Research Article

PERCEIVED HEALTH MODERATES THE ASSOCIATION BETWEEN SMOKING RATE AND PANIC VULNERABILITY VARIABLES AMONG DAILY SMOKERS

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Our aim in this investigation was to evaluate the moderating role of perceived health in the relation between smoking rate and panic variables in a community-based sample of 220 daily smokers (98 females; $M_{age} = 23.76$ years, $SD = 8.76$). As hypothesized, the interaction between smoking and perceived health incrementally predicted anxiety sensitivity (fear of anxiety) and anxious arousal symptoms, but not depressive symptoms. Individuals who had higher smoking rates and lower perceived health reported higher levels of anxiety sensitivity and anxious arousal, but not depressive symptoms. The primary implication of these findings is that there may be segments of the cigarette smoking population who are at relatively greater risk for anxiety symptoms and fear of bodily sensations by virtue of individual differences in perceived health. The identification of such moderating effects is clinically important, because it helps to refine our understanding of complex associations between drug behavior and panic vulnerability. Depression and Anxiety 23:257–265, 2006. *Published 2006 Wiley-Liss, Inc.*†

Key words: *smoking; panic; perceived health; comorbidity; anxiety*

INTRODUCTION

Smoking remains one of the leading preventable causes of death and disability in the United States, accounting for 440,000, or one in five, deaths each year [Centers for Disease Control and Prevention (CDC), 2004]. Although the negative physical consequences of smoking are well documented, less attention, comparatively, has been paid to its association with mental health problems. Such neglect is unfortunate, because smoking may be related to certain types of psychological disorders. For example, past research has documented relations between smoking and schizophrenia, as well as depressive disorders [Ginsberg et al., 1995; Kinnunen et al., 1996]. More recent studies also have found linkages between smoking and anxiety psychopathology [for a review, see Zvolensky et al., 2005b].

Available empirical work on smoking and anxiety has led to a number of important findings. First, smoking has been found to increase the future risk of developing panic attacks, panic disorder, agoraphobia, and generalized anxiety disorder, but not social anxiety disorder or obsessive–compulsive disorder [Breslau and Klein, 1999; Isensee et al., 2003; Johnson et al., 2000]. Second, heavier amounts of smoking are associated with more severe anxiety symptoms among persons with a principal diagnosis of an anxiety disorder who are seeking treatment [McCabe et al., 2004], as well as those who are not seeking treatment [i.e., recruited through the community; Zvolensky et al., 2004a]. Third, rates of smoking are generally higher among

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individuals with anxiety disorders compared to those with no mental illness [Amering et al., 1999; Beckham et al., 1997]. Finally, anxiety vulnerability factors are related to increased risk of smoking problems, including more severe nicotine withdrawal symptoms [Zvolensky et al., 2004b, 2005a], shorter durations of time to relapse during quit attempts [Brown et al., 2001], and the tendency to smoke principally for reducing or avoiding negative affective states [Novak et al., 2003; Zvolensky et al., 2005d]. Collectively, these data suggest that clinically significant bidirectional associations between smoking and anxiety factors highlight the need to explicate these relations.

Although important progress has been made in better understanding smoking and anxiety vulnerability processes, notably, the vast majority of work has focused on documenting *whether* a relation exists between smoking and certain anxiety problems. The strongest and most consistent evidence of a smoking–anxiety association has been for panic-spectrum problems [Zvolensky and Bernstein, 2005]. It is important to build from past work and identify individual difference factors that may moderate the associations between smoking and panic vulnerability. In so doing, the underlying mechanisms of the documented smoking–panic associations may be better understood. There has been an increased level of theoretical and empirical interest in perceived health as a variable that may link certain health-related behaviors (e.g., smoking) to emotional problems (e.g., panic). Indeed, empirical research has documented that "perceived health," defined as beliefs about one's health status/quality [Mossey and Shapiro, 1982], is an important cognitive factor in physical and psychological functioning. For instance, health perceptions have been found to relate to mortality [Mossey and Shapiro, 1982], disability [Schmitz et al., 2004; Taylor and Fox, 2005], and health care–seeking behavior [Boyd, 1986] even after controlling for actual physical health status [Idler and Angel, 1990; Idler and Kasl, 1991]. Other work has found that poor health perceptions are associated with greater pretreatment anxiety symptomotology (panic attacks, anxiety symptoms, and panic-related avoidance) and poorer posttreatment functioning among individuals with panic disorder receiving cognitive-behavioral therapy [Schmidt and Telch, 1997; Schmidt et al., 1996, 2003]. Additional investigations report that poor health perceptions offer unique explanatory value, relative to fear of anxiety (anxiety sensitivity), in predicting panic-related vulnerability processes such as bodily oriented catastrophic thinking and heart-focused anxiety [Yartz et al., 2005].

It is important to extend work on perceived health to the study of smoking-related panic vulnerability by evaluating whether this variable may moderate the effect of smoking on anxiety symptoms and cognitive processes. Theoretically, it is noteworthy that contemporary models of panic disorder and anxiety focused on health functioning suggest that poor perceived health is a risk factor for anxiety-based emotional reactivity to bodily sensations, as well as fear of the negative consequences of anxiety sensations [Eifert and Zvolensky, 2004; Salkovskis and Clark, 1993]. Such theory is important to smoking, specifically, in that this addictive behavior often promotes interoceptive sensations in a number of ways, including nicotine-based withdrawal symptoms, cardiopulmonary impairment, and respiratory perturbations; moreover, these outcomes increase as the rate of smoking rises [CDC, 2004]. It would be theerefore be expected that perceived health may serve to exacerbate fear of, and anxious emotional reactivity to, interoceptive cues secondary to smoking. Specifically, among persons with low compared to high levels of perceived health, interoceptive sensations may likely be subjectively experienced as more anxiety-provoking and personally threatening. A daily smoker with low perceived health would therefore presumably be exposed to more frequent and intense aversive interoceptive learning trials. In this manner, smoking-related interoceptive cues such as somatic arousal secondary to nicotine withdrawal or other aversively perceived interoceptive experiences (e.g., health impairment) are more likely to become fear-relevant stimuli and thereby increase vulnerability for anxiety and panic-spectrum problems [Zvolensky and Bernstein, 2005].

Theoretical and empirical evidence together indicate that smoking rate is related to panic-spectrum problems. Although existing research is limited, it suggests that perceived health may be an individual difference variable relevant to both smoking [Gregor et al., in press] and panic problems [Yartz et al., 2005], and is therefore a promising cognitive risk factor for elucidating smoking-related panic vulnerability. Thus, our aim in this study was to evaluate whether perceived health moderates the association between smoking rate and panic variables among a community-based sample of daily smokers. Specifically, we hypothesized that smoking rate would be positively associated with higher levels of anxiety symptoms and more fear of the negative consequences of such sensations (anxiety sensitivity) among individuals low in perceived health (poor health perceptions), whereas smoking rate would demonstrate a relatively weaker association with these anxiety criteria among individuals high in perceived health (positive health perceptions). As a test of explanatory specificity, no such moderating effect for perceived health was expected for depressive symptoms (i.e., effect specific to anxious arousal symptoms and anxiety sensitivity, but not depressive symptoms).

METHODS

PARTICIPANTS

The sample comprised 220 daily smokers (98 females; $M_{age} = 23.76$ years, $SD = 8.76$) recruited

through the general community using newspaper advertisements and postings on community boards. The racial composition of the studied sample reflected that of the local population [State of Vermont Department of Health, 2000]: approximately 94% Caucasian, 1% African American, 2% Hispanic, 1.5% Asian American, and 1.5% other. Approximately 8% of the sample had at least a 4-year college education, 80% had some college education, 9% had a high school degree or the equivalent, and the remaining 3% did not have a high school education.

Results from the Smoking History Questionnaire indicate that participants smoked on average 14.6 cigarettes per day ($SD = 9.16$), had smoked cigarettes regularly for 7.61 ($SD = 8.49$) years, began cigarette smoking at a mean age of 13.53 ($SD = 2.71$) years, and considered themselves regular smokers by a mean age of 16.02 ($SD = 2.44$) years. When smoking tobacco was heaviest, participants averaged 20.73 ($SD = 10.18$) cigarettes per day. Of the participants, 56.4% ($n = 124$) were regular alcohol users, drinking an average of 3.24 ($SD = 1.09$) alcoholic beverages approximately 2 to 3 times per week. The participants reported the following lifetime history of medical problems as part of a medical screening questionnaire: 1.36% were diagnosed with diabetes or other sugar problems, 11.36% had experienced some type of head injury, 6.82% had been diagnosed with heart problems, 2.27% had been diagnosed with hypertension, 0.45% had been diagnosed with a kidney disorder, 1.82% had been diagnosed with liver problems, 29.1% had allergies, 9.54% had been diagnosed with asthma, 1.36% had some other form of respiratory disease, and 0.91% had epilepsy.

Participants were administered the Structured Clinical Interview for DSM-IV Axis I Disorders—Non-Patient Edition [SCID-NP; First et al., 1995] and reported the following history of psychiatric problems: 10.9% had major depressive disorder, 8.2% had experienced nonclinical panic attacks, 4.1% had post-traumatic stress disorder, 1.8% had generalized anxiety disorder, and 0.91% had social phobia. Participants were excluded from the study if they displayed limited mental competency or the inability to give informed, written consent. Participants were not excluded for medical or psychiatric illness other than panic disorder. Participants with panic disorder were excluded from the study, because our aim in the study was to explore vulnerability processes for panic disorder; therefore, if panic disorder were not exclusionary criterion, it would not be possible to ascertain whether the perceived health by smoking rate effects was simply attributable to this condition rather than being a potential risk-conferring process.

MEASURES

Smoking History Questionnaire (SHQ). Smoking history and pattern were assessed with the SHQ, a measure that includes items pertaining to smoking rate, age of onset of initiation, years of being a regular smoker, and so forth. The SHQ has been used successfully in previous studies as a measure of smoking history [Brown et al., 2002; Zvolensky et al., 2004a].

Short-Form General Health Survey (GHS). In the short-form GHS, a 20-item questionnaire, respondents indicate on a Likert-type scale perceptions of their health status, and functional limitations attributed to that health status [Stewart et al., 1988]. It measures two broad dimensions of perceived health (physical and mental health status), as well as three specific subscales indexing functional impairment (functioning across physical, role, and social domains). Due to the specific relevance of the construct to our hypotheses, only the Perceived Physical Health subscale of the GHS (GHS-PPH) was examined in this study. The GHS-PPH consists of five items (two of which are reverse-scored) that are converted to 100-point scales and averaged to a single score, with low values indicating poor health perceptions and higher scores indicating better perceived health. Sample items from the PPH subscale include "In general, would you say your health is…?", rated on a 5-point Likert scale (1 = *excellent* to 5 = *poor*), as well as "I am somewhat ill" and "I am healthy," rated on a 5-point Likert scale (1 = *definitely true* to 5 = *definitely false*). The GHS has demonstrated adequate reliability and validity [Stewart et al., 1988]. In our investigation, data obtained from the GHS were comparable to those obtained in other young adult community samples [Yartz et al., 2005].

Anxiety Sensitivity Index (ASI). The ASI [Reiss et al., 1986], a 16-item measure, asks respondents to rate on a 5-point Likert scale (0 = *very little* to 4 = *very much*), the degree to which they fear negative consequences stemming from anxiety symptoms. The ASI shows adequate test–retest reliability ($r = .75$ for 2 weeks), criterion validity (individuals with agoraphobia score higher than those with other anxiety disorders and those with no disorder), and is distinct from trait anxiety [Reiss et al., 1986]. 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]. Several prospective studies with adolescents and adults indicate that anxiety sensitivity predicts the future occurrence of panic attacks and worry about the future occurrence of such attacks in the real world [Schmidt et al., 1997; Weems et al., 2002] and in laboratory settings [Zinbarg et al., 2001]. These same prospective studies and other cross-sectional investigations indicate that anxiety sensitivity is relatively specific to panic disorder and does not covary with other phenomena distinct from the syndrome [e.g., depression; Zvolensky et al., 2005c]. In our investigation, we utilized the total ASI score, because it represents the global-order anxiety sensitivity factor and therefore takes into consideration different types of fears, including fears of panic-related somatic,

cognitive, and social cues. The descriptive data indicated that the scale scores were similar to those obtained in other research among young adults [Peterson and Reiss, 1992].

Mood and Anxiety Symptom Questionnaire (MASQ). The MASQ is a comprehensive measure of affective symptoms [Watson et al., 1995]. This self-report instrument measures mood dimensions important 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. In this study, only the MASQ-AA and MASQ-AD subscales were used, because they provide an empirically sound and specific composite for "pure" anxiety and "pure" depression symptoms, respectively. The data obtained from the MASQ in our study were comparable to data reported in other community, young adult samples [Watson et al., 1995; Zvolensky et al., 2005c].

Alcohol Assessment (AA). The AA is a three-item measure that includes items examining the (1) presence–absence of current alcohol a use and (2) frequency (weekly, monthly, and yearly), and (3) quantity of such use. Frequency and quantity of alcohol consumption were assessed in a manner used in previous research [Stewart et al., 1995]. In regard to frequency, participants reported the number of occasions per week on which they normally consumed alcohol; those who consumed alcohol on less than one occasion weekly estimated monthly or yearly frequency. In regard to quantity, participants indicated the average number of alcoholic beverages (using standardized conversions) they normally consumed per drinking occasion. As recommended, an average alcohol volume index was computed via the product of the frequency by quantity items [Wechsler et al., 1994]. In our investigation, alcohol consumption was a primary predictor variable (covariate), because previous work has shown that heavier rates of drinking are potentially a marker or risk factor for certain anxiety and mood problems [Kushner et al., 2000].

PROCEDURE

Participants responding to community-based advertisements for a smoking study were each scheduled for an individual appointment by a trained research assistant. At this appointment, participants first gave informed, written consent and were administered the SCID-NP. Participants then completed a self-report battery assessing 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.

STATISTICAL ANALYSES

We evaluated the main and interactive effects of smoking rate and perceived health for the primary dependent variables using a hierarchical multiple regression procedure [Cohen and Cohen, 1983]. Separate models were constructed for predicting anxiety sensitivity, anxious arousal, and anhedonic depression. Gender and volume of alcohol consumed were entered as covariates at the first level in the model. At the second level, the main effects for smoking rate and perceived health were simultaneously entered into the model to estimate the amount of variance accounted for by these variables individually. At the third level, the interaction term between smoking rate and perceived health was entered into the model [Baron and Kenny, 1986].

RESULTS

CORRELATIONS FOR THEORETICALLY RELEVANT VARIABLES

Associations among variables are displayed in Table 1. Smoking rate was significantly correlated with anxiety sensitivity ($r = .18$, $P < .01$), anhedonic depression ($r = .18$, $P < .01$), but not anxiety symptoms ($r = .01$, $P = .89$). Perceived health was significantly negatively correlated with anxious arousal ($r = -.45$, $P < .01$), anhedonic depression ($r = -.38$, $P < .01$), and anxiety sensitivity ($r = -.39$, $P < .01$). The correlation between smoking rate and perceived health was minimal ($r = -.09$, $P = .21$).

REGRESSION EQUATIONS

Data for the three regression analyses are presented in Table 2. In terms of anxiety sensitivity, there were no significant predictors at level 1 of the model. Main effects for smoking rate and perceived health were found at level 2 of the model ($t = 2.24$, $\beta = .14$, $P < .05$ and $t = -7.12$, $\beta = -.44$, $P < .01$, respectively). As hypothesized, the interaction between smoking rate and perceived health significantly predicted anxiety sensitivity at level 3 of the model; the interaction accounted for 3.4% of unique variance ($t = -3.11$, $\beta = -.63$. $P < .01$).

In terms of anxious arousal, level 1 accounted for approximately 4.5% of the variance. Gender and alcohol use were both significant predictors ($t = 2.41$, $\beta = .16$, $P < .05$ and $t = 2.06$, $\beta = .14$, $P < .05$, respectively); females reported greater anxiety than males. A main effect for perceived health was found at level 2 of the model ($t = -6.76$, $\beta = -.42$, $P < .01$), but no main effect was observed for smoking rate ($t = .21$, $\beta = .01$, $P = .83$). As hypothesized, the interaction between smoking rate and perceived health significantly predicted level of anxious arousal at level 3 of the model; the interaction accounted for 1.5% of unique variance ($t = -2.0$, $\beta = -.41$, $P < .05$).

TABLE 1. Descriptive data and intercorrelations among predictor and criterion variables

Variable	1	2	3	4	5	6	7	*M*	*SD*
1. Gender	—	.01	−.16*	−.14*	.02	.18**	.01	—	—
2. VAC	—	—	−.20**	−.11	.03	.14*	−.04	7.3	4.83
3. Cig/day	—	—	—	−.09	.18**	.01	.18**	14.63	9.16
4. PGH	—	—	—	—	.39**	.45**	.38**	69.41	17.49
5. ASI	—	—	—	—	—	.58**	.40**	19.55	13.96
6. MASQ-AA	—	—	—	—	—	—	.30**	25.67	7.99
7. MASQ-AD	—	—	—	—	—	—	—	55.21	13.08

*Indicates correlation is significant at .05 level;
**Indicates correlation is significant at .01 level.
Gender: males dummy coded as "1" and females as "2"; VAC, volume of Alcohol Consumed; Cig/day, daily cigarettes; PGH: Perceived General Health [from Short Form Health Survey; Stewart et al., 1988].

TABLE 2. Contribution of the interaction between perceived health and smoking frequency in predicting panic-relevant variables

	ΔR^2	*t* (each predictor)	β	sr^{2b}	*P*
Criterion Variable: Anxiety Sensitivity					
Step 1	.00				ns
Gender[a]		.41	.03	.00	ns
Alcohol consumption		.37	.02	.00	ns
Step 2	.22				<.01
Daily cigarettes		2.24	.14	.02	<.05
Perceived health		−7.12	−.44	.19	<.01
Step 3	.03				<.01
Perceived health × daily cigarettes		−3.11	−.63	.04	<.01
Criterion Variable: Anxious Arousal					
Step 1	.04				<.01
Gender		2.41	.16	.03	<.05
Alcohol consumption		2.07	.14	.02	<.05
Step 2	.17				<.01
Daily cigarettes		0.21	.01	.00	ns
Perceived health		−6.76	−.42	.18	<.01
Step 3	.02				<.01
Perceived health × daily cigarettes		−2.00	−.41	.02	<.01
Criterion Variable: Anhedonic Depression					
Step 1	.00				ns
Gender		.06	.00	.00	ns
Alcohol consumption		−.67	−.05	.00	ns
Step 2	.17				<.01
Daily cigarettes		2.13	.14	.02	<.05
Perceived health		−5.80	−.37	.14	<.01
Step 3	.00				ns
Perceived health × daily cigarettes		−0.33	−.07	.00	ns

Note. β = standardized beta weight; $n = 220$.
[a]Males dummy coded as "1" and females as "2".
[b]sr^2=squared semipartial correlation.

Finally, in terms of anhedonic depression scores, there were no significant predictors at level 1 of the model. Main effects for smoking rate and perceived health were found at level 2 of the model ($t = 2.13$, $\beta = .14$, $P < .05$ and $t = -5.80$, $\beta = -.37$, $P < .01$, respectively). As expected, the interaction between

smoking rate and perceived health did not significantly predict depression scores ($t = -.33$, $\beta = -.07$, $P = .74$).

Interactions were examined, in regard to hypothesized moderation, both graphically [for a review, see Cohen and Cohen, 1983] and analytically [Holmbeck, 2002] to determine direction and significance. Based on recommendations of Cohen and Cohen [1983], the form of significant interactions was examined by inserting specific values for each predictor variable into the regression equations associated with the described analysis. Specific values for each predictor variable (one half of a standard deviation above and below the mean for perceived health and smoking rate) were inserted into the regression equation. The forms of the interactions supported the hypotheses (see Figs. 1 and 2). Among individuals smoking a greater number of cigarettes, poorer perceived health was associated with higher levels of anxiety sensitivity, whereas poor perceived health had a relatively weaker association with anxiety sensitivity across the other variable combinations. A similar finding was evident for anxious arousal. Again, poorer levels of perceived health and higher rates of daily smoking were associated with the greatest elevations in anxious arousal symptoms compared to other variable combinations. Furthermore, based on recommendations of Holmbeck [2002], post hoc probing analyses were conducted on the data to examine moderation. Results indicated that moderation does indeed occur in both significant interactions. In both cases, the relation between daily cigarette use and either of the outcome variables (i.e., anxiety sensitivity or anxious arousal) was moderated when perceived health was low ($t = 2.83$, $\beta = .23$, $P < .01$ and $t = 2.44$, $\beta = .20$, $P < .05$, respectively).

DISCUSSION

Consistent with prediction, there were significant interactions between smoking rate and perceived health in relation to anxiety sensitivity and anxious arousal. These effects were above and beyond the variance accounted for by the theoretically relevant covariates and respective main effects. Inspection of the forms of the significant interactions was supportive of the theorized perceived health by smoking model of panic vulnerability (see Figs. 1 and 2). Specifically, at lower levels of perceived health and at higher rates of smoking, there was an increased risk for anxiety symptoms and fear of the negative consequences of bodily sensations (anxiety sensitivity). These data suggest that daily smokers who have more negative health perceptions and smoke at higher rates show the greatest elevations in prototypical panic-related vulnerability. Confidence in the observed specificity of the perceived health by smoking rate model was strengthened by complementary analyses that showed no such interactive effect between smoking rate and perceived health for depressive symptoms. These findings are in accord with the theoretical perspective that perceived health may moderate smoking rate in regard to panic-related, but not depressive, vulnerability processes. Indeed, our findings indicate that perceived health is an important individual difference variable that moderates the associations between smoking rate and panic-related factors. Based upon our cross-sectional data, future work might usefully evaluate the explanatory utility of the combination of poor perceived health and smoking in terms of risk for developing panic attacks, panic disorder, and

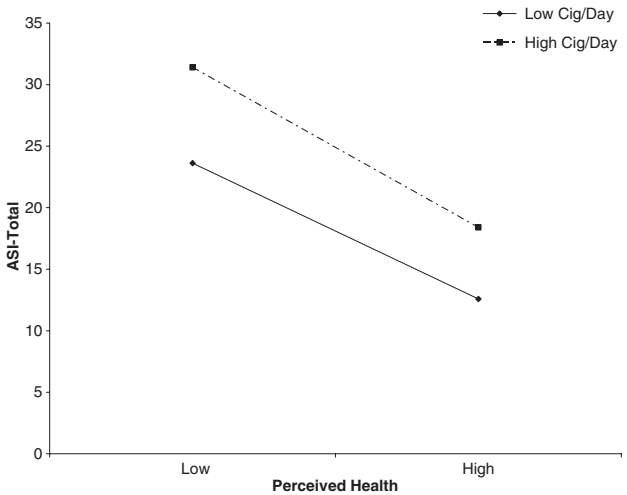

Figure 1. Anxiety sensitivity, as indexed by the ASI total score [Reiss et al., 1986], as a function of perceived health and number of cigarettes smoked per day among participants one-half of a standard deviation above and/or below the mean for each predictor. The data presented are from the interaction between perceived health and daily smoking.

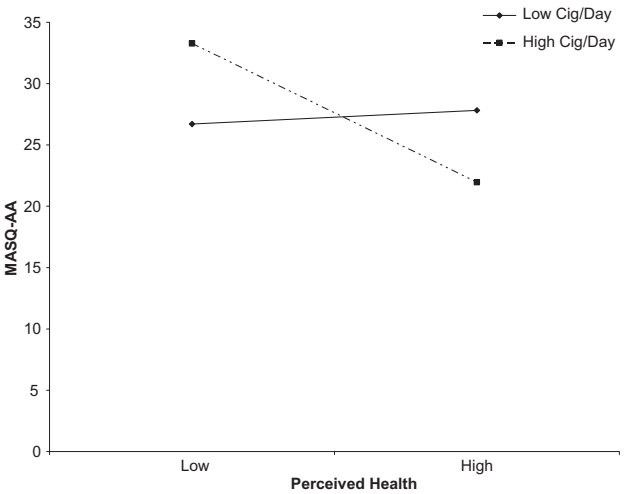

Figure 2. Anxious arousal, as indexed by the MASQ [Watson et al., 1995], as a function of perceived health and number of cigarettes smoked per day among participants one-half of a standard deviation above and/or below the mean for each predictor. The data presented are from the interaction between perceived health and daily smoking.

anxiety focused on bodily sensations using prospective designs.

It also is useful to comment on the zero-order association between perceived health and other theoretically relevant variables. Past work has found that perceived health is distinguishable from other constructs and demonstrates unique associations with emotional problems beyond other risk factors [Schmidt and Telch, 1997]. For example, perceived health demonstrates incremental validity in relation to anxiety sensitivity [Gregor et al., in press; Schmidt et al., 2003; Yartz et al., 2005). Our findings are consistent with previous research in that perceived health shared no variance with smoking rate, indicating that these two variables are unique factors. Additionally, similar to past work, perceived health showed general associations with each of the affect-relevant dependent measures, suggesting that poorer health perceptions are associated with greater emotional vulnerability.

Overall, there was broad-based consistency of the hypothesized perceived health by smoking rate interactions in regard to anxiety sensitivity and anxious arousal, both panic-relevant vulnerability factors. The primary implication of our findings is that there may be segments of the cigarette smoking population who are at relatively greater risk for anxiety symptoms and fear of bodily sensations by virtue of individual differences in perceived health. The identification of such moderating effects is clinically important, because it helps to refine our understanding of complex associations between drug behavior and panic vulnerability. Although generally in accord with theory, the mechanisms by which these effects are achieved cannot be explicated in the present investigation. One important avenue for future research of the mechanisms underlying the smoking–perceived health model of panic-relevant vulnerability may be to evaluate biobehavioral processes using emotion elicitation paradigms. For example, it would be useful to document whether perceived health moderates the relation between smoking rate and panic attack symptoms elicited by biological challenge procedures. This work, aside from removing concern about recall biases or memory distortions, would permit evaluation of both physiological processes and self-report cognitive–emotional data.

Although our study adds to the extant literature on perceived health and panic-relevant variables in a unique manner, a number of interpretive caveats deserve further comment. First, perceived health is characterized by a cognitive process of *perceptions* of health status. It would be useful for future research to evaluate empirically the degree of overlap between perceptions of health and objective–actual health status. In this type of work, objective health status could be operationalized in a number of ways, including performance on physical exercise tests (aerobic and nonaerobic), functional status in completing various physically based tasks (e.g., lifting), and review of physician medical records. This type of work would help explicate the intersections and interplay between perception and objective health status. Nonetheless, past work suggests that perceived health is related to the existence of medical problems, but unique from these problems [Schmidt and Telch, 1997]. Future research might therefore systematically assess for medical problems and evaluate the incremental validity of perceived health relative to these factors in regard to affective vulnerability. For example, future research could test whether the observed interaction for smoking rate by perceived health is apparent after accounting for variance due to diagnosable medical illnesses such as cancer, lung disease, and cardiac problems. To conduct such tests, sampling procedures could be usefully aimed at smoking-oriented medical populations. Second, although we used community-based advertisements in the recruitment of participants for our investigation, it is noteworthy that the sample comprised relatively young adult daily smokers. The sample may have been younger, on average, than would be expected from typical community-based recruitment due to the fact that advertisements for the study were largely posted in areas of the community frequently visited by young adults (e.g., shopping centers, restaurants, bars) and may therefore have attracted younger adult to a greater extent than older adult smokers. Though our data from this sample address an important gap in the existing literature, future studies could build from this work in a number of important ways. For example, research could examine whether smoking rate moderates smoking status (cf. rate) by testing for similar panic-related effects among smokers and nonsmokers. Extending such work beyond smoking also may be a useful way to gauge the specificity of the smoking–perceived health effects relative to other forms of drug use (e.g., alcohol).

Third, although the sample was representative of the ethnic composition of the state of Vermont, it comprised predominately Caucasian young adults. To improve generalizability of the observed effects, future research could sample from locations with more diverse demographic characteristics. Fourth, 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 health- and smoking-related processes. Fifth, although our study was focused on examining moderating processes, future study could explore factors that may mediate the association between perceived health and panic-relevant variables. Here, integrative models suggest that smoking will lead to increased risk of bodily sensations and aversive internal states via a number of routes, including nicotine-based withdrawal

symptoms, health impairment, and physical illness [e.g., lung disease; see Zvolensky and Bernstein, 2005]. Exposure to these types of aversive stimuli may theoretically facilitate learning that internal cues can be personally harmful, dangerous, and anxiety-evoking. In this sense, exploring these factors as possible mediators may be targeted next research steps.

Sixth, although we used community-based advertising methods, our sample nonetheless comprised 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 et al., 1989]. Thus, the results may be, in part, related to a self-selection bias. Finally, we employed established measures of anxiety symptoms and anxiety sensitivity as the primary dependent measures, because these theoretically relevant factors have been used as panic-relevant external criteria in past work [Yartz et al., 2005]. These are nonetheless two prototypical panic-relevant variables, but do not represent all possible candidates. Based upon our results, future work could therefore build on our study by incorporating the use of other panic-relevant dependent measures, including attention to bodily sensations, agoraphobic avoidance, and frequency of unexpected panic attacks. Here, it also may be useful to examine whether the daily smoking and perceived health effects persist over other affect-relevant, individual difference variables such as negative affectivity. This work would refine our theoretical models of the role of general and specific affect-relevant factors, and their interaction with daily smoking in the prediction of panic vulnerability.

Our findings suggest that daily smokers who have both higher smoking rates and lower levels of perceived health report higher levels of anxiety sensitivity and anxious arousal, but not depressive symptoms. The primary implication of our findings is that there may be segments of the cigarette smoking population who are at relatively greater risk for anxiety symptoms and fear of bodily sensations by virtue of individual differences in perceived health. The identification of such moderating effects is clinically important, because it helps to refine our understanding of complex associations between drug behavior and panic vulnerability.

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