

Evaluating the Role of Anxiety Sensitivity in Smoking Outcome Expectancies Among Regular Smokers

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The present study evaluated the association between the lower-order facets of anxiety sensitivity construct (physical, mental incapacitation, and social concerns) and positive (expectancies about negative affect reduction) and negative (expectancies about negative personal consequences) smoking outcome expectancies. Participants were 90 young adult regular smokers [37 females; $M_{\text{age}} = 23.4$ years ($SD = 8.9$); mean number of cigarettes/day = 11.7 ($SD = 6.1$)] with no history of psychopathology or nonclinical panic attacks recruited from the general population. Anxiety sensitivity physical concerns and mental incapacitation concerns, as indexed by the Anxiety Sensitivity Index (ASI; S. Reiss, R. A. Peterson, M. Gursky, & R. J. McNally, 1986), were significantly and incrementally associated with smoking outcome expectancies, as indexed by the Smoking Consequences Questionnaire (SCQ; T. H. Brandon & T. B. Baker, 1991), for negative affect reduction as well as negative personal consequences; the observed effects were over and above the variance accounted for by theoretically relevant smoking history characteristics, gender, and negative affectivity. Results are discussed in relation to better understanding motivational processes for smoking among groups at heightened risk for developing panic psychopathology.

KEY WORDS: anxiety sensitivity; panic; smoking; expectancies; smoking cessation.

Anxiety sensitivity (AS), defined as the fear of anxiety and anxiety-related sensations (Reiss & McNally, 1985), is a traitlike cognitive characteristic that can predispose individuals to the development of panic-related problems. For example, if a person believes bodily sensations are a sign of imminent personal harm or threat, this “high AS” individual would experience escalating levels of anxiety and perhaps a panic attack when exposed to such sensations. Since the late 1980s, separate lines of research have generally supported the AS model of panic disorder vulnerability (see Taylor, 1999). Furthermore, studies suggest an association between AS and

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certain types of substance use problems (Otto, Safren, & Pollack, 2004). Although the vast majority of work in this domain has focused on alcohol-related problems (see Stewart, Samoluk, & MacDonald, 1999), potential relationships between AS and smoking remain largely unexplored.

Zvolensky, Schmidt, and Stewart (2003) proposed an affect regulation model of smoking and panic disorder to help understand the high co-occurrence and interplay between such problems. This model suggests that among regular smokers, AS should be associated with increased motivation to smoke to reduce negative affect and aversive bodily sensations. In particular, as high AS persons believe negative affect-related cues (e.g., restlessness, bodily agitation, anxiety) are personally dangerous, they should be highly motivated to smoke in response to anxiety-related distress as a way of coping with such affective disturbances. That is, as these persons are sensitive and emotionally reactive to aversive interoceptive cues, smokers with high levels of AS may be particularly apt to smoke as a way of avoiding or regulating negative affect (i.e., self-administration aimed principally at terminating or avoiding nicotine withdrawal or related aversive states like anxiety). This type of perspective is premised on the large empirical literature that documents smokers attribute their smoking, at least in part, to its mood-regulating functions and believe that smoking will reduce negative affect states (Kassel, Stroud, & Paronis, 2003). Consistent with the panic-smoking model, investigations have thus far shown that AS is correlated with smoking motives to reduce negative affect, but not other reasons (e.g., pleasure, handling, taste), among regular smokers (Comeau, Stewart, & Loba, 2001; Novak, Burgess, Clark, Zvolensky, & Brown, 2003; Stewart, Karp, Pihl, & Peterson, 1997).

Although there is evidence that individual differences in sensitivity to anxiety and anxiety-related symptoms is associated with negative affect reduction motivation for smoking among regular smokers, very little work has addressed the relationship between AS and smoking outcome expectancies. Smoking motivation and smoking outcomes expectancies are distinct but related cognitive constructs. Specifically, motivation to smoke reflects the degree to which one is interested in smoking to achieve a certain effect, whereas outcome expectancies reflect anticipation of the expected consequences of smoking (Brandon, Juliano, & Copeland, 1999). Research has found that positive smoking outcome expectancies (e.g., relaxation, mood enhancement) are associated with greater levels of nicotine consumption and dependence (Ahijevych & Wewers, 1993; Copeland, Brandon, & Quinn, 1995; Downey & Kilbey, 1995). Other research has shown that outcome expectancies for mood regulation are associated with the tendency to experience negative affect (Cohen, McCarthy, Brown, & Myers, 2002). Such findings underscore the importance of better understanding the extent to which individual differences in emotional vulnerability relate to smoking outcome expectancies in efforts to explicate the nature of smoking behavior among high-risk groups.

An important next step in research on panic and smoking would be to empirically evaluate the extent to which AS, a well-established panic-specific risk factor (Schmidt, Lerew, & Jackson, 1997), relates to outcome expectancies in an effort to better understand the nature of smoking behavior among regular smokers. Indeed, as smokers relative to nonsmokers are at heightened risk for developing panic-related problems (Breslau & Klein, 1999; Isensee, Wittchen, Stein, Hofler, &

Lieb, 2003; Johnson et al., 2000; Zvolensky, Kotov, Antipova, & Schmidt, 2003), it would be useful to elucidate the cognitive processes involved with their smoking behavior. Extrapolating from panic-smoking theory (Zvolensky, Schmidt, et al., 2003) and recent smoking-motivation findings (Novak et al., 2003), individual differences in AS should be associated with negative affect reduction smoking expectancies among regular smokers. Specifically, smokers with high relative to low AS may experience a greater degree of negative affect reduction from smoking (e.g., via attention reallocation, the pharmacological effects of nicotine, or both) or be more attentive to anxiety-related change associated with smoking. Thus, even in the absence of any genuine stress-reducing properties of nicotine, AS could contribute to the expectation that smoking can help alter the experience of anxiety-related distress. In the only relevant study on smoking outcome expectancies and AS conducted to date, Brown, Kahler, Zvolensky, and Ramsey (2001) found that among regular smokers with a past history of major depressive disorder total AS scores were significantly associated with the reduce negative affect subscale of the Smoking Effects Questionnaire (SEQ; Rohsenow et al., 1992), but not pleasure and stimulation subscales. Although consistent with the panic-smoking theory (Zvolensky, Schmidt, et al., 2003), these data are limited in at least three key respects: (1) they focus on a subpopulation of smokers (i.e., those with past histories of major depression) and therefore have limited applicability to other segments of the smoking population; (2) they do not examine facets of the AS construct and therefore cannot explicate which subdimensions are responsible for such effects; and (3) they employed an unpublished measure of smoking expectancies.

Although AS may theoretically relate to expectations for affect-based negative reinforcement from smoking, this panic-relevant cognitive factor also may be associated with the expectation of smoking-related negative personal consequences (e.g., respiratory irritation, physical illness). There is a well-established relationship between AS and health anxiety (Asmundson, 1999). High relative to low AS individuals tend to worry to a greater extent about adverse health-related events and the possibility of acquiring physical disease (Furer, Walker, & Freeston, 2001). As cigarette smoking is a well-known risk factor for various types of medical illness (e.g., heart disease, a variety of pulmonary diseases, and several types of cancer; Centers for Disease Control and Prevention, 1997), high compared to low AS regular smokers may be particularly likely to expect smoking-related symptoms to lead to negative consequences (e.g., personal health risks). That is, because AS indexes a predisposition to fear anxiety-related sensations (e.g., bodily sensations), smokers with heightened levels of AS may be apt to expect smoking-related bodily perturbation to lead to negative health outcomes (e.g., die at an early age due to smoking). In exploratory analysis in the Brown et al. (2001) investigation, a significant association between AS and expected negative physical effects from smoking was found ($r = .28$). Yet, it is unclear whether this significant association between AS and expectancies for negative physical health effects due to smoking is attributable to preexisting psychiatric problems (e.g., major depressive disorder), a generalized tendency to experience negative affect, or various theoretically relevant smoking history characteristics (e.g., cigarettes consumed per day). If AS is an important cognitive variable in helping to understand outcome expectancies for

negative physical health effects from smoking, it needs to demonstrate unique explanatory power relative to these other theoretically relevant factors.

Taken together, the overarching purpose of the present investigation was to evaluate theoretically relevant associations between AS and smoking outcome expectancies among regular adult smokers without a history of psychopathology or nonclinical panic attacks (i.e., a within-group evaluation). Examining the association between facets of AS and outcome expectancies within this population is clinically important, as it will document relationships between these constructs that cannot be attributed to preexisting psychological problems (i.e., effects attributed to AS rather than preexisting psychological problems). It was hypothesized that the AS subdimensions would be associated at the zero-order level with both negative affect reduction expectancies (e.g., “cigarettes help me deal with anxiety or worry”) and expectations that smoking would be associated with negative health consequences (e.g., “the more I smoke, the more I risk my health”). As an index of specificity, it also was expected that indices of AS would not be associated at the zero-order level with smoking expectancies for positive reinforcement/sensory satisfaction (e.g., “cigarettes taste good”), as this outcome expectancy is unrelated to anxiety processes. Second, we tested the incremental validity of specific facets of AS, relative to theoretically relevant smoking characteristics (e.g., nicotine dependence), negative affectivity, and gender, in terms of predicting (1) expectancies for negative affect reduction and (2) expectancies that smoking would lead to negative consequences. In both cases, it was hypothesized that AS physical concerns, relative to the other two subdimensions, would be the best predictor of smoking outcome expectancies even after controlling for variance accounted for by these other theoretically relevant factors. This hypothesis was based on recent findings that converge on the observation that the AS physical concerns dimension, as opposed to the other subdimensions, plays a central and specific role in terms of panic disorder vulnerability (Zinbarg, Brown, Barlow, & Rapee, 2001; Zvolensky, Kotov, Antipova, & Schmidt, in press) and therefore would be particularly relevant to smoking due the close connection between smoking and various types of bodily perturbation (e.g., respiratory distress; Zvolensky, Schmidt, et al., 2003).

METHOD

Participants

The sample consisted of 90 regular smokers (37 females; $M_{\text{age}} = 23.4$ years, $SD = 8.9$), as defined by smoking ≥ 10 cigarettes per day for at least one year, recruited through the general community. Overall, 93.3% of the total sample was Caucasian, 3.3% Asian American, 1.1% African American, 1.1% Hispanic, and the remainder chose not to specify their ethnicity. Approximately 10% of the sample had at least a 4-year college education, 80% had some college education, 8.9% had a high school degree or the equivalent, and the remaining 1.1% did not have a high school education. Participants averaged 11.7 ($SD = 6.1$) cigarettes per day, began smoking at age 13.3 ($SD = 2.2$), and considered themselves regular smokers by

age 15.9 ($SD = 1.9$). Smoking status was confirmed by a carbon monoxide (CO) analysis of breath samples, with participants recording at least 10 ppm, which is an established cutoff for determining smoking status (Cocores, 1993). The average level of nicotine dependence, as indexed by the Fagerstrom Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991), was 2.6 ($SD = 1.8$).

None of the participants had a positive psychiatric history, including nonclinical panic attacks, based upon their responses to the Anxiety Disorders Interview Schedule-IV (ADIS-IV; DiNardo, Brown, & Barlow, 1994). This psychiatric history exclusionary criterion was included in the present investigation to reduce concern that any potential observed associations between AS and outcome expectancies was due to preexisting psychopathology or nonclinical panic attack history, rather than AS. Interrater reliability for the ADIS-IV in our laboratory has been very high for Axis I diagnoses and nonclinical panic attack history (e.g., Zvolensky et al., 2004). Participants were excluded from the study if they evidenced limited mental competency or the inability to give informed, written consent.

Measures

Anxiety Sensitivity Index (ASI)

The ASI (Reiss, Peterson, Gursky, & McNally, 1986) is a 16-item measure in which respondents indicate on a 5-point Likert-type scale [0 (*very little*) to 4 (*very much*)] the degree to which they are concerned about possible negative consequences of anxiety symptoms. The structure of the 16-item ASI is hierarchical, with three first-order factors entitled AS-physical concerns, AS-mental incapacitation concerns, and AS-social concerns and a single, higher order general factor (Zinbarg, Barlow, & Brown, 1997). The ASI has high levels of internal consistency (average alpha coefficient: 0.84) and good test-retest reliability ($r = .70$ for 3 years; Peterson & Reiss, 1992). The factor structure and psychometric properties of the ASI have been replicated across diverse populations, testifying to its broad-based applicability (e.g., Carter, Miller, Sbrocco, Suchday, & Lewis, 1999; Schmidt & Joiner, 2002; Zvolensky, McNeil, Porter, & Stewart, 2001). The ASI is unique from, and demonstrates incremental validity to, trait anxiety (Rapee & Medoro, 1994); thus, this construct is distinguishable from the frequency of anxiety symptoms (McNally, 1996).

The Positive Affect Negative Affect Scale (PANAS)

The PANAS is a well-established mood measure commonly used in psychopathology research (Watson, Clark, & Tellegen, 1988). It assesses two global dimensions of affect: negative and positive. A large body of literature supports the validity of the PANAS (Watson, 2000). Only the negative affect scale (PANAS-NA) was used in the present study. As negative affectivity is nonspecific, it can be used to covary out a range of negative emotional states, rather than simply alternative measures of anxiety or fear.

Fagerstrom Tolerance Questionnaire (FTQ)

The FTQ (Fagerstrom, 1978) was used as a continuous measure of nicotine dependence. Specifically, we administered the FTQ and scored it as the FTND; see the Heatherton et al. (1991) for scoring directions for the FTND. The FTND has shown good internal consistency, positive relations with key smoking variables (e.g., saliva cotinine; Heatherton et al., 1991; Payne, Smith, McCracken, McSherry, & Antony, 1994), and high degrees of test-retest reliability (Pomerleau, Carton, Lutzke, Flessland, & Pomerleau, 1994).

Smoking History Questionnaire (SHQ)

Smoking history and pattern were assessed with a measure that included items pertaining to smoking rate, age of onset of initiation, years of being a regular smoker, etc. The SHQ has been successfully used in previous studies as a measure of smoking history (Brown, Lejuez, Kahler, & Strong, 2002; Zvolensky, Lejuez, Kahler, & Brown, 2004).

Smoking Consequences Questionnaire (SCQ)

The SCQ (Brandon & Baker, 1991) is a 50-item measure that assesses smoking expectancies on a 0–9 scale for likelihood of occurrence, ranging from 0 (*completely unlikely*) to 9 (*completely likely*). The measure consists of four key subscales: Positive Reinforcement/Sensory Satisfaction (15 items), Negative Reinforcement/Negative Affect Reduction (12 items), Negative Consequences (18 items), and Appetite-Weight Control (5 items). The entire measure and its constituent factors have good psychometric properties (Brandon & Baker, 1991; Downey & Kilbey, 1995). Coefficient alpha's for the subscales, for instance, range from .90 to .95, indicating excellent internal consistency (Brandon & Baker, 1991). To the best of our knowledge, the SCQ only published measure of smoking outcome expectancies and therefore we employed it to assess theoretically relevant outcome expectancies. Specifically, we utilized the Positive Reinforcement/Sensory Satisfaction (e.g., "I enjoy the taste sensations while smoking"), Negative Reinforcement/Negative Affect Reduction (e.g., "Smoking helps me calm down when I feel nervous"), and Negative Consequences (e.g., "The more I smoke, the more I risk my health") subscales of the SCQ, as these are the only scales for which we had developed a priori hypotheses.³

CO Assessment

Noninvasive biochemical verification of smoking history was completed by CO analysis of breath samples (10 ppm cutoff; Cocores, 1993). Expired air CO levels were assessed using a CMD/CO Carbon Monoxide Monitor (Model 3110; Spirometrics, Inc.).

³Previous work on smoking expectancies also has examined desirability ratings for a particular smoking occurrence. However, desirability ratings provide no predictive power over and above likelihood ratings alone (Brandon & Baker, 1991). For this reason, research studies have principally been focused on likelihood ratings.

Procedure

Interested participants responding to community-based advertisements for a smoking study were scheduled for an individual appointment by a trained research assistant. At the appointment, participants first provided informed written consent. Then, participants were administered the ADIS-IV by a trained clinical psychology graduate-level interviewer in a private office space. If eligible after the interview, participants completed the CO analysis and then a self-report assessment battery tapping smoking and affect-relevant factors. Upon completion of the investigation, all participants were debriefed about the intent of the study and compensated \$30 for their efforts.

RESULTS

Table I provides the zero-order correlational matrix and descriptive data for all variables that were evaluated. Consistent with prediction, AS physical concerns and mental incapacitation concerns were significantly related to smoking expectancies for Negative Reinforcement, Negative Consequences, but not Positive Reinforcement (see Table I). In contrast to expectation, AS-social concerns were not related to any of the smoking expectancy indices (see Table I). As in past work (Brown et al., 2001), none of the AS facets were significantly associated with nicotine dependence or average number of cigarettes smoked per day.

Hierarchical multiple regression analyses were employed to test the study hypotheses (Cohen & Cohen, 1983). Separate models were constructed for outcome expectancies for negative reinforcement and Negative Consequences subscales of the SCQ. Nicotine dependence (FTND), cigarettes per day, negative affectivity, and gender (coded dichotomously) were entered as a set at level one in the model for all equations to test the incremental (or relative) validity of AS above and beyond these factors (Sechrest, 1963). At the second level in the model, the main effects of each of the AS subdimensions were entered into the equation. This analytic approach allows an evaluation of which AS facet is most strongly associated with theoretically relevant outcome variables; that is, provides a test of AS effects after controlling for the variance of the other theoretically relevant factors, and in doing so, constitutes a particularly conservative test of the model.

In terms of expectations for negative affect reduction smoking expectancies, the predictor set (i.e., FTND, average cigarettes smoked per day, PANAS-NA, and gender) at the first level in the model accounted for a significant amount of variance ($R^2 = .18, p < .01$). Negative affectivity ($\beta = .30, sr^2 = .12$) was significantly associated with greater negative affect reduction expectancy scores; all other variables at the first step in the model failed to meet traditional levels of statistical significance. After controlling for the variance associated with nicotine dependence, amount smoked per day, negative affectivity, and gender, results indicated that AS physical concerns ($\beta = .21, sr^2 = .04, p < .05$) and mental incapacitation concerns ($\beta = .20, sr^2 = .04, p < .05$) were each significantly associated with a greater level of expectation that smoking would reduce negative affect (total level two predictor set $\Delta R^2 = .07$). No significant variance was accounted for by AS-social concerns.

Table 1. Intercorrelations Among Anxiety Sensitivity Subdimensions, Smoking Outcome Expectancies, and Smoking Variables

Variable	1	2	3	4	5	6	7	8	9	10	M	SD
1. Anxiety sensitivity (physical)	—	.51**	.45**	.42**	.06	-.05	-.15	.31**	.32**	.14	6.3	4.8
2. Anxiety sensitivity (mental incapacitation)	—	—	.29**	.53**	-.13	-.07	-.21*	.30**	.30**	.18	1.4	1.8
3. Anxiety sensitivity (social)	—	—	—	.28**	-.06	-.09	-.09	.01	.11	.03	5.2	2.2
4. Negative affectivity (PANAS-N)	—	—	—	—	-.25*	-.19	-.04	.27**	.27**	.28**	16.4	5.8
5. Nicotine dependence (FTND)	—	—	—	—	—	.64**	-.26**	.20	-.11	.12	2.6	1.9
6. Cigarettes per day	—	—	—	—	—	—	-.24**	.23*	-.16	.12	11.7	6.1
7. Gender	—	—	—	—	—	—	—	-.03	.00	-.07	—	—
8. SCO-negative reinforcement	—	—	—	—	—	—	—	—	.39**	.71**	5.1	1.8
9. SCO-negative consequences	—	—	—	—	—	—	—	—	—	.49**	5.2	1.6
10. SCO-positive reinforcement	—	—	—	—	—	—	—	—	—	—	5.5	1.6

Note. N = 90. ASI, Anxiety Sensitivity Index (Reiss et al., 1986); PANAS, Positive Affect Negative Affect Scale (Watson et al., 1988); FTND, Fagerstrom Test for Nicotine Dependence (Heatherton et al., 1991); SCO, Smoking Consequences Questionnaire (Brandon & Baker, 1991).
*p < .05. **p < .01.

In regard to expectancies for smoking-related negative consequences, the predictor set at the first level in the model (i.e., FTND, average cigarettes smoked per day, PANAS-NA, and gender) accounted for 9% of variance ($p = .1$). As hypothesized, after controlling for the (nonsignificant) variance associated with nicotine dependence, cigarettes per day, negative affectivity, and gender, AS physical concerns ($\beta = .21, sr^2 = .04, p < .05$) and mental incapacitation concerns ($\beta = .18, sr^2 = .03, p < .05$) were each significantly associated with a greater level of expectation that smoking would reduce negative affect (total level two predictor set $\Delta R^2 = .07$). No significant variance was accounted for by AS-social concerns.

DISCUSSION

Although panic-related vulnerability factors co-occur at high rates with cigarette smoking (Zvolensky, Schmidt et al., 2003), little scientific attention has been applied to better understanding the nature of smoking processes among panic-relevant high risk groups. The present investigation was therefore designed to evaluate the association between the well-established panic risk factor of AS and smoking outcome expectancies among regular smokers.

Consistent with prediction, AS physical concerns and mental incapacitation concerns were significantly associated with smoking outcome expectancies for negative affect reduction and negative consequences, but were not associated with smoking expectancies for sensory satisfaction/positive reinforcement. There was no association between AS-social concerns and any of the specific smoking expectancy processes. These results are generally in accord with previous work evaluating the total score on 16-item ASI and outcome expectancies among depressed smokers (Brown et al., 2001) and explicate the subdimensions responsible for such global effects. It also is noteworthy that, again similar to past work (Brown et al., 2001), AS was not associated with nicotine dependence or number of cigarettes consumed per day. These results suggest that AS may be associated with smoking behavior (and problems in quitting) by virtue of particular cognitive processes (e.g., expectancies about smoking), rather than maintaining some sort of direct relation with nicotine dependence or cigarettes consumed per day. That is, AS is associated with a particular type of thinking style in terms of smoking. By further clarifying the nature of the smoking-related cognitive processes with panic risk factors like AS, it may be possible to refine our therapeutic approaches for this high-risk population (i.e., tailored preventative and treatment strategies; see Zvolensky, Lejuez, Kahler, & Brown, 2003).

Partially consistent with the original hypothesis, AS physical concerns and mental incapacitation concerns significantly predicted outcome expectancies for smoking to reduce negative affect. Importantly, these effects were over and above the variance accounted for by theoretically relevant smoking characteristics, negative affectivity, and gender. Such results suggest that regular smokers with higher relative to lower levels of AS physical concerns and mental incapacitation concerns are more apt to expect smoking to relieve negative emotional distress.

This finding is broadly consistent with previous theory and research that has suggested that temperamental (anxiety-related) individual difference factors are associated with affect-related smoking (e.g., neuroticism; Kassel et al., 2003) and extends it to a panic-specific cognitive vulnerability factor. Although we had initially hypothesized that only the physical concerns subfactor, relative to the other subdimensions, would incrementally predict negative affect reduction outcome expectancies (after controlling for other theoretically relevant smoking and affect factors) due to its relevance as a panic-specific vulnerability variable (Zinbarg et al., 2001; Zvolensky, Kotov et al., in press), the data did not support such a strict specificity perspective. Rather, the present results suggest AS-relevant interoceptive concerns, including those focused on bodily and psychological processes, are pertinent to understanding negative affect reduction outcome expectancies. If the present data are independently replicated, they highlight the need to refine theoretical models seeking to understand the role of cognitive-based panic vulnerability factors in the maintenance of smoking behavior by noting the role of fears about both the negative consequences of bodily arousal and catastrophic mental events.

Consistent with the original hypothesis, AS-physical concerns significantly predicted outcome expectancies for smoking-related negative consequences. Yet, in contrast to expectation, the data also indicated that the AS-mental incapacitation concerns subdomain also significantly predicted outcome expectancies for negative consequences. These results suggest that regular smokers with high AS physical concerns and mental incapacitation concerns are more apt to believe smoking produces negative personal consequences (e.g., “smoking is taking years off my life”) and that such effects are not due to a generalized tendency to experience negative affect, theoretically relevant smoking history characteristics, or gender. Perhaps the association between AS physical concerns and mental incapacitation concerns, rather just the former of these two subdimensions, reflects the fact that on at least one occasion the latter also has shown to be related to increased risk for panic-related problems (Schmidt, Lerew, & Jackson, 1999). Thus, while the physical concerns dimension is particularly and most frequently discussed as being the domain most relevant to panic vulnerability (Zinbarg et al., 2001; Zvolensky, Kotov et al., in press), and hence guided our study conceptualization, both of these facets of the construct may be important to consider in this context of panic-related risk. In all cases, it is noteworthy that other research has found regular smokers with higher expectancies about the negative consequences of smoking more likely to plan on quitting (Copeland et al., 1995) and make more attempts to quit (Rose, Chassin, Presson, & Sherman, 1996). Such findings are important to the present study given that AS is paradoxically associated with greater motivation to quit smoking (i.e., more quit attempts, more self-rated interest in quitting; Zvolensky, Baker et al., in press), but less success in actually succeeding in a quit attempt (Brown et al., 2001). It would therefore be useful if future investigations evaluate whether negative outcome expectancies for smoking mediate the established association between AS and motivation to quit. That is, negative outcome expectancies for smoking may account for the observed association between AS and increased quitting behavior.

A number of limitations of this study should be noted. First, the present study utilized a cross-sectional design. Although such a methodological strategy was useful for providing an initial test of an AS–smoking expectancy relationship, it is necessarily limited because it cannot shed light on processes over time or isolate causal relations between variables. Second, self-report measures were utilized as the primary assessment methodology. The utilization of self-report methods does not fully protect against reporting errors and may be influenced by shared method variance. Thus, future studies could build upon the present work by utilizing alternative assessment instruments such as tasks from cognitive science that tap implicit and automatic types of smoking-based motivational processes. Third, although community-based advertising methods were utilized, the present sample was nonetheless comprised of a relatively homogenous group of young adult smokers who volunteered to participate in the study for monetary reward. In fact, university students responded to the advertisements to a greater extent than other segments of the community and these persons 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. Given heavier smoking is associated with greater risk for anxiety-related problems (Dierker, Avenevoli, Merikangas, Flaherty, & Stolar, 2001), it will be important for researchers to draw from a more diverse group of heavy smokers in future work. Fourth, although the present study was able to verify, consistent with the Zvolensky, Schmidt et al. (2003) model, that high levels of negative affect reduction expectancies in high AS smokers, we were not able to test the relations of this panic-relevant construct and expectancies for smoking to relieve bodily sensations. This limitation is due to the availability of current outcome expectancy measures, which do not currently have a domain that would tap expectancies for relief from bodily distress. Finally, it will be important for future research to simultaneously assess smoking behavior to firmly establish the relevance of AS to smoking processes. Such work will require the utilization of research designs that allow for prospective monitoring of smoking behavior, perhaps aided by the use of electronic diaries.

Taken together, the present investigation represents an important early step in terms of better understanding the smoking–panic association. The results suggest that there may be segments of the regular smoking population who are at relatively greater risk for certain expectancies for tobacco smoking by virtue of individual differences in AS.

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