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Anxiety sensitivity as a moderator of the association between smoking status and anxiety symptoms and bodily vigilance: Replication and extension in a young adult sample

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Abstract

The present investigation evaluated the moderational role of the physical concerns dimension of anxiety sensitivity (fear of anxiety and anxiety-related states) in the relation between smoking status and panic-relevant symptoms in a young adult sample ($n=222$; 123 females; $M_{age}=22.45$ years, SD=8.08). Consistent with prediction, anxiety sensitivity physical concerns moderated the association of smoking status with body vigilance and anxious arousal symptoms, such that greater anxiety sensitivity physical concerns was associated with greater panic symptoms among smokers. The observed effects were evident even after controlling for the variance accounted for by alcohol use problems and gender. Also consistent with prediction, there was no interactive effect apparent for depressive symptoms, providing evidence of explanatory specificity with respect to the anxiety variables examined. Findings are discussed with regard to the role of anxiety sensitivity in the relation between smoking and panic processes.
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1. Introduction

There is an increased scientific recognition that, beyond risk of physical health problems related to smoking, this addictive behavior is associated with increased risk for problems with panic-spectrum

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psychopathology (Zvolensky, Feldner, Leen-Feldner, & McLeish, 2005; Zvolensky, Schmidt, & Stewart, 2003). For example, studies have found that cigarette smoking, especially at higher rates, is concurrently and prospectively related to an increased risk of panic-relevant symptoms, panic attacks, panic disorder, and agoraphobia (Breslau & Klein, 1999; Breslau, Novak, & Kessler, 2004; Isensee, Wittchen, Stein, Höfler, & Lieb, 2003; Johnson et al., 2000; McCabe et al., 2004; McLeish, Zvolensky, & Bucossi, 2007; Morissette, Brown, Kamholz, & Gulliver, 2006; Zvolensky, Forsyth, Fuse, Feldner, & Leen-Feldner, 2002; Zvolensky et al., 2004). Moreover, these smoking effects for panic-spectrum psychopathology have been apparent after controlling for other forms of substance use and demographic factors (Zvolensky & Bernstein, 2005).

Although research has documented that an association exists between smoking and panic-spectrum psychopathology, little scholarly attention has been directed at identifying factors that may qualify such smoking–panic effects; that is, the type of individual difference factors that may moderate the smoking–panic relationship. In general, identification of a moderator is clinically relevant in that it helps explicate the subgroups of smokers most at risk for panic psychopathology (Holmbeck, 2002). One promising factor in this context is anxiety sensitivity (AS), a cognitive characteristic defined as the fear of arousal-related physical and psychological sensations (McNally, 2002; Reiss & McNally, 1985). Specifically, AS encompasses lower-order fears of physical, mental, and publicly observable anxiety experiences that load onto a single higher-order factor (Zinbarg, Barlow, & Brown, 1997; Deacon & Valentiner, 2001).

Anxiety sensitivity is theorized to predispose individuals to the development of panic-spectrum psychopathology and other anxiety disorders (Reiss & McNally, 1985). For example, if a person perceives bodily sensations associated with autonomic arousal as a sign of imminent, personal harm, this "high AS" individual is theorized to experience elevated levels of anxiety and be at increased risk for a panic attack. This perspective has been empirically supported through both prospective (Li & Zinbarg, 2007; Maller & Reiss, 1992; Schmidt, Lerew, & Jackson, 1997, 1999; Schmidt, Zvolensky, & Maner, 2006) and cross-sectional laboratory work (Brown, Smits, Powers, & Telch, 2003; Carter, Suchday, & Gore, 2001; Rapee & Medoro, 1994; Zinbarg, Brown, Barlow, & Rapee, 2001; Zvolensky, Feldner, Eifert, & Stewart, 2001). Integrative models predict that AS may influence the documented smoking–panic association by fostering greater anxiety-driven reactions to smoking-related cues (Zvolensky & Bernstein, 2005; Zvolensky et al., 2003). For example, high AS smokers, compared to low AS smokers, are theoretically more apt to perceive internal withdrawal symptoms, and perhaps other aspects of smoking (e.g., health impairment), as aversive. Therefore, they would presumably have greater opportunity to learn that internal cues are emotionally distressing and personally dangerous.

Consistent with panic–smoking models, the AS global construct has been found to moderate smoking rate in regard to anxiety symptoms, agoraphobic avoidance, and anticipatory anxiety (McLeish et al., 2007; Zvolensky, Kotov, Antipova, & Schmidt, 2003). These data suggest that among daily smokers, higher levels of AS and rates of smoking are associated with the greatest level of panic-relevant distress. More recent work has suggested that such AS effects also may be apparent between smokers and non-smokers. For example, Leen-Feldner et al. (2007) found that high levels of AS among smokers, compared to non-smokers, was related to greater self-reported panic symptoms in response to voluntary hyperventilation among adolescents. Zvolensky, Kotov, Bonn-Miller, Schmidt, and Antipova (in press) extended such work among a representative sample of adults from Russia ($n=390$; 197 females; $M_{age}=43.55$). Here, the AS global factor moderated the association of smoking status in regard to anxious arousal symptoms.

Given the limited empirical knowledge available regarding smoking–panic relations, there is a scientific need to replicate and uniquely extend this AS–smoking model of panic vulnerability in at least two specific ways. First, extant research has focused on the general AS factor, leaving unclear whether or not the observed effects could be accounted for by one of the specific sub-domains. Specifically, recent work suggests that the AS Physical Concerns factor may be the most relevant to panic-relevant learning (Zinbarg et al., 2001; Zvolensky et al., 2001) and has been found to be a more robust predictor of fear responding during laboratory-based panic provocation (McNally, 2002). Second, past work has focused on adolescents (from the United States) and middle-aged adults (from Russia), but has yet to be tested among young adults. Such a test would permit increased generalizability from a developmental perspective in regard to the underlying model as well as provide needed data on an age group wherein smoking–panic effects often first emerge (i.e., young adulthood; Bernstein, Zvolensky, Schmidt, & Sachs-Ericsson, 2007). With evidence of an AS moderational effect for smoking status among young adults, a more concerted effort could be placed to extend this work to targeted intervention strategies for this high risk group.

The objective of the current study was to replicate and uniquely extend extant research on the AS–smoking status interaction among young adults. It was hypothesized that, after accounting for the variance associated with gender and alcohol use problems, the Physical Concerns domain of AS would moderate the relation between smoking status and body vigilance and anxiety symptoms. Specifically, it was expected that high AS smokers, relative to all other variable combinations, would report the highest levels of body vigilance and anxiety symptoms. These hypotheses were driven by panic–smoking conceptual models (Zvolensky & Bernstein, 2005) and empirical evidence among youth (Leen-Feldner et al., 2007) and middle-aged adults in Russia (Zvolensky et al., in press). Additionally, it was expected that no such interactive effect would be evident for depressive symptoms. According to extant smoking–panic theoretical models (Zvolensky & Bernstein, 2005), the interactive AS by smoking status model among young adults should be relatively specific to anxiety-relevant and panic processes rather than being broadly applicable to other negative emotional states, such as depressive symptoms.

2. Method

2.1. Participants

The sample consisted of 222 young adults (123 females; M_{age}=22.45 years, SD=8.08). The racial composition of the studied sample generally reflected that of the local population (State of Vermont Department of Health, 2000): approximately 94% of the sample was Caucasian, 2% African–American, 1% Hispanic, 2% Asian, and 1% other. Approximately 6% of the sample had at least a 4-year college education, 44% had some college education, 47% had a high school degree or the equivalent, and the remaining 3% did not have a high school education.

Approximately half of the sample (46.8%; n=104) were daily smokers, with an average daily smoking rate of 17.59 cigarettes (SD=7.03), whereas the other 53.2% had no smoking history. Participants who were smokers had smoked cigarettes daily for an average of 9 (SD=10.5) years, began cigarette smoking at a mean age of 13.49 (SD=2.93) years, and considered themselves daily smokers by a mean age of 15.86 (SD=2.84) years. The average level of nicotine dependence, as indexed by the Fagerstrom Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) was 3.38 (SD=1.81); this

reflects a low level of overall nicotine dependence (Heatherton et al., 1991). Participants were administered the Structured Clinical Interview for DSM-IV Axis I Disorders—Non-Patient Edition by trained raters (First, Spitzer, Gibbon, & Williams, 1995). The participants reported the following history of (current or past) psychiatric problems: 10.4% had major depressive disorder, 5% had post-traumatic stress disorder, 2.3% had social phobia, 1.8% had generalized anxiety disorder, and 0.9% had obsessive–compulsive disorder. Exclusionary criteria for the current study included a diagnosis of panic disorder (as assessed by the SCID) so as to not confound the examination of the predicted AS–smoking interaction with this group (Zvolensky & Forsyth, 2002); that is, to make sure any observed effect was not simply due to the presence of panic disorder rather than the anxiety sensitivity and smoking status interaction. Any individuals positive for a panic disorder diagnosis were informed that they were not eligible for the current study and no further data were collected.

2.2. Measures

2.2.1. Structured Clinical Interview for DSM-IV Axis I Disorders—Non-Patient Edition (SCID-NP)

The SCID-NP (First et al., 1995) is a well-established diagnostic interview for psychiatric problems. The interview was administered in order to determine participants' history of psychiatric problems.

2.2.2. Smoking History Questionnaire (SHQ)

Smoking history and pattern were assessed with the SHQ (Brown, Lejuez, Kahler, & Strong, 2002), which includes items pertaining to smoking status, rate, age of onset at initiation, and years of being a daily smoker. The SHQ has been successfully used in previous studies and has been identified as a psychometrically sound descriptive measure of smoking history (Zvolensky et al., 2005).

2.2.3. Alcohol Use Disorders Identification Test (AUDIT)

The AUDIT is a 10-item screening measure developed by the World Health Organization to identify individuals with alcohol problems (Babor, de la Fuente, Saunders, & Grant, 1992). Major areas of problematic drinking that are assessed include: alcohol consumption, drinking behavior (dependence), adverse psychological reactions, and alcohol-related problems. There is a large body of literature indicating the AUDIT has strong and well-established psychometric properties (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). We used the total score on the AUDIT in the present investigation as an index of alcohol use problems.

2.2.4. Anxiety Sensitivity Index (ASI)

The ASI (Reiss, Peterson, Gursky, & McNally, 1986) measures the degree to which participants fear negative consequences stemming from anxiety symptoms. Previous research indicates that the ASI is made up of one higher-order factor (ASI Total Score) and three lower-order factors: Physical, Psychological, and Social Concerns (Zinbarg et al., 1997; Stewart, Taylor, & Baker, 1997; Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004). The ASI shows adequate test–retest reliability (r=.75 for two weeks), 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 (Rapee & Medoro, 1994). Recent findings converge on the observation that the Physical Concerns dimension, specifically, is most relevant to panic attack vulnerability (Zinbarg et al., 2001; Zvolensky et al., 2001). Accordingly, we utilized the AS Physical Concerns dimension in the present study as a primary predictor variable on an a priori basis.

2.2.5. Body Vigilance Scale (BVS)

The BVS was employed to assess attentional focus on somatic symptoms (Schmidt, Lerew, & Trakowski, 1997). The BVS is a 4-item instrument in which respondents indicate on an 11-point Likert-type scale (0=*none* to 10=*extreme*) the degree to which they agree with a particular statement regarding attentional focus on body sensations and related processes. Specifically, three of the items measure attentional focus, perceived sensitivity to changes in body sensations, and the average duration of time spent attending to body sensations. A fourth item involves having participants rate their attention to 15 body sensations, as defined by the DSM-IV physical symptoms for panic attacks. Research suggests that the BVS has adequate internal consistency (alpha=.75; Schmidt, Lerew, & Trakowski, 1997).

2.2.6. Mood and Anxiety Symptom Questionnaire (MASQ)

The MASQ is a measure of affective symptoms with well-established psychometric properties (Watson et al., 1995). Specifically, this self-report instrument measures mood dimensions according to the tripartite model. 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") and reverse-keyed items measuring positive affect. Participants indicate how much they have experienced each symptom from 1 (not at all) to 5 (extremely) during the past week. As in a past work (Zvolensky et al., in press), only the MASQ-AA and MASQ-AD subscales were used in the present investigation, as they provide empirically sound and specific composites for "pure" anxiety and "pure" depression symptoms, respectively (Watson et al., 1995).

2.3. Procedure

Participants responding to community-based advertisements for a research study focused on emotion were scheduled for an individual appointment by a trained research assistant. After providing informed, written consent, participants were administered the structured clinical interview by a trained research assistant or doctoral level graduate student and were then asked to complete a self-report battery to assess smoking and affect-related variables. Upon completion of the study, participants were debriefed regarding the aims of the study and compensated $20 for their efforts.

2.4. Analytic approach

The main and interactive effects of smoking status and AS Physical Concerns for the primary dependent variables were evaluated using a hierarchical multiple regression procedure (Cohen & Cohen, 1983). Separate models were constructed for predicting body vigilance, anxiety symptoms, and depressive symptoms. Gender and alcohol use problems were simultaneously entered as covariates at step one in the model to control for theoretically relevant factors and replicate previous findings. At the second step in the model, the main effects for smoking status (smoker/non-smoker) and AS Physical Concerns (mean-centered) were simultaneously entered into the model in order to estimate the amount of variance accounted for by these variables individually. At the third step, the interaction term between smoking status and AS Physical Concerns was entered into the model (Baron & Kenny, 1986). Please note that the interactive effects for the other AS subscales (mental incapacitation and social concerns) also were tested in exploratory, post-hoc analyses in regard to the

Table 1
Descriptive data and intercorrelations among predictor and criterion variables

	1	2	3	4	5	6	7	*M*	SD
1. Gender	–	−.07	.16*	−.16*	.13*	.11	.06	–	–
2. Alcohol	–	–	−.01	.11	−.09	.12	−.07	12.6	7.13
3. AS-PC	–	–	–	.26**	.44**	.61**	.46**	8.58	6.41
4. Smoking status	–	–	–	–	.06	.29**	.27**	–	–
5. BVS	–	–	–	–	–	.42**	.18**	14.8	7.90
6. Anxiety symptoms	–	–	–	–	–	–	.33**	25.1	8.03
7. Depressive symptoms	–	–	–	–	–	–	–	54.8	13.9

Note. A single asterisk indicates correlation is significant at .05 level; double asterisk indicates correlation is significant at .01 level; Gender: 1 = male, 2 = female; Alcohol: Alcohol Use Disorders Identification Test (Babor et al., 1992); AS-PC: Anxiety Sensitivity Index—Physical Concerns subscale (Reiss et al., 1986); Smoking status: 0 = non-smoker, 1 = smoker; BVS: Body Vigilance Scale (Schmidt, Lerew, & Trakowski, 1997); Anxiety symptoms: Mood and Anxiety Symptom Questionnaire—Anxious Arousal subscale (Watson et al., 1995); Depressive symptoms: Mood and Anxiety Symptom Questionnaire—Anhedonic Depression subscale (Watson et al., 1995).

outcome variables; there were no significant interactive effects for such tests and therefore they were not included in the present report.

3. Results

3.1. Zero-order associations among the predictor variable and criterion variables

A series of conceptually relevant zero-order Pearson correlations were computed to assess the associations among the predictor and criterion variables (please see Table 1). Smoking status was significantly associated with AS Physical Concerns ($r=.26$, $p<.01$), anxiety symptoms ($r=.29$, $p<.01$), and depressive symptoms ($r=.27$, $p<.01$), but not body vigilance. AS Physical Concerns was significantly associated with all of the criterion variables (range: .44 to .61).

3.2. Regression equations

Results of the three regression analyses are presented in Table 2. For body vigilance, the first step accounted for 2.5% of the variance. Alcohol use problems was not a significant predictor at step one; however, there was a non-significant trend for gender ($t=1.91$, $\beta=.13$, $p=.058$). Step two of the model predicted 18.2% of unique variance. There was a significant main effect for AS Physical Concerns ($t=6.89$, $\beta=.44$, $p<.01$), but not for smoking status ($t=-.59$, $\beta=-.04$, $p=.56$). As hypothesized, the interaction between AS Physical Concerns and smoking status significantly predicted body vigilance above and beyond steps 1 and 2 in the model ($t=2.26$, $\beta=.23$, $p<.05$); the interaction accounted for 1.8% of unique variance.[1,2]

[1] Exploratory, post-hoc analyses also were performed adding the number of psychiatric diagnoses as a covariate at step one. There was a significant interaction for anxious arousal and a non-significant trend ($p = .06$) for body vigilance. The interaction was non-significant for depressive symptoms. Number of psychiatric diagnoses was a significant predictor at step 1 for all three analyses. Thus, these findings are conceptually similar to those found without psychiatric diagnoses as a covariate.

[2] Follow-up analyses were completed with alcohol use (cf. problems) being as a covariate. The same interactive effect was apparent for such analyses. These results can be obtained from Dr. McLeish upon request.

Table 2
Smoking status by anxiety sensitivity physical concerns predicting body vigilance, anxiety symptoms, depressive symptoms, and negative affect

	ΔR^2	t (each predictor)	β	sr^2	p
Criterion variable: body vigilance					
Step 1	.02				ns
Gender		1.91	.13	.02	.06
Alcohol use		−1.26	−.08	.01	ns
Step 2	.18				<.01
Smoking status		−.59	−.04	.00	ns
AS Physical Concerns		6.89	.44	.18	<.01
Step 3	.02				<.05
Smoking status × AS Physical Concerns		2.26	.23	.02	<.05
Criterion variable: anxiety symptoms					
Step 1	.03				<.05
Gender		1.82	.12	.01	ns
Alcohol use		1.96	.13	.02	ns
Step 2	.38				<.01
Smoking status		2.47	.14	.03	<.05
AS Physical Concerns		10.16	.57	.32	<.01
Step 3	.02				<.01
Smoking status × AS Physical Concerns		3.04	.27	.04	<.01
Criterion variable: depressive symptoms					
Step 1	.01				ns
Gender		.77	.05	.00	ns
Alcohol use		−.92	−.06	.00	ns
Step 2	.24				<.01
Smoking status		2.82	.18	.03	<.01
AS Physical Concerns		6.53	.41	.16	<.01
Step 3	.01				ns
Smoking status × AS Physical Concerns		1.33	.13	.01	ns

Note. β = standardized beta weight; sr^2 = squared partial correlation. Gender: coded as 1 = male; Alcohol use: Alcohol Use Disorders Identification Test (Babor et al., 1992); AS-PC: Anxiety Sensitivity Index—Physical Concerns subscale (Reiss et al., 1986); Smoking status: 0 = non-smoker, 1 = smoker; Body vigilance: Body Vigilance Scale (Schmidt, Lerew, & Trakowski, 1997); Anxiety symptoms: Mood and Anxiety Symptom Questionnaire—Anxious Arousal subscale (Watson et al., 1995); Depressive Symptoms: Mood and Anxiety Symptom Questionnaire—Anhedonic Depression subscale (Watson et al., 1995).

In regard to anxiety symptoms, the first step accounted for 3% of the variance. Gender was not a significant predictor at step one; however, there was a non-significant trend for alcohol use problems predicting anxiety symptoms (t=1.96, β=.13, p=.052). Step two accounted for 37.6% of unique variance, with significant main effects for both AS Physical Concerns (t=10.16, β=.57, p<.01) and smoking status (t=2.47, β=.14, p<.05). As predicted, the interaction between AS Physical Concerns and smoking status significantly predicted anxiety symptoms above and beyond steps 1 and 2 (t=3.04, β=.27, p<.01) in the model; the interaction accounted for 2.5% of unique variance.

In regard to depressive symptoms, step one of the model accounted for 0.7% of unique variance; alcohol use problems and gender were not significant predictors at step one. Step two accounted for

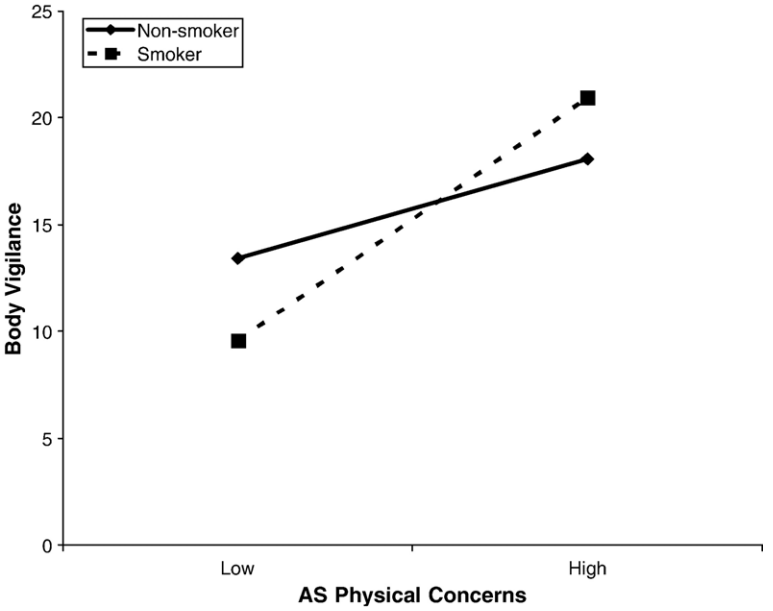

Fig. 1. Body vigilance as a function of AS Physical Concerns and smoking status among non-smokers one standard deviation above and/or below the total sample mean for AS and among smokers one standard deviation above and/or below the total sample mean for AS.

23.6% of unique variance, with significant main effects for both AS Physical Concerns (t=6.53, β=.41, p<.01) and smoking status (t=2.82, β=.18, p<.01). As hypothesized, the interaction between AS Physical Concerns and smoking status did not significantly predict depressive symptoms, suggesting these predictor variables are relatively specific to anxiety-related processes.

3.3. Graphical representation of the statistically significant interactions

Significant interactions were examined in regard to the hypothesized moderation graphically (Cohen & Cohen, 1983) to determine direction and significance by inserting specific values for each predictor variable into the regression equations associated with the described analysis. As can be seen in Figs. 1 and 2, the form of the interactions generally supported our hypotheses. Specifically, having a positive smoking status combined with higher levels of AS Physical Concerns (n=34; 72% of high AS Physical Concerns group) was associated with greater body vigilance (Fig. 1) and anxiety symptoms (Fig. 2), compared to being high on only one or neither of these factors.

4. Discussion

The present study sought to replicate and uniquely extend past work documenting an interactive relationship between AS and smoking status in regard to the physical concerns dimension of AS in a young adult sample from the U.S. Consistent with prediction, there was a significant interactive effect between AS Physical Concerns and smoking status in regard to both body vigilance and anxiety

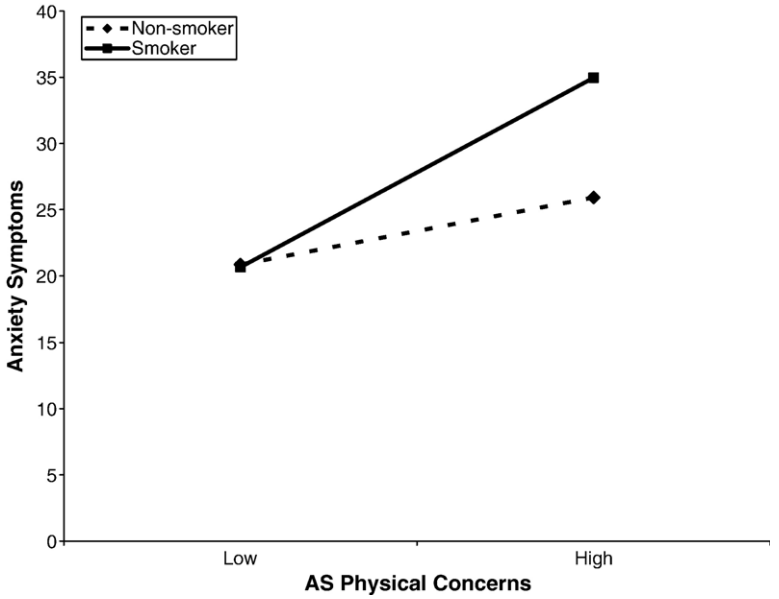

Fig. 2. Anxiety symptoms as a function of AS Physical Concerns and smoking status among non-smokers one standard deviation above and/or below the total sample mean for AS and among smokers one standard deviation above and/or below the total sample mean for AS.

symptoms. Moreover, these effects were apparent even after controlling for the variance accounted for by gender, alcohol use problems, and the respective main effects. Inspection of the form of these interactions indicated that high AS Physical Concerns smokers reported the highest levels of body vigilance and anxiety symptoms (see Figs. 1 and 2). Also as expected, there was no interactive effect apparent for depressive symptoms, providing evidence of explanatory specificity with respect to the studied anxiety variables. Thus, the interactive effect for the Physical Concerns factor of AS and smoking status provides evidence for anxiety, but not depressive vulnerability. These results replicate previous work in adolescent and older adult samples (Leen-Feldner et al., 2007; Zvolensky et al., in press). Notably, the Physical Concerns domain of AS accounted for similar amounts of variability in predicting panic-relevant symptoms as the global AS score in these earlier studies (1.8%–2.5% of unique variance in the current study vs. 1%–3% of unique variance in previous studies).

A primary implication of the present findings is that smokers reporting high levels of AS Physical Concerns may be at the greatest risk for experiencing panic-related anxiety symptoms and bodily attention (Zvolensky & Bernstein, 2005). The identification of such moderating variables is important, as it helps to identify certain subpopulations at greatest risk for panic problems that can be targeted for specialized prevention and intervention efforts (Zvolensky, Schmidt, Bernstein, & Keough, 2006). For example, rather than focusing on a single risk factor, it may be more beneficial to implement prevention programs that focus on high risk subgroups of a specific population, such as smokers with high AS Physical Concerns. Such a strategy could potentially provide a more efficacious and cost-efficient method of implementing such programs. Moreover, these results indicate this high risk subgroup of smokers will likely require targeted smoking cessation programs that address fears of physiological arousal in the context of smoking cessation (e.g., Zvolensky, Lejuez, Kahler, & Brown, 2003).

By using a prospective methodological design, future work could strengthen the findings from the present investigation and others (Leen-Feldner et al., 2007; Zvolensky et al., in press). This type of approach would corroborate the observed concurrent associations across time. Future study also would benefit from exploration of other 'affect amplifying factors' such as the role of perceived health in these associations. Indeed, at least two investigations have found that perceived health may similarly interact with smoking to predict anxiety symptoms (Leen-Feldner et al., in press; McLeish, Zvolensky, Bonn-Miller, & Bernstein, 2006). Future study also would benefit by exploring the mediating processes involved in the smoking–AS relation to panic vulnerability. For example, additional research could usefully explore whether nicotine withdrawal or medical problems (e.g., respiratory illness or disease) mediate the association between high AS Physical Concerns daily smokers and panic psychopathology. This type of work will, as a "system", begin to lay the groundwork for even more advanced tests that attempt to explicate the direction of such processes and incorporate multi-variable modeling of effects.

Interpretive caveats to the present study warrant consideration. First, self-report methods were utilized to index the variables of interest, thus there is the possibility of shared method variance contributing to the study results. Future studies could therefore usefully incorporate a multi-method assessment approach. Second, due to the well-documented link between smoking and alcohol use problems and alcohol panic psychopathology, we covaried for alcohol use problems in the current study. However, empirical research indicates that smoking is correlated with other types of drug/alcohol use and problems (Amos, Wiltshire, Bostock, Haw, & McNeill, 2004) and individuals with panic-related problems may use multiple types of psychoactive substances (Zvolensky, Bernstein, Marshall, & Feldner, 2006). Thus, a key issue to address in future research is whether and how other types of substances (e.g., marijuana) affect the AS–panic association, and how polysubstance use relates to panic vulnerability.

Third, 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, in part, related to a self-selection bias related to this segment of the population. Future work would benefit from replicating this work among a more diverse group of heavier smokers (i.e., those with higher nicotine dependence). Fourth, information on medical problems was not collected for the current sample. It will be important for future studies to covary for medical problems to insure that the observed effects are not attributable to physical problems. Lastly, although the sample was representative of the ethnic composition of the state of Vermont, it was comprised of predominately Caucasian young adults. To improve generalizability of the observed effects, future research could sample from locations with more diverse demographic characteristics.

Overall, the present data provide further empirical evidence that young adults are at relatively greater risk for anxiety symptoms and bodily vigilance as a function of individual differences in AS Physical Concerns and smoking status. The identification of such moderating relations is theoretically important and clinically relevant, as it ultimately helps to refine understanding of complex associations between cigarette smoking and panic psychopathology thereby informing prevention and intervention efforts aimed at these problems.

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