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Understanding the Connection Between Posttraumatic Stress Symptoms and Respiratory Problems: Contributions of Anxiety Sensitivity

Brittain L. Mahaffey,[1] Adam Gonzalez,[1] Samantha G. Farris,[2,3] Michael J. Zvolensky,[2,4] Evelyn J. Bromet,[1] Benjamin J. Luft,[5] and Roman Kotov[1]

[1]Department of Psychiatry, Stony Brook University, Stony Brook, New York, USA
[2]Department of Psychology, University of Houston, Houston, Texas, USA
[3]Department of Psychiatry and Human Behavior, Alpert Medical School of Brown University, Providence, Rhode Island, USA
[4]Department of Behavioral Science, University of Texas MD Anderson Cancer Center, Houston, Texas, USA
[5]Department of Medicine, Stony Brook University, Stony Brook, New York, USA

Respiratory problems and posttraumatic stress disorder (PTSD) are the signature health consequences associated with the September 11, 2001 (9/11), World Trade Center disaster and frequently co-occur. The reasons for this comorbidity, however, remain unknown. Anxiety sensitivity is a transdiagnostic trait that is associated with both PTSD and respiratory symptoms. The present study explored whether anxiety sensitivity could explain the experience of respiratory symptoms in trauma-exposed smokers with PTSD symptoms. Participants ($N = 135$; $M_{age} = 49.18$ years, $SD = 10.01$) were 9/11-exposed daily smokers. Cross-sectional self-report measures were used to assess PTSD symptoms, anxiety sensitivity, and respiratory symptoms. After controlling for covariates and PTSD symptoms, anxiety sensitivity accounted for significant additional variance in respiratory symptoms ($\Delta R^2 = .04$ to $.08$). This effect was specific to the somatic concerns dimension ($\beta = .29$, $p = .020$); somatic concerns contributed significantly to accounting for the overlap between PTSD and respiratory symptoms, $b = 0.03$, 95% CI [0.01, 0.07]. These findings suggest that the somatic dimension of anxiety sensitivity is important in understanding respiratory symptoms in individuals with PTSD symptoms. These findings also suggest that it may be critical to address anxiety sensitivity when treating patients with comorbid respiratory problems and PTSD.

The September 11, 2001 (9/11), terrorist attack on the World Trade Center (WTC) created a disaster with enduring physical and psychological consequences for responders and survivors. In particular, lower respiratory symptoms (LRS) and posttraumatic stress disorder (PTSD) have emerged as the signature health consequences of the disaster (Aldrich et al., 2010; Luft et al., 2012). Elevated rates of asthma have been reported in responders and survivors (Brackbill et al., 2009; Farfel et al., 2008, Wisnivesky et al., 2011) and persistent changes in pulmonary functioning have been documented in firefighters (Aldrich et al., 2010). High rates of probable PTSD have also been reported in responders (10% to 11%; Berninger, Webber, Niles, et al., 2010; Brackbill et al., 2009; Niles et al., 2011; Wisnivesky et al., 2011) and survivors (16%; Farfel et al., 2008). Moreover, PTSD and LRS frequently co-occur in 9/11-exposed individuals, with correlations ranging from .27 to .46 more than a decade after exposure (e.g. Berninger, Webber, Cohen, et al., 2010; Luft et al., 2012; Webber et al., 2011). High rates of comorbidity between LRS and PTSD symptoms have also been documented in veterans (Boscarino, 1997; Schwartz, Doebbeling, Merchant, & Barret, 1997) and community samples (Sareen et al., 2007). Longitudinal research suggests that PTSD symptoms may play a role in the etiology LRS, as PTSD symptoms have been observed to precede the onset of LRS in 9/11 responders and to predict greater symptom chronicity (Kotov et al., 2015; Niles et al., 2011). The authors of these investigations suggest that this may provide evidence for a stress–inflammatory relationship between PTSD and LRS. The mechanisms underpinning the PTSD–LRS link, however, remain poorly understood.

Another possibility is that a shared psychological risk factor underlies both types of symptoms. Anxiety sensitivity is a candidate factor that may play a role in explaining the experience of respiratory symptoms in trauma-exposed individuals.

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Correspondence concerning this article should be addressed to Brittain L. Mahaffey, Putnam Hall, Department of Psychiatry, Stony Brook University, Stony Brook, NY 11794. E-mail: Brittain.Mahaffey@stonybrook.edu

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Anxiety sensitivity is a clinical trait defined as the tendency to misinterpret the body sensations associated with anxious arousal (e.g., dizziness, heart pounding, and difficulty concentrating) as dangerous (McNally, 2002; Reiss, Peterson, Gursky, & McNally, 1986). Anxiety sensitivity is similar in scope to lower-order personality traits and has high temporal stability starting in adolescence (Rodriguez, Bruce, Pagano, Spencer, & Keller, 2004). It is composed of three dimensions: somatic concerns, fear of socially observable symptoms, and worries about cognitive dyscontrol (Taylor et al., 2007). Anxiety sensitivity is a risk factor for PTSD (Lang, Kennedy, & Stein, 2002; Marshall, Miles, & Stewart, 2010) and longitudinally predicts PTSD symptom severity (Marshall et al., 2010). The somatic, and to a lesser extent cognitive, dimensions are the most robustly associated with PTSD (Asmundson & Stapleton, 2008; Fetzner, Collimore, Carleton, & Asmundson, 2012).

Anxiety sensitivity is also implicated in the experience of respiratory symptoms (Caccappolo-van Vliet, Kelly-McNeil, Natelson, Kipen, & Fiedler, 2002; Carr, Lehrer, Rausch, & Hochron, 1994; McLeish, Zvolensky, Smits, Bonn-Miller, & Gregor, 2007). For instance, individuals with respiratory diseases report higher levels of anxiety sensitivity (Dorhofer & Sigmon, 2002; Meuret et al., 2006) and higher rates of panic disorder symptoms (Smoller, Pollack, Otto, Rosenbaum & Kradin, 1996) than healthy controls. Anxiety sensitivity is associated with poorer symptom control in patients with asthma (Avallone, McLeish, Luberto, & Bernstein, 2012) as well as more severe dyspnea (i.e., difficult or labored breathing) and greater behavioral avoidance in patients being evaluated for pulmonary dysfunction (Simon et al., 2006). Despite the associations between anxiety sensitivity, respiratory symptoms, and PTSD, no work has examined the link between these variables in WTC-exposed individuals.

Given that anxiety sensitivity tends to be trait-like in nature, one possibility is that anxiety sensitivity acts as a common risk factor for the development of both PTSD and LRS. For example, individuals high in anxiety sensitivity may be more likely to react with prolonged anxiety to a traumatic exposure and to be hypersensitive to the physiological changes that accompany anxious arousal and respiratory symptoms. This is consistent with information processing theories, which suggest that individuals who are high in trait anxiety (MacLeod, Mathews, & Tata, 1986) and anxiety sensitivity (Keogh, Dillon, Georgiou, & Hunt, 2001) demonstrate attentional biases towards threat-related cues (e.g., physical sensations). Therefore, individuals high in anxiety sensitivity may be more likely than those low in anxiety sensitivity to experience and report both PTSD symptoms and LRS following a trauma exposure. This may be especially salient in the context of the environmental exposures associated with 9/11 (e.g., toxic particulates) and biological vulnerabilities for respiratory conditions. PTSD symptom onset may naturally occur sooner than LRS in affected individuals due to respiratory changes associated with aging (Janssens, Pache, & Nicod, 1999) and a slower disease progression in LRS, rather than a causal relationship between these symptoms. Thus, the primary aim of this study was to investigate the association between PTSD symptoms, anxiety sensitivity, and LRS in a sample of cigarette smokers exposed to the WTC disaster. A secondary aim was to examine the relationship between the three dimensions of anxiety sensitivity and LRS to investigate domain-specific associations. This study focused on trauma-exposed smokers because smokers are a particularly vulnerable subgroup of the population when it comes to the experience of LRS; thus, the study of these variables in this type of sample is of particular interest (U.S. Department of Health and Human Services, 2014).

We used a hierarchical regression approach to examine contributions of anxiety sensitivity and PTSD symptoms to the experience of LRS. We hypothesized that anxiety sensitivity would account for significant variance in LRS over PTSD symptoms and average cigarettes smoked per day. Second, we hypothesized that somatic concerns in particular would account for additional variance in LRS over the four PTSD symptom dimensions. Third, we examined the degree of confounding between anxiety sensitivity and PTSD symptoms in the context of LRS. We expected that the somatic dimension of anxiety sensitivity would significantly contribute to explaining the relationship between PTSD and LRS.

Method

Participants and Procedure

A consecutive sample of 168 smokers were screened between July 2012 and August 2014 for inclusion in a smoking cessation trial. The inclusion criteria were (a) currently smoking ≥ five cigarettes per day, (b) motivation to quit smoking, (c) direct exposure to the WTC disaster, and (d) scoring ≥ 30 on the PTSD Checklist-Specific Stressor Version (PCL-S; Weathers, Litz, Herman, Huska, & Keane, 1993). The exclusion criteria were (a) alcohol dependence in the past 6 months, (b) current psychosis, or (c) current mania. A minimum score of 30 on the PCL-S was selected to reflect at least moderate symptom severity (Wilkins, Lang, & Norman, 2011). All eligible participants were invited for a baseline appointment. After informed consent was verbally obtained, participants completed self-report measures and a clinician-administered diagnostic interview. All study procedures were approved by the Stony Brook University Institutional Review Board.

Altogether, 135 smokers met full eligibility criteria for the clinical trial and provided complete data on the measures included in this analysis. For the 151 participants who provided complete baseline self-report data, there was no significant difference in PTSD symptom severity between the 135 participants included in this analysis and 16 participants who were excluded for smoking less than five cigarettes per day, $t(149) = -1.42$, $p = .157$. On average, participants included in this analysis were 49.18 ($SD = 10.01$) years old. The sample was 64.4% male and predominately Caucasian (60.1%) or African

Table 1
Anxiety Sensitivity, Posttraumatic Stress Disorder, and Perceptions of Respiratory Health

Variable	2	3	4	5	6	7	8	9	10	11	12	13	14	15	*M* or *n*	*SD* or %
Concern with anxious arousal																
1 Physical	.48	.67	.85	.34	.06	−.08	.25	.23	.25	.27	.30	.10	−.02	.26	7.64	6.25
2 Social	–	.63	.82	.14	−.04	.05	.10	.20	.30	.27	.27	.03	−.04	.35	8.75	5.76
3 Cognitive		–	.89	.28	.00	−.05	.23	.19	.38	.42	.39	.05	−.04	.42	6.30	6.26
4 ASI-3 Total			–	.30	.01	−.04	.22	.25	.35	.37	.37	.07	−.04	.40	22.91	15.55
Respiratory symptoms																
5 LRS				–	.26	.19	.12	.14	.24	.29	.25	.20	.00	.09	9.35	4.90
Smoking history																
6 Years smoked					–	.26	−.11	−.15	−.08	.00	−.09	.76	−.08	−.04	28.93	11.53
7 Cig/day						–	.02	.03	.06	.06	.06	.16	−.10	.02	15.69	12.28
PTSD symptoms[a]																
8 Reexperiencing							–	.58	.61	.61	.84	−.14	.11	.15	12.87	4.63
9 Avoidance								–	.55	.47	.71	−.15	.06	.15	5.77	2.44
10 Numbing									–	.76	.89	−.09	.05	.39	13.07	4.81
11 Hyperarousal										–	.88	−.05	.13	.42	15.10	5.02
12 Total severity											–	−.12	.11	.35	46.78	14.29
Covariates																
13 Age												–	−.13	.06	49.18	10.01
14 Sex (female)													–	.10	48	35.6%
15 Neuroticism														–	24.34	5.72

Note. Correlations greater than .18 are significant at $p \leq .05$; correlations greater than .22 are significant at $p \leq .01$. ASI-3 Total = Anxiety Sensitivity Index-3; LRS = Lower Respiratory Symptom Scale; Cig/day = average cigarettes smoked per day at baseline.
[a]PTSD reexperiencing, avoidance, numbing and hyperarousal scores were derived from the PTSD Checklist-Specific Stressor Version.

American (29.0%). Less than half were married/living with a partner (42.8%).

Measures

Posttraumatic Stress Disorder Checklist-Specific Stressor Version. The PCL-S (Weathers et al., 1993) is a 17-item self-report measure assessing the PTSD symptom severity per the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev.; *DSM-IV-TR*; American Psychiatric Association, 2000) criteria. For this study, participants were asked to rate how bothered they were by problems in the past month specifically "in relation to 9/11." The scale demonstrates good psychometric properties (Wilkins et al., 2011; Cronbach's $\alpha = .93$ in the present sample). The four dimensions of the PCL-S (reexperiencing, numbing, avoidance, and hyperarousal) were derived based on King, Leskin, King, and Weathers (1998).

Structured Clinical Interview for DSM-IV Axis I Disorders-Nonpatient Version. The Structured Clinical Interview for DSM-IV Axis I Disorders-Nonpatient Version (SCID-NP; First, 2015) is a semistructured clinical interview to assess the presence of psychopathology. Interviews were administered by trained doctoral- and master's-level interviewers. A sample of 14% of interviews ($n = 19$) was reviewed by an independent rater (κ for current PTSD = .95; 94.7% agreement). These data were only used to document rates of clinician-diagnosed PTSD in the sample.

Smoking History Questionnaire. The Smoking History Questionnaire (SHQ; Brown, Lejuez, Kahler, & Strong, 2002) is a widely used self-report questionnaire that assesses history and patterns of smoking behavior (Zvolensky et al., 2004). The SHQ includes items pertaining to smoking rate, prior quit attempts, and problematic symptoms during prior quit attempts. The SHQ was used for measuring covariates and for descriptive purposes.

Anxiety Sensitivity Index-3. The Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007) is an 18-item self-report assessment of fear related to anxious arousal. The scale is composed of three empirically derived dimensions: Somatic Concerns (e.g., "It scares me when my heart beats rapidly"), Social Concerns (e.g., "It is important for me not to appear nervous"), and Cognitive Concerns (e.g., "It scares me when I am unable to keep my mind on a task"). The ASI-3 has strong psychometric properties (Taylor et al., 2007; $\alpha = .81$ to .93 in the present sample).

Lower Respiratory Symptom Scale. The Lower Respiratory Symptom Scale (LRS; Gonzalez et al., 2016) assesses the severity of six lower respiratory symptoms: shortness of

Table 2
Respiratory Symptoms Regressed on PTSD Symptoms and Anxiety Sensitivity (Model 1)

Variable	Step ΔR^2	*b*	*SE*	β	*t*
Step 1	0.08*				
Age		0.07	0.04	.15	1.69
Sex		0.53	0.89	.05	0.59
Cig/day		0.11	0.06	.18	2.07*
Neuroticism		0.09	0.07	.10	1.21
Step 2	0.05**				
Age		0.09	0.04	.18	2.02
Sex		0.38	0.87	.04	0.44
Cig/day		0.09	0.05	.14	1.60
Neuroticism		0.01	0.08	.01	0.12
PTSD symptoms[a]		0.09	0.03	.25	2.78*
Step 3	0.04*				
Age		0.07	0.04	.15	1.74
Sex		0.52	0.86	.05	0.60
Cig/day		0.10	0.05	.16	1.84
Neuroticism		−0.05	0.08	−.06	−0.65
PTSD symptoms		0.06	0.03	.18	1.95
Anxiety sensitivity		0.07	0.03	.24	2.51*

Note. Total model $R^2 = .18$. PTSD = posttraumatic stress disorder; Anxiety sensitivity = Anxiety Sensitivity Index-3 (ASI-3) total score; Cig/day = average cigarettes smoked per day.
[a]PTSD symptoms = PTSD Checklist-Specific Stressor Version (PCL-S) total score.
*$p < .05$. **$p < .01$.

breath, chest tightness, wheezing, dry cough, productive cough, and overall difficulty breathing. Participants rate the degree to which each symptom was a problem in the past week on a 5-point Likert-type scale. The items of the LRS scale were derived from standard assessments (Burney et al., 1989; Kotov et al., 2015) presently in use in medical settings. Internal consistency in this sample was good ($\alpha = .82$) and items were not redundant with each other (all corrected item-total correlations *r*s < .46).

The Big Five Inventory-Neuroticism subscale. The Big Five Inventory-Neuroticism subscale (BFI; John, Donahue, & Kentle,1991) includes eight items that assess the extent to which individuals experience trait-like negative mood states (e.g., "Is depressed, blue"). The BFI and subscale items have strong psychometric properties (Benet-Martínez & John, 1998; John & Srivastava, 1999; BFI-Neuroticism $\alpha = .74$ in the current sample). The BFI was used for measuring covariates and for descriptive purposes.

Data Analysis

First, descriptive analyses were conducted including an examination of zero-order correlations among study variables. Ipsative mean imputation was used to address missing item-level data. Next, a hierarchical regression approach was used to examine the contribution of the ASI-3 total score over the PCL-S total score to LRS. We controlled for cigarettes smoked per day, a major contributor to LRS (Centers for Disease Control, 2013), alongside age and gender. All three were entered as covariates in Step 1. Neuroticism was also included at Step 1 to control for general vulnerability to distress. The PCL-S total score was entered in Step 2, and the ASI-3 total score was entered in Step 3.

A second model was then constructed to examine contributions of the ASI-3 subscales (i.e., Somatic Concerns, Social Concerns, and Cognitive Concerns) to LRS over the four PCL-S dimensions (i.e., Reexperiencing, Avoidance, Numbing, and Hyperarousal). As in the previous model, covariates were entered in Step 1, the PCL-S symptom dimensions were entered in Step 2, and the ASI-3 subscales in Step 3. Finally, an analysis was conducted to test for confounding between the PCL-S and the ASI-3 subscales—that is to explore whether the ASI-3 subscales could partially explain the relationship between PTSD symptoms (i.e., PCL-S total score) and respiratory symptoms (i.e., LRS total score). This analysis was conducted using PROCESS, a conditional modeling macro that tests for significant change in an association (i.e., between PCL-S and LRS, in this case) after controlling for confounders (i.e., three ASI-3 subscales) using an ordinary least squares-based path analytical framework (Hayes, 2013). PROCESS is frequently used to test for indirect effects (i.e., mediation), but our focus was on the complementary question of testing for significant reduction in a correlation after controlling for confounders

Table 3
Respiratory Symptoms Regressed on Anxiety Sensitivity Dimensions and PTSD Dimensions (Model 2)

Variable	Step ΔR^2	*b*	*SE*	β	*t*
Step 1	0.08	2.07	3.13		0.66
Age		0.08	0.05	.16	1.69
Sex		0.29	0.93	.03	0.31
Cig/day		0.12	0.06	.18	1.99*
Neuroticism		0.06	0.08	.07	0.83
Step 2	0.08	1.89	3.33		0.57
Age		0.08	0.05	.16	1.66
Sex		0.10	0.92	.01	0.11
Cig/day		0.08	0.06	.13	1.35
Neuroticism		−0.06	0.08	−.07	−0.70
PTSD Reexperiencing[a]		−0.07	0.14	−.06	−0.52
PTSD Avoidance		−0.15	0.23	−.07	−0.63
PTSD Numbing		0.17	0.15	.17	1.15
PTSD Hyperarousal		0.23	0.14	.24	1.71
Step 3	0.08	3.24	3.28		0.99
Age		0.05	0.04	.11	1.22
Sex		0.39	0.89	.04	0.43
Cig/day		0.11	0.06	.17	1.78
Neuroticism		−0.10	0.09	−.12	−1.22
PTSD Reexperiencing		−0.11	0.13	−.10	−0.83
PTSD Avoidance		−0.17	0.23	−.09	−0.76
PTSD Numbing		0.17	0.15	.17	1.15
PTSD Hyperarousal		0.20	0.14	.21	1.47
AS Physical Concerns[b]		0.24	0.10	.29	2.41*
AS Cognitive Concerns		0.06	0.11	.07	0.30
AS Social Concerns		−0.10	0.10	−.12	−1.03

Note. Total model $R^2 = .24$. PTSD = posttraumatic stress disorder; AS = anxiety sensitivity; Cig/day = average cigarettes smoked per day.
[a]PTSD Reexperiencing, Avoidance, Numbing, and Hyperarousal scores were derived from the PTSD Checklist-Specific Stressor Version (PCL-S). AS = anxiety sensitivity. [b]AS Physical, Social and Cognitive Concerns were derived from the Anxiety Sensitivity Index-3 (ASI-3).
*$p < .05$.

(MacKinnon, Krull, & Lockwood, 2000). Standardized and unstandardized regression coefficients were obtained analytically whereas bootstrapping with 10,000 resamples was used to estimate 95% confidence intervals (CIs).

Results

Descriptive Statistics

Means and standard deviations for all study variables are presented in Table 1. Most participants began smoking in adolescence and had made at least four prior quit attempts. Participants generally reported severe levels of WTC-related PTSD symptoms (PCL-S $M = 46.81$, $SD = 13.99$). Based on the SCID-I-NP, 40.6% of the sample met criteria for current *DSM-IV* PTSD.

Bivariate correlations for all mental health, respiratory, and smoking variables are presented in Table 1. Overall, the PCL-S total score was positively associated with LRS, all three dimensions of anxiety sensitivity, and the ASI-3 total score. Correlations between the ASI-3 dimensions and PCL-S total score were moderate in magnitude, with the strongest correlation between ASI-3 Cognitive Concerns and PCL-S Hyperarousal symptoms. Years smoked and average cigarettes per day were significantly correlated with the LRS total score, the PCL-S total score, and all four symptom clusters.

Multivariate Models Explaining LRS

The results of the two regression equations are described here and summary statistics are presented in Tables 2 and 3. Model 1 reflects the incremental effect of the anxiety sensitivity total score over the total PTSD symptom severity in accounting for LRS. Model 2 reflects the incremental effects of the three anxiety sensitivity dimensions over the four PCL-S dimensions and relevant covariates in accounting for LRS.

In Model 1, the ASI-3 total score accounted for an additional 4.2% of the variance in LRS, $\Delta R^2 = .04$, $F(1, 123) = 6.31$,

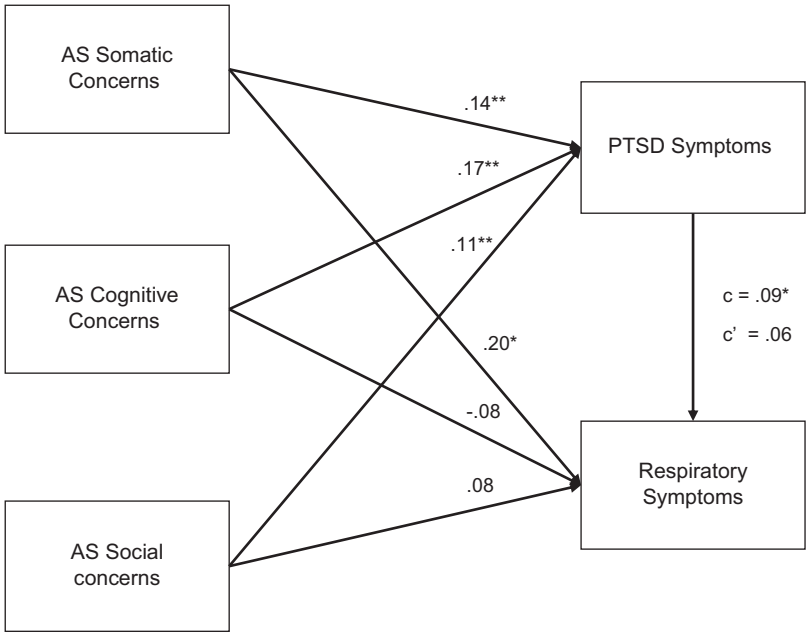

Figure 1. Unstandardized regression coefficients for model testing confounding of anxiety sensitivity dimensions with posttraumatic stress disorder (PTSD). AS Somatic, Cognitive, and Social Concerns were derived from the Anxiety Sensitivity Index-3. PTSD Symptoms = Posttraumatic Stress Checklist-Specific Stressor Version (PCL-S) total score. *$p < .05$. **$p < .01$.

$p = .013$, indicating that anxiety sensitivity accounts for the variance in LRS over that contributed by PTSD symptom severity and other covariates. In Model 2, none of the PCL-S symptom dimensions was a significant unique predictor of LRS after accounting for the covariates, although hyperarousal symptoms did approach significance ($\beta = .24$, $p = .090$). The ASI-3 subscales accounted for an additional 8% of the variance in LRS beyond the PTSD dimensions and covariates. Only Somatic Concerns was significant ($\beta = 0.29$, $p = .021$). A post hoc power analysis suggested that with $N = 135$ these models were powered at .80 to detect effects as small as $\beta = .246$ at a significance level of $p < .05$.

Contribution of Anxiety Sensitivity to the PTSD-LRS Link

Overall anxiety sensitivity. First, we examined the relationship between the PCL-S and LRS after controlling for the ASI-3 total score to examine the impact of overall anxiety sensitivity on the PTSD-LRS link. To conserve power, we excluded covariates (i.e., neuroticism, age, sex, and cigarettes per day), given that none were significant in the final steps of Models 1 and 2. We utilized the PCL-S total score as the predictor given that none of the PTSD subdimensions were significantly associated with the LRS total score in Model 2. As expected, PTSD symptoms were significantly associated with respiratory symptoms ($b = 0.09$, $t = 3.11$, $p = .01$), and the overall model was no longer significant after including the three ASI-3 dimensions ($b = 0.06$, $t = 1.90$, $p = .06$). Further, controlling for the ASI-3 total score resulted in a significant reduction in the magnitude of the association between the PCL-S total and the LRS total, $b = 0.03$, 95% CI [0.01, 0.06].

Anxiety sensitivity dimensions. Second, we examined the relationship between the PCL-S total and the LRS total after controlling for the narrower ASI-3 dimensions (i.e., Somatic, Cognitive, and Social Concerns). All three dimensions were simultaneously entered into the model. Path results are presentedin Figure 1. The ASI-3 Somatic Concerns dimension produced a significant reduction in the association between the PCL-S total and the LRS total, $b = 0.03$, 95% CI [0.01, 0.07], whereas contributions of ASI-3 Social Concerns, $b = -0.01$, 95% CI [−0.03, 0.05], and ASI-3 Cognitive Concerns, $b = 0.01$, 95% CI [−0.04, 0.02], were not significant.

Discussion

The present study evaluated the associations among PTSD symptoms, anxiety sensitivity, and lower respiratory symptom severity in a sample of 9/11-exposed smokers. As hypothesized, higher levels of PTSD symptoms were associated with higher levels of LRS. This finding replicates previous work that has demonstrated a robust association between LRS and PTSD symptoms in 9/11 responders (Kotov et al., 2015; Luft et al., 2012) and other trauma-exposed samples (Boscarino, 1997; Sareen et al., 2007). As expected, somatic concerns emerged as being the most strongly linked with both LRS and PTSD symptoms. These findings are consistent with previous work highlighting the importance of anxiety sensitivity in individuals with

respiratory conditions (Avallone et al., 2012; Caccappolo-van Vliet et al., 2002; Carr et al., 1994) and work that has separately linked somatic concerns with respiratory symptoms (Avallone et al., 2012) and PTSD (Asmundson & Stapleton, 2008), respectively. The present investigation, however, is the first to simultaneously evaluate associations between PTSD symptoms, LRS, and anxiety sensitivity.

As hypothesized, anxiety sensitivity added a unique variance to LRS over PTSD symptom severity, and this relationship was specific to somatic concerns. This finding is consistent with the literature implicating somatic concerns in the prediction of interoceptive anxiety (Eifert, Zvolensky, Sorrell, Hopko, & Lejuez, 1999; Schmidt, 1999). Further, these analyses also suggested that anxiety sensitivity contributed significantly to explaining the relationship between PTSD and LRS. Together these findings suggest that PTSD may be confounded with a risk for respiratory symptoms because anxiety sensitivity acts as an underlying risk factor for both types of symptoms: Because the individual high in anxiety sensitivity believes that physiological perturbations indicate illness, he or she may be more likely to attend to changes in both respiration and anxious arousal symptoms, and to interpret them as dangerous. These findings suggest that it may be fruitful to target anxiety sensitivity when treating PTSD in this population and other trauma-exposed groups at risk for respiratory disease (e.g., Iraq and Afghanistan veterans; Szema, Salihi, Savary, & Chen, 2011).

The results are tempered by several limitations. First, the data are cross-sectional and symptom onset and course could not be directly examined. Second, the sample was predominately male and seeking to participate in a smoking cessation trial. This work should be replicated in more heterogeneous samples. Third, these analyses may have been underpowered to detect the effects of some of the PTSD symptom clusters beyond anxiety sensitivity. Fourth, the assessment of PTSD and respiratory symptoms was based on self-report. We elected to use the PCL-S to allow for more direct comparisons to previous work done in this population and because it correlates highly with interview-based ratings (Blanchard, Jones-Alexander, Buckley & Forneris, 1996). We opted to use a self-report measure of LRS because objective measures of respiratory dysfunction (e.g., spirometry) generally correlate poorly with perceived LRS (Tsiligianni, Kocks, Tzanakis, Siafakas, & van der Molen, 2011). An important next step will be to replicate these findings with multiobserver and in vivo observation methods.

Overall, the present study provides support for the role of anxiety sensitivity in explaining the association between PTSD and LRS. Specifically, findings suggest that the somatic concerns domain of anxiety sensitivity is elevated in individuals with PTSD symptoms and may account for some of the shared variance between PTSD and LRS. Anxiety sensitivity may play a significant role in the etiology and maintenance of both types of symptoms and merits closer scrutiny as a possible point of intervention.

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