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Anxiety Sensitivity Cognitive Concerns Predict Suicidality among Smokers

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Abstract

Background—Anxiety along with anxiety-related risk factors is receiving increased attention in regard to its role in elevated suicidality. One such risk factor, anxiety sensitivity (AS), refers to a fear of anxiety-related symptoms. Emerging research indicates that components of AS, particularly the AS subfactor focused on cognitive arousal concerns, are significantly associated with elevated suicidality in samples of diverse clinical outpatients, clinical outpatients with PTSD symptoms, and Air Force cadets undergoing a stressful life experience. Cigarette smokers represent another relevant population for this line of research due to recent reports indicating that cigarette smoking and nicotine dependence may be related to elevated suicidality.

Methods—Study 1 examined the role of AS and the AS subfactors in a large sample (n = 343) of community adult smokers. Study 2 examined the role of AS and AS subfactors in a sample of “pack-a-day” adult smokers (n = 78) who were seeking outpatient treatment for substance abuse issues.

Results—Study 1 results were consistent with our a priori hypothesis that AS cognitive concerns would be significantly associated with suicidality. Additionally, after covarying for relevant substance use variables, Study 2 results were also consistent with our hypothesis that AS cognitive concerns were significantly associated with suicidality.

Limitations—Limitations included the use of suicide related outcomes, not death by suicide, and cross-sectional design.

Conclusions—These findings suggest that suicide potential in cigarette smokers may be related to AS cognitive concerns and add to the emerging literature suggesting AS cognitive concerns are a risk factor for suicidality.

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Contributors

Daniel Capron designed the idea for the manuscript and did the majority of the writing. H. Blumenthal wrote parts of the introduction and Study 2 methods. A. Medley wrote the methods for Study 1. S. Lewis collected the data for Study 2. M. Feldner, M. Zvolensky, and N. Schmidt provided feedback and assistance at all steps in the development of the manuscript.

Keywords

anxiety sensitivity; suicide; AS cognitive concerns; cigarette smokers

Suicide is responsible for nearly 1 million premature deaths worldwide each year, with rates of death by suicide increasing substantially over the past half century (WHO, 2009). Studying death by suicide is difficult because of low base rates and the need for very long follow-ups (Hughes, 2008). However, death by suicide is strongly predicted by suicide attempt history, which, in turn, is predicted in part by suicidal ideation (Kessler et al., 1999; Weissman et al., 1989). Therefore, understanding and modifying risk factors for suicidal ideation remains an important approach to reducing overall death by suicide.

Cigarette smoking and nicotine dependence have been reliably linked to suicidality. Multiple epidemiological studies have found elevated rates of suicide attempts and suicidal ideation among smokers (Breslau et al., 2005; Miller et al., 2000), although some studies have found this relationship dissipates after adjusting for co-occurring mental health disorders (Kessler et al., 2009; Hemmingsson & Kriebel, 2003). However, two recent studies using the National Epidemiological Study of Alcohol and Related Conditions (NESARC) have found a positive relationship between smoking/nicotine dependence and suicide, even after controlling for possible confounding variables (Bolton & Robinson, 2010; Yaworski et al., 2011). The first of these studies (Bolton & Robinson, 2010) found that nicotine dependence was among only four diagnoses that independently accounted for a high proportion of suicide attempts (the other three disorders were major depressive disorder, borderline personality disorder, and posttraumatic stress disorder). The second NESARC study (Yaworski et al., 2011) found that nicotine dependence was associated with suicide attempts, independent of all Axis I and Axis II conditions as well as physical disease. In addition, previously nicotine dependent people who have abstained for at least one year were significantly less likely to attempt suicide than people still dependent upon nicotine. Further, Bronisch and colleagues (2008) found that baseline smoking/nicotine dependence increased the risk for onset of suicidal ideation and suicide attempt at a four-year follow-up. However, baseline suicidal ideation did not predict subsequent smoking or nicotine dependence. These recent studies support a direct role of smoking/nicotine dependence on suicidality.

One factor, relevant to smokers, that has received a great deal of attention in the broader literature is anxiety sensitivity (AS), which refers to a fear of anxiety-related sensations (Reiss et al., 1986). Building upon a substantial literature linking AS to the development of psychopathology, including anxiety disorders (Schmidt et al., 2006), PTSD (Marshall et al., 2010), and substance use disorders (Schmidt et al., 2007b), a growing body of work suggests that AS also is linked with suicide (Capron et al., 2011; Capron et al., in press).

To understand the relationship between AS and suicide, it is essential to consider that AS is constituted from three subfactors including physical concerns, cognitive concerns, and social concerns (Zinbarg et al., 1997). Although the literature does not indicate an association between overall AS and suicide, a number of studies suggest that AS cognitive concerns, in particular, may be related to suicide (Capron et al., 2011; Capron et al., in press). AS cognitive concerns refer to fears of mental incapacitation or losing control of mental processes in the context of stress or anxiety symptoms. From a theoretical perspective, the association between AS cognitive concerns and suicide is consistent with positive feedback models of suicide that suggest those vulnerable to catastrophic cognitions ("I might lose control of my mind") such as individuals with high AS cognitive concerns are at increased risk of attempting suicide (Katz et al., 2011). The positive feedback model posits that

limbic-autonomic arousal and catastrophic cognitions are mutually activating. Within this positive feedback loop, catastrophic cognitions are amplified, thereby producing suicidal ideation. Eventually, the combination of limbic-autonomic arousal and suicidal ideation drives an individual to act in the form of a suicide attempt (Katz et al., 2011).

The extant literature on AS cognitive concerns and suicide suggests they are associated across multiple populations. Schmidt and colleagues (2001) found that AS cognitive concerns were significantly associated with suicidal ideation in a group of patients with panic disorder. More recently, Capron et al. (2011) found that AS cognitive concerns were significantly associated with both suicidal ideation and suicide attempt history in a large sample of clinical outpatients. Further, AS cognitive concerns in the presence of low AS physical concerns predict suicide attempt history among clinic outpatients with significant PTSD symptoms (Capron et al., in press). Finally, AS cognitive concerns also prospectively predicted the genesis of suicidal ideation in a group of military cadets undergoing basic training (Capron et al., in press).

Given evidence to suggest a linkage between high AS and suicidality, identification and assessment of this relation among individuals who may be at risk by virtue of elevated AS is an important next step in this line of work. Here, research has indicated that this cognitive factor is related to important aspects of smoking behavior. For example, AS is positively correlated with smoking to reduce negative affect, but often not other smoking motives (e.g., pleasure, handling, taste; Battista et al., 2008; Comeau et al., 2001; Leyro et al., 2008; Novak et al., 2003; Stewart et al., 1997; Zvolensky et al., 2006). Other studies have found that AS is related to beliefs that smoking will reduce negative affect (Brown et al., 2001; Gregor et al., 2008). Additionally, smokers high in AS perceive the prospect of quitting as both a more difficult and personally threatening experience (Zvolensky et al., 2007b), possibly due to a hypersensitivity to aversive internal sensations such as nicotine withdrawal symptoms (Zvolensky et al., 2004) or elevated state anxiety (Vujanovic & Zvolensky, 2009). Perhaps most notably, AS is significantly associated with less success during smoking cessation attempts (Zvolensky & Bernstein, 2005). Specifically, higher levels of AS are related to greater odds of early lapse (Brown et al., 2001) and relapse during quit attempts (Zvolensky et al., 2006, 2007a, 2009); these effects are not explained by smoking rate or nicotine dependence, nicotine withdrawal symptoms, or trait-like negative mood propensity (Zvolensky et al., 2009).

Despite these interesting findings, there are still a number of gaps in the smoking - suicide literature. Most notably there is a lack of work on possible risk factors related to smoking that also may elevate suicidality. Constructs such as AS cognitive concerns, which are elevated in both smokers and among those with increased suicidality, need to be evaluated. Second, in previous work associating AS cognitive concerns with suicide (Capron et al., 2011; Schmidt et al., 2001), the ASI was used to measure AS cognitive concerns. Incorporation of the ASI-3 (Taylor et al., 2007) into this literature is needed, as it was designed to more accurately measure AS subfactors, such as AS cognitive concerns. However, currently there is no work evaluating the relationship between AS cognitive concerns and suicidality using the ASI-3. Finally, measurement of suicidality in the majority of previous work has been done using a single item (Capron et al., [in press; study 2]; Schmidt et al., 2001). Utilization of more robust indicators of suicidality is important to ensure the accuracy and meaningfulness of prior findings.

The aim of the current study was to address the current gaps in the suicide literature by: (1) utilizing samples of heavy cigarette smoking individuals; and (2) using multi-item psychometrically-validated scales to examine suicidality. Moreover, we utilized two different data sets to further address gaps in the literature including: (3) using both the

original ASI and the ASI-3; (4) examining the effect of AS and each AS subfactor on a non-clinical population of regular smokers above and beyond negative affect, anxiety disorder diagnosis, past MDD diagnosis, and current MDD diagnosis (Study 1); and (5) examining the effect of AS and AS subfactors on a heavy smoking (≥ 20 cigarettes per day) sample of adults seeking outpatient treatment for substance abuse, above and beyond negative affectivity, substance use and alcohol consumption in Study 2. Each of these aspects of the current project represents significant, novel advances to prior research in this domain. Based on previous findings (Capron et al., 2011; Schmidt et al., 2001), we predicted that AS cognitive concerns would be significantly and incrementally associated with suicidal ideation, even after accounting for negative affectivity (Studies 1 and 2) and substance abuse variables (Study 2).

Study 1 Method

Participants

The sample consisted of 343 adult smokers ages 18–65 years ($M = 35.96$, $SD = 13.04$; 55.7% male) recruited from the general community through various media outlets including newspaper ads, flyers, and radio announcements. To be eligible for inclusion, participants had to be 18 years of age or older, a daily smoker for at least 1 year, currently smoke a minimum of 8 cigarettes per day, and report motivation to quit smoking within the next month. Participants were excluded if they expressed severe current suicidal ideation, plans, or preparations that were deemed by study personnel to be an immediate danger to themselves or others. They were also excluded if they were psychotic, using any other smoking cessation pharmacotherapy or other tobacco products, or if they had a history of a significant medical condition. The ethnic and racial composition of the current sample was as follows: 85% White/Caucasian, 9.4% Black Non-Hispanic, .3% Black Hispanic, 1.8% Hispanic, 1.2% Asian, and 2.3% Other. Approximately one-third (32.8%) of the sample was married or living with someone, whereas 46% were never married, 16.1% were divorced, 3.2% were separated, and 1.8% were widowed. Among the sample, 6.5% never graduated from high school, 22.6% had a high school diploma or the equivalent, 34.3% completed some college, 9.1% graduated with a 2-year degree, 14.1% graduated with a 4-year degree, 5.3% completed some graduate or professional school, and 8.2% completed graduate or professional school.

Procedure

Interested participants, who also met the initial requirements during a telephone screen, were scheduled to come in for a structured clinical interview to assess for the presence or absence of any Axis I condition (SCID – I/P; First, Spitzer, Gibbon, & Williams, 1995). Individuals who were deemed eligible after the screening/interview process were then scheduled to come in for a baseline appointment to complete various demographic, smoking, anxiety, and substance use assessments. After the baseline assessment, participants were randomly assigned to either a standard smoking cessation program or an anxiety-based management smoking cessation program. Treatment consisted of four 90-minute sessions with a trained therapist. Following the treatment phase, participants were followed up periodically over a 2 year period. The current report utilizes data collected during the baseline assessment which takes place prior to randomization and the onset of treatment. Informed consent was obtained from all participants and the study was approved by the university's Institutional Review Board.

Measures

Anxiety Sensitivity Inventory 3 (ASI-3)—The ASI-3 is an 18-item self-report questionnaire derived from a widely used multi-dimensional measure of anxiety sensitivity

(Taylor et al., 2007). The ASI-3 was designed to provide a more stable assessment of the three most commonly replicated anxiety sensitivity subfactors (cognitive, social, and physical concerns). Respondents were asked to read a series of statements (e.g. “It is important to me not to appear nervous”, “It scares me when my heart beats rapidly”, “When I cannot keep my mind on a task I worry I might be going crazy”) and rate the degree to which they agreed with each statement using a 5-point likert scale ranging from 0 (*very little*) to 4 (*very much*). Research has demonstrated that the ASI-3 is both a reliable and valid measure of anxiety sensitivity (Taylor et al., 2007). Internal consistency in the present sample was excellent for ASI-3 total (Chronbach’s $\alpha = .93$) and ranged from good to excellent for the social (Chronbach’s $\alpha = .83$), physical (Chronbach’s $\alpha = .88$), and cognitive (Chronbach’s $\alpha = .91$) subscales.

Inventory of Depression and Anxiety Symptoms (IDAS)—The IDAS is a 64-item self-report questionnaire in which respondents were asked to read a list of feelings, sensations, problems, and experiences, and rate the degree to which each statement describes their feelings and experiences during the past two weeks (Watson et al., 2007). Ratings are made using a 5-point likert scale ranging from 1 (*not at all*) to 5 (*extremely*). The IDAS yields 10 specific symptom scales, including: Suicidality, Lassitude, Insomnia, Appetite loss, Appetite gain, Ill temper, Well-being, Panic, Social anxiety, and Traumatic intrusions. In the current study suicidality was measured using the IDAS-suicidality subscale, which is comprised of 6 items (e.g. “I had thoughts of suicide,” “I hurt myself purposely”). Research has demonstrated that the IDAS subscales have good internal consistency, short-term stability, and convergent and discriminant validity (Watson et al., 2007). Internal consistency in the current sample was excellent for the IDAS total (Chronbach’s $\alpha = .94$) and acceptable for the IDAS suicide subscale (Chronbach’s $\alpha = .77$).

Positive and Negative Affect Scale (PANAS)—The PANAS consists of two 10-item mood scales that represent both positive and negative affect (Watson et al., 1988). Respondents were instructed to read each feeling/emotion (e.g., “sad,” “shaky”) and rate the extent to which they generally feel that way using a 5-point likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). In the current study, negative affectivity was measured using the PANAS negative affect scale. Previous research has demonstrated that the PANAS is both a reliable and valid measure of these two mood dimensions (Watson et al., 1988). Internal consistency in the current sample was excellent (Chronbach’s $\alpha = .91$).

Study 1 Results

Sample Descriptives

Means, standard deviations, and intercorrelations for the variables included in these analyses can be found in Table 1. The mean score on the IDAS-Suicidality subscale was comparable to other samples of community adults (Watson et al., 2007). The mean ASI-3 total and subscale scores were above those found in non-clinical samples (e.g., $M_{\text{total}} = 12.80$; Taylor et al., 2007), suggesting the sample was above average in AS. All ASI-3 subfactor means were also above the non-clinical means found by Taylor et al. (2007). ASI-3-social concerns showed the largest discrepancy between the current sample ($M = 7.43$) and the normative sample ($M = 5.9$). As expected, all variables were significantly intercorrelated. The most common Axis I diagnosis was an anxiety disorder (29.2%), followed by a past diagnosis of major depressive disorder (MDD; 21.6%) and current MDD (7.3%).

Primary Analyses

Multiple regression was performed to assess the ability of the ASI-3 total score to predict levels of suicidality (as measured by the suicidality subscale of the IDAS), after controlling

for a generalized tendency to experience negative mood (i.e., negative affectivity as indexed by the PANAS-NA), anxiety disorder diagnosis, and past and current MDD diagnosis. Preliminary analyses revealed no threats or violations to multicollinearity or homoscedasticity. Suicidality variables in a community sample are often positively skewed (higher frequency of low scores), as was the case in the current sample. Consistent with recommendation (Tabachnick & Fidell, 2007), we did not transform this variable because transformations for skewness/kurtosis in samples larger than 200 does not substantively impact analyses. Negative affectivity, anxiety disorder diagnosis, past MDD diagnosis, and current MDD diagnosis were entered at step 1, explaining 21.5% of the variance in IDAS suicidality ($F(4,333) = 22.76, p < .001$). The entry of the ASI-3 total in step 2 did not significantly improve the model (r^2 change = .01, $p = .437$). In the full model, negative affectivity ($t = 6.02, \beta = .40, p < .001, sr^2 = .10$), but not ASI-3 total ($p = .437, sr^2 < .01$) was a significant predictor of IDAS suicidality.

To investigate the specific relations among the ASI-3 subfactors and suicidality, a second regression was performed with the same covariates (i.e. negative affectivity, anxiety disorder diagnosis, past MDD diagnosis, and current MDD diagnosis) and the three ASI-3 subfactors in lieu of ASI-3 total. Preliminary analyses revealed no threats or violations of normality, linearity, multicollinearity, or homoscedasticity. The covariates were again entered in the first step of the model explaining 21.5% of the variance in IDAS suicidality ($F(4,333) = 22.76, p < .001$). The addition of ASI-3-physical, ASI-3-cognitive, and ASI-3-social in the second step explained an additional 2.2% of IDAS suicidality (F change (3,330) = 3.22, $p = .023$). In the final model, negative affectivity ($t = 6.02, \beta = .40, p < .001, sr^2 = .10$), ASI-3-cognitive ($t = 2.08, \beta = .16, p < .05, sr^2 = .01$), and ASI-3-social ($t = -2.47, \beta = -.18, p < .05, sr^2 = .01$) were the only significant predictors of IDAS suicidality. This pattern of findings suggests that looking at AS as a unitary construct may obscure the relation between ASI-3 cognitive concerns and suicidality among smokers. ASI-3-physical concerns were not a significant predictor of IDAS suicidality ($p = .27$).

Study 2 Method

Participants and Procedure

Participants were 78 adults (ages 19–66 years, $M = 31.25, SD = 11.97$; 24.4% female) seeking substance abuse/dependence treatment at residential treatment facilities. Participants selected for analysis in the current study were those who reported smoking a current average of at least 20 cigarettes per day. The ethnic and racial composition of the current sample was as follows: 8.1% Hispanic, 86.5% Caucasian, 1.4% African American, and 4% “other” or did not respond. Participants reported a median annual income of \$20–30,000 (Range: up to \$10,000 – over \$200,000). Finally, 75.6% of participants reported being single, 11.5% were married, 2.6% divorced, 2.6% separated, and 7.7% did not respond.

All people enrolling in treatment, which focused on substance use problems, were approached about participation in the study by members of the treatment staff. Interested participants then completed written informed consent that was approved by an Institutional Review Board. Participants then completed the baseline assessment that included the measures described below as well as others not directly relevant to the current project.

Measures

Treatment Outcome Package (TOP)—The TOP (Kraus et al., 2005) was used to index both suicidality and problematic substance use. Across both factors, participants indicated on a six-point Likert scale (1 = *all*, 6 = *none*) how often they have experienced each item over the past two weeks. The Suicidality factor includes five items addressing recent

suicidal attempts, gestures, and ideation (e.g., “Thought about killing yourself or wished you were dead”). The Substance Abuse factor is the six-item UNCOPE questionnaire (Hoffmann et al., 2003), which addresses DSM-IV-defined substance abuse and dependence symptomatology (e.g., “Neglected school, work, or other responsibilities;” “Felt you wanted or needed to cut down”). Subscales are totaled and converted to z-scores based on general population means and standard deviations. The TOP and its subscales evidence good psychometric properties (e.g., convergent and discriminant validity; test-retest reliability) across both clinical and nonclinical samples (Kraus et al., 2005).

Anxiety Sensitivity Index (ASI)—The ASI (Reiss et al., 1986; Zinbarg et al., 1997) was used to index fear of the consequences of anxiety. On a five point scale (0 = *very little*, 4 = *very much*) participants rated agreement with 16 statements regarding the possible negative consequences of anxiety symptoms; responses are summed to provide a total AS score. In addition to the summary score, the ASI also consists of three first-order factors: AS-physical concerns (e.g., “It scares me when my heart beats rapidly”), AS-cognitive concerns (e.g., “When my thoughts seem to speed up, I worry that I might be going crazy”), and AS-social concerns (e.g., “It is important not to appear nervous;” Zinbarg et al., 1997). The AS total and factor subscales consistently demonstrate adequate reliability and validity (e.g., Schmidt & Joiner, 2002; Zinbarg et al., 1997; Zvolensky et al., 2001; current sample: total $\alpha = .91$, physical $\alpha = .90$, cognitive $\alpha = .86$, social $\alpha = .40$).

Positive and Negative Affect Schedule (PANAS)—See Study 1 Method for full details of this measure. The negative affect scale of the PANAS evidenced good internal consistency ($\alpha = .87$) in the present sample.

Alcohol Use Disorders Identification Test (AUDIT)—The widely used AUDIT (Saunders et al., 1993) was employed to assess level of alcohol consumption. Standard frequency (i.e., “How often do you have a drink containing alcohol;” 0 = *never* to 4 = *4+ times a week*) and amount (i.e., “How many drinks containing alcohol do you have on a typical day when you are drinking;” 0 = *1 or 2* to 4 = *10 or more*) were summed to create a total consumption score. The AUDIT is a well-established screening tool for the identification of hazardous consumption behaviors and consistently evidences good psychometric properties (e.g., test-retest reliability; Reinert & Allen, 2002).

Study 2 Results

Sample Descriptives

Means, standard deviations, and intercorrelations for the variables included in these analyses can be found in Table 2. The mean score on the NA scale of the PANAS is comparable to other samples of adult substance abusing smokers (e.g., $M = 25.00$; Quinn et al., 1996). The TOP-Suicidality mean was similar to that reported in a sample of over 19,000 behavioral health clients (i.e., $M = 2.38$; Kraus et al., 2005). Finally, as in the prior study, ASI total and subscale scores were greater than those reported in community-based work (Taylor et al., 2007), and the cognitive concerns factor was comparable to that found in other work examining individuals in residential substance abuse treatment ($M = 3.78$; Lejeuz et al., 2006). ASI scores are consistently higher among substance abusers than non-substance abusers (Stewart et al., 1999). With the exception of alcohol consumption, all measures were significantly correlated. This was expected given previous research on the associations between negative affect, substance abuse, and suicidality (Nock et al., 2010).

Primary Analyses

Multiple regression was used to gauge the relation between AS and suicidality (as measured by the ASI and suicidality factor of the TOP, respectively) after controlling for variability associated with negative affectivity (PANAS-NA), alcohol consumption (AUDIT consumption subscale), and level of substance abuse (TOP – substance abuse factor). Given the sample was seeking treatment for substance use problems, it was important to account for variance associated with negative affectivity, alcohol consumption, and substance abuse as these factors relate to suicidality (Nock et al., 2010). Negative affectivity, substance abuse, and alcohol consumption were entered at step 1, explaining 12.6% of the variance in TOP suicidality ($F(3,64) = 3.09, p = .033$). The entry of the ASI total in step 2 did not significantly improve the model (r^2 change = .02, $p = .264$). In the final model, only substance abuse ($t = 2.26, \beta = .27, p = .027, sr^2 = .07$) was a significant predictor of TOP suicidality. Negative affectivity ($p = .526; sr^2 < .01$), alcohol consumption ($p = .728; sr^2 < .01$), and ASI total ($p = .264; sr^2 = .02$) were not significantly predictive of TOP suicidality.

To investigate the specific roles of the ASI subfactors, a second regression was performed with the same covariates (negative affect, substance abuse, alcohol consumption) and the three ASI subfactors in lieu of total AS. Preliminary analyses revealed no threats or violations of normality, linearity, multicollinearity and homoscedasticity. Negative affect, substance abuse, and alcohol consumption were again entered in the first step of the model explaining 12.6% of the variance in TOP suicidality ($F(3,64) = 3.09, p = .033$). The addition of ASI-physical, ASI-cognitive, and ASI-social in the second step explained an additional 13.5% of TOP suicidality (F change (3,61) = 3.71, $p = .016$). The full model (negative affect, substance abuse, alcohol consumption, ASI-physical, ASI-cognitive, ASI-social) explained 26.1% of suicidality, ($F(6, 61) = 3.60, p = .004$). In the final model, substance abuse ($t = 2.65, \beta = .30, p = .010, sr^2 = .10$), ASI-physical ($t = -2.18, \beta = -.36, p < .05, sr^2 = .07$), and ASI-cognitive ($t = 2.71, \beta = .46, p < .01, sr^2 = .11$) were significant predictors of TOP suicidality. Across both studies, ASI-cognitive was the only ASI subfactor to consistently predict a relationship with increased suicidality among smokers. Negative affectivity ($p = .698; sr^2 < .01$) and alcohol consumption ($p = .429; sr^2 = .01$) were not significantly predictive of TOP suicidality.¹

Discussion

The results of this investigation suggest that AS cognitive concerns are associated with elevated rates of suicidality among daily smokers. These results are consistent with previous findings from Schmidt et al. (2001) and Capron et al. (2011), who found that AS cognitive concerns were associated with suicide related outcomes in samples of panic disorder patients and clinical outpatients respectively. In contrast to Capron et al. (2011), we found in both studies that total ASI was not significantly associated with suicidality. This suggests that examining AS as a unitary construct among smokers may obscure relationships between AS subfactors, such as AS cognitive concerns, and suicidality.

Our finding that AS cognitive concerns are associated with elevated suicidality among smokers adds to a growing literature that suggests that severe anxiety/agitation is associated with suicide (Nock et al., 2010). The current findings also provide support for positive feedback models that suggest those vulnerable to catastrophic cognitions are at increased risk for elevated suicidality (Katz et al., 2011).

¹-Based on Capron et al. (in press) we ran post-hoc regression analyses to examine if an interaction of ASI-3-physical concerns and ASI-3-cognitive concerns predicted suicidality, but the results were not statistically significant for either sample.

The results of this investigation implicate AS cognitive concerns as a mechanism that may account for increased suicide risk among smokers, a population that is at relatively elevated risk for death by suicide (Bolton & Robinson, 2010; Yaworski et al., 2011). Encouragingly, AS has been shown to be amenable to amelioration. The utilization of brief interventions featuring psychoeducation and interoceptive exposure exercises have consistently reduced total ASI and ASI subfactors (Feldner et al., 2008; Schmidt et al., 2007). Clinicians may benefit from implementing these AS reduction strategies with smokers who endorse elevated suicide risk as well as elevated ASI-cognitive scores.

Unexpectedly, AS social concerns as measured by the ASI-3 were negatively associated with suicidality in Study 1. One possible explanation for this is that individuals who endorse AS social concerns (“When I begin to sweat in social situations, I fear people will think negative of me”, “I think it would be horrible for me to faint in public”) are unlikely candidates to participate in the repeated painful and provocative events necessary to develop *acquired capability for suicide*, a necessary component for suicide attempt postulated by the Interpersonal-Psychological theory of suicide (Joiner, 2005; Van Orden et al., 2010). However, AS social concerns (as measured by the original ASI) have previously been found to be positively related to suicide attempt history in a large sample of clinical outpatients (Capron et al., 2011). It is important to note that the social subscales of the ASI-3 and the ASI have only one item in common. The possibility exists that they are measuring different constructs, which offers another potential explanation for the discrepant findings between study 1 (that used the ASI-3) and Capron et al. (2011) where the ASI was administered. Another possibility is that AS social concerns are more related to suicide attempt (Capron et al., 2011) than the broader construct of suicidality used in the current study. Further analysis of the role of AS social concerns in suicidality is needed.

It is important to note limitations of the present studies. First, a limitation in both studies is the possibility that the association between AS cognitive concerns and suicidality may not generalize to actual death by suicide. However, suicide attempt is the strongest predictor of death by suicide (Suominen et al., 2004), and was included in the measure of suicidality for Study 2 (TOP). The measure of suicidality in Study 1 (IDAS suicidality) includes items related to self-harm but does ask explicitly if the individual enacted the self-harm with the intent to die. This is comparable to other research on the connection between anxiety and suicide (Cogle et al., 2009; Sareen et al., 2007; Schmidt et al., 2001). Second, the design of both studies precluded us from examining the causal roles of AS subfactors in suicidality among smokers. More specifically, we were unable to ascertain whether these high AS cognitive scores preceded increased suicidality or whether modification of AS might reduce suicide risk. Future large-scale prospective studies are needed to help clarify these relationships. Finally, data on psychotropic medication use was not available for these analyses. There is a possibility that psychotropic medication could affect the pattern of results. However, despite concerns about psychotropic medication use increasing suicide risk, several large scale studies have found either no significant relationship (Gibbons et al., 2005) or a negative association (Dome et al., 2011; Olfson et al., 2003).

The current investigation also had a number of notable characteristics. Primarily, it was the first examination of the role of AS and AS subfactors in elevated suicidality among smokers. This is important given the increasing evidence that smoking has a direct effect on increasing suicide related outcomes (Bolton & Robinson, 2010; Yaworski et al., 2011). Second, Study 1 was the first examination of the association between AS and suicidality using the ASI-3. The finding that AS cognitive concerns (as measured by the ASI-3) were significantly positively associated with increased suicidality is an important step in this emerging line of research because it suggests that AS cognitive concerns as measured by either the ASI or ASI-3 are relevant to suicide related outcomes. Third, the outcome

measures of suicidality (IDAS suicidality subscale and TOP suicide factor) are the most comprehensive measures of suicidality in the AS cognitive and suicide literature to date. These measures have items related to the full spectrum of non-lethal suicide-related outcomes including ideation, self-injury, and suicide attempt. The accumulation of evidence shows that AS cognitive concerns play a significant role in increased suicidality. However, future research is needed to examine this relationship prospectively, as well as whether targeting AS or AS cognitive concerns reduces suicide related outcomes in smokers with elevated suicide risk.

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Table 1
Study 1 - Means, Standard Deviations and Intercorrelations for Included Measures

Measure	M	SD	1	2	3	4	5
1. ASI3 - Physical	4.89	4.86	-				
2. ASI3 - Cognitive	3.35	4.35	.67*	-			
3. ASI3 - Social	7.43	5.14	.62*	.69*	-		
4. ASI3 - Total	15.65	12.61	.87*	.88*	.88*	-	
5. PANAS NA	19.22	7.31	.52*	.63*	.61*	.67*	-
6. IDAS - Suicidality	6.88	1.89	.30*	.36*	.25*	.34*	.45*

* $p < .001$.

ASI3 = Anxiety sensitivity index 3. PANAS NA = Negative affect scale. IDAS = Inventory of depression and anxiety symptoms.

Table 2
Study 2 - Means, Standard Deviations and Intercorrelations for Included Measures

Measure	M	SD	1	2	3	4	5	6	7
1. Alcohol Consump	4.95	2.34	-						
2. ASI Physical	8.56	6.98	.02	-					
3. ASI Cognitive	3.72	4.07	.05	.63*	-				
4. ASI Social	7.27	2.93	.1	.43*	.46*	-			
5. ASI Total	19.47	11.61	.04	.93*	.85*	.66*	-		
6. PANAS NA	26.93	8.51	.09	.52*	.55*	.46*	.62*	-	
7. TOP SA	10.43	5.15	.18	.20*	.17*	.21*	.22*	.18*	-
8. TOP Suicide	1.58	2.93	-.03	.18*	.22*	.23*	.25*	.28*	.24*

* $p < .01$.

Alcohol Consump = AUDIT alcohol consumption. ASI = Anxiety sensitivity index. PANAS NA = Positive and negative affect scales - Negative affect scale. TOP SA = Treatment outcome package - Substance abuse factor. TOP Suicide = Treatment outcome package - Suicide factor.