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Anxiety sensitivity: Concurrent associations with negative affect smoking motives and abstinence self-confidence among young adult smokers

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Abstract

The present study evaluated the association between the lower-order facets of Anxiety Sensitivity construct (Physical, Mental Incapacitation and Social Concerns) and theoretically relevant cognitive-based smoking processes. Participants were 151 young adult daily smokers (63 females); mean number of cigarettes/day=12.3 [S.D.=5.6]). Both AS Physical and Mental Incapacitation Concerns were significantly associated with greater negative affect reduction smoking motives and lower levels of self-confidence in remaining abstinent from smoking when emotionally distressed. The observed effects were over and above the variance accounted for by nicotine dependence, smoking rate, and gender. Results are discussed in relation to better understanding cognitive-based smoking processes among individuals at heightened risk for panic psychopathology.

Keywords: AS Physical and Mental Incapacitation Concerns Negative affect reduction; Cognitive-based smoking; Panic psychopathology; Abstinent; Self-confidence

Empirical evidence suggests that panic attacks and panic disorder co-occur with smoking at rates that exceed those found among individuals with no mental illness (Amering et al., 1999; Lasser et al., 2000; Pohl, Yeragani, Balon, Lycaki, & McBride, 1992; see Zvolensky, Feldner, Leen-Feldner, & McLeish, in

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press, for a review). Cigarette smoking also is associated with an increased risk for developing panic attacks and panic disorder (Breslau & Klein, 1999; Goodwin & Hamilton, 2002; Johnson et al., 2000; Zvolensky, Kotov, Antipova, & Schmidt, 2003) as well as more severe panic-related problems (McCabe et al., 2004; Zvolensky, Forsyth, Fuse, Feldner, & Leen-Feldner, 2002; Zvolensky, Leen-Feldner et al., 2004; Zvolensky, Schmidt, & McCreary, 2003). Yet, there is little research addressing the role of panic vulnerability factors in terms of the nature of smoking behavior. Thus, it is largely unclear whether panic vulnerability factors are related to theoretically relevant cognitive-based smoking factors.

One of the most well-established risk factors for developing panic attacks and panic disorder is anxiety sensitivity (AS), a dispositional, traitlike cognitive characteristic reflecting the fear of physical, mental, and publicly observable anxiety-related experiences (Reiss & McNally, 1985). Due to the association between AS and panic-related emotional vulnerability, researchers have begun to explore whether this panic-relevant individual difference factor relates to various types of smoking cognitive–affective processes and outcomes. The conceptual basis of this work, specifically, is that factors related to increased risk of affective vulnerability may lead to certain patterns of smoking, particular beliefs about smoking consequences, and perhaps problems in quitting. Prospective work, in fact, indicates elevated levels of AS increase the chance of early smoking lapse during a quit attempt (Brown, Kahler, Zvolensky, Lejuez, & Ramsey, 2001) and the expectation of that smoking helps alleviate negative affect (Zvolensky, Feldner, Leen-Feldner et al., 2004). Additionally, total scores on the 16-item Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) incrementally predict the intensity of affect-related nicotine withdrawal symptoms during past quit attempts beyond a history of panic attacks and other theoretically relevant factors (e.g., nicotine dependence; Zvolensky, Baker et al., 2004). These data, albeit limited, highlight the potentially important role of AS in the maintenance of smoking, relapse to smoking, or both.

It is important to examine the relationship between AS and smoking motives to better understand the role of this panic-relevant cognitive factor in affect-relevant processes involved with smoking. Zvolensky, Schmidt, and Stewart (2003) have theorized that individual differences in AS may be related to a number of theoretically and clinically relevant emotional sensitivity processes associated with smoking. This conceptualization is based, in part, on the large empirical literature that documents persons with elevated AS often are fearful of anxiety-related symptoms and bodily sensations (Taylor, Koch, & McNally, 1992), react with anxiety and fear when confronted with personally relevant interoceptive cues (Barlow, 2002, pp. 139–179), and cope with anxiety-related states by trying to escape or avoid them (Feldner, Zvolensky, & Leen-Feldner, 2004). These AS characteristics may underlie an association with emotional sensitivity processes involved with smoking, including (1) specific types of motivation to smoke and (2) biases to report affective problems when abstaining from smoking (e.g., reporting less confidence in remaining abstinent when emotionally distressed; Otto, Safren, & Pollack, 2004).

From an affect regulation perspective, the degree to which smokers attribute their smoking to negative affect reduction is of central importance (Otto et al., 2004; Stewart, Samoluk, & MacDonald, 1999; Zvolensky, Feldner, Leen-Feldner et al., in press). Indeed, negative affect reduction smoking motives are related to increased smoking levels, greater nicotine dependence, and heightened risk of relapse to smoking (O'Connell & Shiffman, 1988; Pomerleau, Adkins, & Pertschuk, 1978). Although the anxiety-ameliorating effects of smoking have not been fully explicated (see Kalman, 2002, for a review), smokers generally believe smoking will alleviate negative moods (Pomerleau & Pomerleau, 1991). Smokers high relative to those low in AS may be particularly likely to smoke in order to cope with anxiety-related symptoms because they perceive interoceptive stimuli as relatively more aversive and personally threatening (Zvolensky, Schmidt et al., 2003). This perspective is premised on the large

empirical literature that documents smokers attribute smoking, at least in part, to its mood-regulating functions (Kassel, Stroud, & Paronis, 2003).

Consistent with an AS-smoking motivation model, a number of studies have found total scores on the 16-item ASI are associated with negative affect smoking motives among adolescents (Comeau, Stewart, & Loba, 2001) and adults (Novak, Burgess, Clark, Zvolensky, & Brown, 2003; Stewart, Karp, Pihl, & Peterson, 1997). Although promising, these studies are limited in at least three key ways. First, none explicate whether the findings are due to higher levels of smoking or nicotine dependence among high relative to low AS individuals. This is an important interpretative consideration given that smokers most prone to panic problems may smoke more than smokers without panic problems (Johnson et al., 2000; McCabe et al., 2004). If AS is indeed an important panic-specific variable for better understanding affect-relevant smoking motives, it needs to demonstrate (unique) explanatory power relative to already established smoking factors (e.g., nicotine dependence, smoking rate). Second, none of the studies involved the administration of a structured clinical interview to rule out panic problems or other related psychopathology. This limitation obstructs an understanding of the role of AS and smoking motivation processes. Specifically, given AS is elevated among persons with panic attacks and certain types of anxiety disorders (Taylor et al., 1992), any previously observed effect attributed to AS could be due to a history of panic attacks or pre-existing psychopathology (Zvolensky, Schmidt, Antony et al., in press). To address this limitation, researchers need to study AS among smokers with no previous history of panic attacks or psychopathology. Finally, previous studies have not confirmed smoking status using biochemical methods of verification. Thus, this literature would benefit from an investigation that replicated and extended past work by using biochemical assessment strategies for smoking in addition to standard self-report instruments.

Self-efficacy for abstaining from smoking is a second motivational factor potentially related to AS, anxiety-related states, and smoking. The influential model of ""Marlatt and Gordon (1985) of drug use predicts success in refraining from smoking depends, in part, on expectancies about both the ability to endure high-risk situations without smoking and the positive outcomes associated with smoking in such situations. Smokers with ineffective strategies for coping with certain high-risk situations (e.g., negative affect contexts) are theorized to have decreases in self-efficacy for abstaining from smoking. Moreover, such decreases in self-efficacy are believed to promote a desire (urge) to smoke, contributing to smoking and perhaps relapse. Considerable empirical support has been found for expectations about one's ability to refrain from smoking predicting future smoking behavior (Etter, Bergman, Humair, & Pernege, 2000; Haaga & Stewart, 1992; Hughes et al., 1992; Shadel & Mermelstein, 1993), although this research has not been conducted in relation to AS or other panic-related vulnerability factors. Given the established association between AS and panic vulnerability (Schmidt, Lerew, & Jackson, 1997, Schmidt, Lerew, & Jackson, 1999) and the potentially important role of this cognitive factor in negative affect smoking motives (Comeau et al., 2001; Stewart et al., 1997), individual differences in AS would be expected to relate to self efficacy for abstaining from smoking in negative affect contexts. Specifically, smokers high in AS may have low levels of confidence in refraining from smoking when experiencing anxiety-related symptoms because of their (1) increased sensitivity to affect-relevant interoceptive stimuli and (2) tendency to smoke as a way of coping with such distress. To the best of our knowledge, no studies have thus far investigated associations between AS and a sensitivity to affective problems when abstaining from smoking. Gaining a better understanding of the relationship between AS and abstinence self-confidence would facilitate an understanding of cognitive processes involved with smoking among anxiety-relevant high-risk groups.

Together, the overarching purpose of the present investigation was to examine whether AS would be associated with theoretically relevant emotional sensitivity processes involved with smoking, including (1) specific types of motivation to smoke and (2) low levels of confidence in remaining abstinent from smoking when emotionally distressed. Young adults were examined in this investigation because smoking prevalence among this age group has risen in recent years (Presley, Meilman, & Leichliter, 2002; Wechsler, Rigotti, Gledhile-Hoyt, & Lee, 1998) and it remains one of the most prevalent types of drug use among this segment of the community (Johnston, O'Malley, & Bachman, 2002). First, the incremental validity of AS lower-order factors, relative to theoretically relevant smoking characteristics (i.e., nicotine dependence and smoking rate) and gender was examined in predicting greater motivation to smoke to reduce negative affect. It was hypothesized that AS Physical and Mental Incapacitation Concerns would incrementally predict negative affect reduction smoking motives. As a test of specificity, it also was expected that AS lower-order factors would not be associated with smoking motivation for other reasons (e.g., stimulation, addictive reasons), as these factors would theoretically be unrelated to anxiety processes. Second, the incremental validity of AS lower-order factors was tested, again relative to other theoretically relevant smoking variables and gender, in predicting abstinence self-efficacy. It was hypothesized that AS Physical and Mental Incapacitation Concerns would predict self-efficacy in refraining from smoking when experiencing negative affect above and beyond the variance accounted for by the other factors in the model.

1. Method

1.1. Participants

The sample consisted of 151 daily smokers (63 females; M_{age}=21.9 years, S.D.=7.3), as defined by smoking ≥10 cigarettes per day for at least one year. The ethnic distribution reflected that of the local population (State of Vermont Department of Health, 2000); ninety-three percent of the sample was Caucasian, 2% Asian, .7% African-American, .7% Hispanic, .7% others, and 2.6% did not specify. Participants averaged 12.3 (S.D.=5.6) cigarettes per day, smoked regularly for 5.9 (S.D.=6.7) years, began smoking at age 13.5 (S.D.=2.2), and considered themselves regular smokers by age 15.9 (S.D.=1.8). When smoking the heaviest, participants averaged 18.7 (S.D.=8.2) cigarettes per day. Smoking status was confirmed by a carbon monoxide (CO) analysis of breath samples, with participants recording at least 10 ppm, which is an established cut-off for determining smoking status (Cocores, 1993). The average level of nicotine dependence, as indexed by the Fagerstrom Test for Nicotine Dependence (FTND; Heatherton, Kowzlowski, Frecker, & Fagerstrom, 1991), was 2.4 (S.D.=1.6).

Participants were excluded on the basis of a positive psychiatric history, including nonclinical panic attacks, as measured by the Structured Clinical Interview for the Diagnostic and Statistical Manual-Fourth Edition (SCID-IV; First, Spitzer, Gibbon, & Williams, 1997). Importantly, this psychiatric history exclusionary criterion was included to control for observed associations between AS and smoking factors resulting from pre-existing psychopathology or nonclinical panic attack history. Interrater reliability for structured clinical interviews in our laboratory has been very high for Axis I diagnoses and nonclinical panic attack history (e.g., Zvolensky, Leen-Feldner et al., 2004). Participants also were excluded from the study if they evidenced limited mental competency or the inability to give informed, written consent.

1.2. Measures

1.2.1. Anxiety Sensitivity Index (ASI)

The ASI (Reiss et al., 1986) is a 16-item measure on which respondents indicate on a five-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 three years; Peterson & Reiss, 1992). The ASI is unique from, and demonstrates incremental validity to, trait anxiety (McNally, 1996; Rapee & Medoro, 1994). Moreover, AS possesses specificity for panic versus depressive symptoms (Schmidt, Lerew, & Joiner, 1998), indicating this subdimension of the construct does not covary with emotional distress in general (i.e., nonspurious effect; Hollon, Kendall, & Lumry, 1986).

1.2.2. Smoking History Questionnaire (SHQ)

Smoking history and pattern were assessed with a structured instrument that included smoking rate, brand, total number of previous serious quit attempts, and age of onset of initiation as well as regular smoking. The SHQ has been successfully used in previous studies as a measure of smoking history (e.g., Brown, Kahler et al., 2001; Zvolensky, Baker et al., 2004; Zvolensky, Lejuez, Kahler, & Brown, 2004).

1.2.3. 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 Fagerstrom test for nicotine dependence (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).

1.2.4. Reasons for Smoking (RFS)

The Reasons for Smoking questionnaire (RFS; Ikard, Green, & Horn, 1969) was used to assess the role of different smoking motives. The psychometric properties of this scale, including measures of factor structure, internal consistency, and test–retest reliability, have been well-established (Shiffman, 1993). The version of the RFS used in this study consists of 23 items, which comprise 6 subscales: Habitual (e.g., "I've found a cigarette in my mouth and didn't remember putting it there"), Addictive (e.g., "Between cigarettes, I get a craving only a cigarette can satisfy"), Negative Affect Reduction (e.g., "When I feel uncomfortable or upset about something, I light up a cigarette"), Relaxation (e.g., "I find cigarettes pleasurable"), Sensorimotor (e.g., "Part of the enjoyment of smoking a cigarette comes from the steps I take to light up"), and Stimulation (e.g., "I like smoking when I am busy and working hard"). Items are rated on a 1 (*never*) to 5 (*always*) scale.

1.2.5. Smoking Cessation Self-Efficacy (SSC)

The SSC (Velicer, Diclemente, Rossi, & Prochaska, 1990) is a well-established nine-item measure of confidence in remaining abstinent from smoking. The SSC lists nine different situations (e.g., "when I am extremely anxious or stressed") and asks respondents to indicate whether or not they would smoke in

such situations, with extent of confidence in such judgments rated on a five point Likert type scale (1=*not at all confident* to 5=*extremely confident*). We used the SSC to index confidence in abstaining from smoking when experiencing negative affect (Cronbach's alpha in the present study=.77).

1.2.6. Carbon Monoxide (CO)

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.).

1.3. Procedure

Interested participants responding to university- and 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 consent. Then, the SCID-IV was administered by a trained interviewer. If eligible, participants completed the CO analysis and then a self-report assessment battery tapping smoking and affect-relevant factors. Upon completion of the investigation, participants were debriefed about the intent of the study and compensated $30 for their efforts.

2. Results

As predicted, AS Physical ($r=.19$, $p=.02$) and Mental Incapacitation ($r=.18$, $p=.05$) Concerns were both significantly associated with Negative Affect Reduction smoking motives and had a nonsignificant association with Addictive (p's $>.1$), Stimulation (p's $>.1$), Relaxation (p's $>.1$), and Sensorimotor (p's $>.1$) motives. In contrast to expectation, AS Physical Concerns had a significant association with Habitual smoking motives ($r=.21$, $p<.01$), but Mental Incapacitation Concerns did not ($p>.1$). Also consistent with the original hypothesis, there was a significant negative association between both AS Physical Concerns ($r=-.17$, $p=.03$) and Mental Incapacitation ($r=-.15$, $p<.05$) with SSC scores, indicating as AS level increased abstinence self-confidence decreased. It is noteworthy that no significant association was apparent between AS Social Concerns and either smoking motives or abstinence self-confidence (p's $>.1$).

Dependent variables were examined using a hierarchical multiple regression procedure (Cohen & Cohen, 1983). Nicotine dependence as measured by the FTND, average number of cigarettes smoked per day, and gender (coded dichotomously) were entered as a set at level one in the model for all equations in order to test the incremental (or relative) validity of AS Physical Concerns above and beyond these factors (Sechrest, 1963). This conservative test of incremental validity is important as previous work has found that both nicotine dependence, cigarettes consumed per day, and gender are associated with smoking to reduce negative affect and less confidence about abstaining from smoking in negative affect situations (Shiffman, 1979; Sorensen & Pechacek, 1987; Wetter et al., 1999). In this study, an index of manifest anxiety (e.g., trait anxiety) was not entered as a covariate in the model because negative emotional symptoms are an integral part of both criterion variables and therefore there is no conceptual rationale to covary such variance in the equations. That is, removing manifest negative affect symptoms from the criterion variables would omit a central, defining feature of the construct, obstructing a test of the study hypotheses (see Miller & Chapman, 2001). 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.[1]

In regard to negative affect reduction motives for smoking, the predictor set at the first level in the model accounted for a significant amount of variance ($R^2 = .16$, $p < .001$). Both higher levels of nicotine dependence ($\beta = .42$, $sr^2 = .07$) and being female ($\beta = .27$, $sr^2 = .08$) were associated with greater RFS Negative Affect Reduction scores. Average number of cigarettes consumed per day did not significantly predict negative affect reduction motives for smoking. After controlling for the variance at level one in the model, results indicated that both AS Physical and Mental Incapacitation Concerns were significantly associated with smoking motivation to reduce negative affect ($\beta = .17$, $t = 2.3$, $sr^2 = .03$, $p < .05$ and $\beta = .16$, $t = 2.1$, $sr^2 = .02$, $p < .05$, respectively).

In terms of self-efficacy in refraining from smoking while emotionally distressed, results indicated that the predictor set at step one in the model did not account for a significant amount of variance ($R^2 = .04$, $p = .09$). As predicted, after controlling for the (nonsignificant) variance at level one in the model, both AS Physical and Mental Incapacitation Concerns were significantly negatively associated with self-efficacy in remaining abstinent from smoking when emotionally distressed ($\beta = -.16$, $t = -2.0$, $sr^2 = .04$ and $\beta = -.14$, $t = -2.0$, $sr^2 = .02$, $p < .05$, respectively).

3. Discussion

Consistent with prediction, both higher levels of AS Physical and Mental Incapacitation Concerns significantly predicted greater motivation to smoke to reduce negative affect. This result uniquely extends past work by finding the effect was above and beyond the variance accounted for by nicotine dependence, average number of cigarettes consumed per day, and gender. Although the size of the respective AS effects were small in magnitude at 2–3% of unique variance, it is nonetheless potentially clinically significant as variance in other theoretically relevant factors removed prior to the AS lower-order factors (Abelson, 1985). Moreover, due to the selection criteria employed, these findings cannot be a result of pre-existing panic attack or psychiatric history, underscoring the association between AS Physical and Mental Incapacitation Concerns and affect regulation smoking motives. Importantly, AS Physical and Mental Incapacitation Concerns had a nonsignificant association with all of the other types of smoking motives examined (i.e., Addictive, Stimulation, Relaxation, and Sensorimotor), except Habitual motives for the Physical Concerns subscale, demonstrating a high degree of overall smoking motivation specificity. Although RFS Negative Affect Reduction and Habitual motives are conceptually and empirically unique motivational processes (Shiffman, 1993), they share approximately 30% of variance. Thus, the unexpected significant association between AS Physical Concerns and Habitual motives for smoking may be due to the shared variance between the two constructs.

Also consistent with prediction, greater AS Physical and Mental Incapacitation Concerns were associated with less self-efficacy in remaining abstinent from smoking when emotionally distressed.

[1] We also tested the interaction between gender and AS lower-order factors to determine whether the association between AS and the studied smoking factors differs by gender. There were no significant interactions detected.

This relation was apparent after for the variance accounted for by the theoretically relevant factors of nicotine dependence, smoking rate, and gender. Previous work has found that self-efficacy in refraining from smoking is positively associated with less success in quitting smoking (Hughes et al., 1992; Velicer et al., 1990). The present findings may therefore suggest that one of the reasons why high relative to low AS individuals have more difficulty quitting (Brown et al., 2001) despite making more quit attempts (Zvolensky, Baker et al., 2004) could be due to low levels of self-efficacy to remain abstinent when emotionally distressed. It will be important for future work to examine if these relations are consistent over time. The present findings may suggest that targeting abstinence self-efficacy may ultimately be an important strategy to incorporate into specialized intervention programs for smoking cessation among high AS individuals (see e.g., Zvolensky, Lejuez, Kahler, & Brown, 2003).

Similar to past work on smoking outcome expectancies (Zvolensky, Feldner et al., 2004), it is important to recognize that for both sets of analyses AS Physical and Mental Incapacitation Concerns are related similarly to cognitive-based smoking variables. This pattern of findings differs from associations between AS and problematic drinking, whereby the Mental Incapacitation Concerns subscale is particularly important (Koven, Heller, & Miller, in press; Zvolensky, Kotov, Antipova, Leen-Feldner, & Schmidt, in press). Overall, such results suggest that daily smokers with higher relative to lower levels of AS Physical and Mental Incapacitation Concerns are more apt to be motivated to smoke to relieve negative emotional distress and have little confidence in abstaining when in a negative mood state. 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. These data 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.

There are a number of interpretative caveats for the present investigation. First, the present sample was comprised of a relatively homogenous group of young adult smokers who volunteered to participate in the study for monetary reward. Additionally, these young adult smokers were daily but not “heavy” smokers (Pomerleau, Majchrzak, & Pomerleau, 1989). Thus, the results may be somehow 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 panic-related problems (Johnson et al., 2000), it will be important for researchers to draw from a more diverse group of heavy smokers in future work. Second, negative affect reduction motives for smoking, as indexed by the RFS, include several negative affect states (e.g., anger, sadness) that are not necessarily specific to panic-related problems. Therefore, future research should attempt to disentangle this AS-negative affect reduction smoking motivation effect in terms of specific affective domains using laboratory-based tests that examine smoking motivation under different affect states (e.g., anxiety versus depression). Finally, self-report measures were utilized as the primary assessment methodology for smoking motivation and self-efficacy ratings. The utilization of self-report methods does not fully protect against reporting errors (e.g., memory or recall biases) 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.

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