inform past work

Table 2. Lapse and relapse: Odds ratios and hazard ratios for all variables

	Odds ratios[a] and hazard ratios[b]					
Variables	Day 1 lapse	Day 7 lapse	Day 14 lapse	Day 1 relapse	Day 7 relapse	Day 14 relapse
Gender[c]	1.46	0.88	0.92	0.52	0.65	1.00
FTND-Total	1.25	1.19 ($p = .01$)	1.20 ($p < .01$)	1.30	1.21	1.18 ($p < .05$)
MWS-Total	0.91	0.96	0.95	0.96	0.96	0.97
MASQ-AA	0.98	0.98	0.98	0.92	0.97	0.98
MASQ-AD	1.04 ($p < .05$)	1.02	1.02	1.07 ($p < .01$)	1.05 ($p < .01$)	1.03 ($p = .01$)
ASI-Total	1.04 ($p < .05$)	1.02 ($p < .05$)	1.02 ($p < .05$)	1.04	1.01	1.00

Note. [a]Odds ratios (logistic regression) are presented for day 1 lapse and day 1 relapse outcomes.

[b]Hazard ratios (Cox proportional hazards regression) are presented for day 7 and day 14 lapse and relapse outcomes.

[c]Gender (1 = male; 2 = female). FTND, Fagerström Test for Nicotine Dependence; MWS, Minnesota Nicotine Withdrawal Scale (quit day); MASQ-AA, Mood and Anxiety Symptom Questionnaire-Anxious Arousal; MASQ-AD, Mood and Anxiety Symptom Questionnaire-Anhedonic Depression; and ASI, Anxiety Sensitivity Index.

on anxiety sensitivity and early relapse that used different methodological designs and reporting timeframes (Mullane et al., 2008; Zvolensky, Bernstein, et al., 2007; Zvolensky, Bonn-Miller, Feldner, et al., 2006). The present findings suggest that anxiety sensitivity and early relapse effects among smokers receiving treatment for smoking cessation are not evident within a 2-week time period. Specifically, depressive symptoms, rather than anxiety sensitivity, may be a better (statistically significant) predictor of relapse in the early phases of a quit attempt. Depression-prone smokers may be more apt to become hopeless about successfully overcoming an early lapse and therefore be more likely to experience a full relapse during this same time period. Overall, the present results may suggest that anxiety sensitivity is particularly useful in terms of understanding early lapse but not necessarily early relapse. However, because the present study involved the administration of evidence-based care strategies for smoking cessation, anxiety-sensitive smokers may have been aided by such treatment elements (e.g., learned skill-based coping strategies for avoiding relapse) that helped them recover from lapses and possibly prevented relapses. Future work could test this possibility by using a self-guided quit attempt approach (i.e., no intervention delivered) to further inform the anxiety sensitivity–early relapse conjecture. Given that previous prospective work with smokers undergoing the same smoking cessation program showed that anxiety-sensitive smokers were more likely to have relapsed to smoking by a 1-month posttreatment follow-up (Mullane et al., 2008), the present study's 2-week postquit date timeframe may have been too short to observe a relationship between anxiety sensitivity and relapse. It remains plausible that, given the established relationship between anxiety sensitivity and early lapse, repeated lapses over time may place anxiety-sensitive smokers at increased risk for relapse in the longer term (i.e., after the first 2 weeks of the smoking cessation attempt).

Although not the primary focus of the present investigation, the study contributes to knowledge about the role of depressive and anxiety symptoms during the early phases of smoking cessation treatment. We found evidence that depressive symptoms at baseline were a significant predictor of both early lapse (at day 1) and early relapse (at days 1, 7, and 14). These results are in accordance with past work suggesting that depressive symptoms prior to smoking cessation treatment are a reliable negative predictor of sustained abstinence and a reliable positive predictor of relapse (Burgess et al., 2002; Covey et al., 1990; Kahler et al., 2002; Zelman et al., 1992). Although past work has found that anxiety disorders are associated with early relapse (Zvolensky, Gibson, et al., 2008), we found no evidence in the present investigation that anxiety symptoms prequit were related to early smoking lapse or relapse. Thus, anxiety psychopathology, but not anxiety symptoms per se, may be a more clinically significant target for better understanding early smoking lapse and relapse.

At a broad-based level, the present data add to the growing literature suggesting that smokers with emotional risk factors such as anxiety sensitivity and depressive symptoms may profit from specialized treatment approaches for the purpose of preventing early lapse and relapse (Zvolensky, Bernstein, Yartz, McLeish, & Feldner, 2008). Findings of the present study can inform conceptually the development of specialized intervention strategies for smokers who tend to lapse and relapse early in their quit attempts. For example, smokers with elevated levels of anxiety sensitivity and depressive symptoms may benefit from intensive cognitive-behavioral strategies delivered prior to a quit attempt, such as interoceptive exposure, cognitive restructuring, and affective regulation strategies to decrease anxious and depressive responsivity and increase tolerance of negative affect, craving, and nicotine withdrawal symptoms to promote greater degrees of smoking abstinence. Although effort has been made to address anxiety sensitivity (Zvolensky, Lejuez, Kahler, & Brown, 2003; Zvolensky et al., 2008) and depressive problems (Muñoz, Marín, Posner, & Pérez-Stable, 1997; Thorsteinsson et al., 2001) in smoking cessation treatments, integrated, multirisk factor approaches that target both anxiety sensitivity and depressive symptoms have yet to be developed. Such types of therapeutic strategies may represent a fertile area for further pursuit, particularly in the context of current trends toward the development of broadband approaches to the treatment of emotional disorders (Barlow, Allen, & Choate, 2004).

A number of limitations of the present investigation and points for future direction should be considered. First, the present sample comprised a relatively homogenous (e.g., primarily White) group of adult smokers who volunteered to participate. To rule out the potential self-selection bias among persons with these characteristics and increase the generalizability of these findings, it will be important for researchers to draw from populations other than those included in the present study. Second, the study focused on anxiety sensitivity and anxiety and depressive symptoms. These emotional factors are naturally only some of many possible emotional risk candidates for early lapse and relapse in smoking cessation. Future work could usefully continue to build multirisk factor models of early lapse and relapse by incorporating other promising affective-relevant variables, such as behavioral persistence and distress tolerance (Brandon et al., 2003; Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005).

Third, determination of lapse and relapse was based on participants' self-reports in their daily smoking logs and did not include biochemical verification of smoking status. Although past work has indicated that such self-reported smoking behavior is reliable (McLeish et al., 2007), the findings could nevertheless be influenced by the veracity and accuracy of participants' self-report of their emotional status and smoking behavior. Future work could substantiate the present findings by incorporating biochemical verification procedures. Fourth, the present study was aimed principally at explicating anxiety sensitivity and early lapse and relapse effects within the context of other relevant emotional variables such as anxiety and depressive symptoms. Building from this work, future studies could be directed at clarifying the mechanisms underlying anxiety sensitivity (and other emotional variables such as depressive symptoms) and early lapse effects using ecological momentary sampling tactics. This type of research would directly inform the nature of emotional vulnerability processes and early problems in quitting smoking. Fifth, the present study did not include diagnostic assessments of past or present psychopathology. Such information would help to provide a more fine-grained analysis of the psychopathological characteristics of the sample. Finally, the quit date for the present study was not fixed relative to the 4-week program. Thus, some participants might have quit before they covered relevant program content that might have been useful for a high-anxiety-sensitive smoker. Although this timing should

have averaged out across participants, it would be ideal to standardize the quit date relative to the program start in future research.

Together, the present findings uniquely extend previous work documenting a prospective association between anxiety sensitivity and early lapse among adult daily smokers. Results suggest that anxiety sensitivity is associated with increased risk of smoking lapse relative to other factors. Although not the primary aim of the investigation, we found that depressive symptoms were a significant predictor of early lapse and relapse effects. These findings provide novel evidence that certain affective vulnerabilities are important factors to consider in terms of early experience of quitting.

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Declaration of Interests

None declared.

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