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Anxiety Sensitivity and Posttrauma Stress Symptoms in Female Undergraduates Following a Campus Shooting

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Abstract

Participants were recruited from female undergraduate students participating in an ongoing longitudinal study at the time of a campus shooting. Eighty-five percent ($N = 691$) of the 812 students who were invited to participate in the current study completed questionnaires an average of 27 days following a campus shooting. In a mixed cross-sectional and longitudinal design, the cognitive and the physical concerns dimensions of postshooting anxiety sensitivity accounted for unique variance in posttrauma stress symptom severity (cross-sectional), after controlling for pre-shooting psychological symptoms (longitudinal). The cognitive concerns dimension showed the strongest relationship. Anxiety sensitivity also appeared to moderate the relationships of hyperarousal symptoms with reexperiencing and numbing symptoms.

Keywords

PTSD Phenomenology; Crime/Community Violence; Least Squares (Multiple) Regression; Women

Despite developments in our understanding of the factor structure of Posttraumatic Stress Disorder (PTSD) symptoms (e.g., Asmundson et al., 2000), less is understood about the structural relationship between the symptom clusters. Researchers have proposed various models of PTSD (e.g., Brewin, Dalgleish, & Joseph, 1996; Foa, Riggs, & Gershuny, 1995; Horowitz, 1976), leading to differing views of the relationships among the symptom clusters. For example, Horowitz (1976) suggests that avoidance and numbing contribute to reexperiencing, but Creamer, Burgess, and Pattison (1992) suggest that reexperiencing (i.e., intrusions) contributes to avoidance.

Recent research suggests that the hyperarousal symptom cluster may play a more significant role than previously thought. Schell, Marshall, and Jaycox (2004) examined the relationships among the PTSD symptom clusters across time. Schell et al. found that the hyperarousal symptom cluster was the best predictor of changes in severity of other symptom clusters. Reexperiencing was the only other symptom cluster that influenced future symptom clusters; however, the effect size was modest. The results of the Schell et al. study suggest that hyperarousal symptoms play a crucial role in subsequent symptom severity. Other studies have also highlighted the role that hyperarousal plays in the course of PTSD symptoms. For example, Tull and Roemer (2003) found that hyperarousal symptoms predicted emotional numbing above and beyond symptoms of experiential avoidance, refuting suggestions that the relationship between hyperarousal and numbing is better accounted for by emotional avoidance. The observation that hyperarousal plays a significant

role in the course of symptom severity in PTSD (Schell et al., 2004; Tull & Roemer, 2003; see also Doron-Lamarca, 2005) suggests a role for anxiety sensitivity.

Anxiety Sensitivity and its Relationship to PTSD

Anxiety sensitivity has been defined as the fear of arousal-related sensations arising from beliefs that the sensations have harmful physical, cognitive, or social consequences (e.g., death, insanity, or social rejection; Reiss & McNally, 1985; Taylor et al., 2007). Anxiety sensitivity is thought to be important in the development and maintenance of anxiety disorders, especially panic disorder. More recently, researchers have studied anxiety sensitivity in the context of PTSD. Anxiety sensitivity has been found to be elevated in individuals with panic disorder and PTSD when compared to individuals with other anxiety disorders, individuals with non-anxiety psychopathology, and non-disordered individuals (Taylor, Koch, & McNally, 1992). Anxiety sensitivity has been positively related to PTSD symptom severity (Federoff, Taylor, Amundson, & Koch, 2000), and appears to moderate the relationship between trauma exposure frequency and PTSD symptom severity (Feldner, Lewis, Leen-Feldner, Schnurr, & Zvolensky; 2006). In prospective studies, anxiety sensitivity has been found to be a risk factor for the development of PTSD symptoms (Keogh, Ayers, & Francis, 2002; Asmundson, Coons, Taylor, & Katz, 2002). Despite these findings, little is known about the mechanisms by which anxiety sensitivity influences PTSD symptoms. In other words, it is unclear *why* anxiety sensitivity is related to PTSD symptom severity. In the current study, we propose that anxiety sensitivity is important for understanding the role of hyperarousal in the course of PTSD.

Individuals higher in anxiety sensitivity may evaluate hyperarousal symptoms as more threatening or dangerous than individuals lower in anxiety sensitivity. Consistent with this idea, PTSD patients are often described as being afraid of being overwhelmed by their memories and the accompanying emotional and physiological arousal (Taylor, 2004). Thus, sensitivity to anxiety sensations and over-evaluation of threat may increase the likelihood of avoidance, numbing, and subsequent reexperiencing symptoms. Past studies have found that anxiety sensitivity results in increased levels of pain-related escape avoidance (Asmundson & Taylor, 1996), that veterans with high levels of anxiety sensitivity and depressive symptoms are more likely to avoid experiencing negative affect (Forsyth, Parker, & Finlay, 2003), and that the physical concerns dimension of anxiety sensitivity is predictive of body vigilance and the cognitive concerns dimension is predictive of emotional avoidance (Zvolensky & Forsyth, 2002).

Study Rationale

To clarify anxiety sensitivity's role in PTSD symptom severity, the present study first examines which anxiety sensitivity dimensions (i.e., physical, cognitive, or social) are uniquely associated with posttrauma stress symptoms among female undergraduates following a campus mass shooting. Given research establishing a clear relationship between anxiety sensitivity and PTSD symptomatology, researchers have recently become interested in how the various dimensions of anxiety sensitivity relate to PTSD symptoms. Although some evidence suggests that the cognitive anxiety sensitivity dimension may be particularly important in predicting PTSD symptom severity (Feldner et al., 2006; Lang, Kennedy, & Stein, 2002; Vujanovic, Zvolensky, & Bernstein, 2008) other evidence suggests that the physical anxiety sensitivity dimension is important (Asmundson & Stapleton, 2008; Feldner et al., 2006). However, previous studies are limited by inadequate measurement of anxiety sensitivity. Specifically, previous research used a version of the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986) that was not designed to measure anxiety sensitivity as a multidimensional construct. Prior measures of anxiety sensitivity appear to

insufficiently measure anxiety sensitivity dimensions, especially the social anxiety sensitivity dimension (Taylor et al., 2007). In addition, no study to date has investigated the relationship between anxiety sensitivity dimensions and posttrauma stress symptoms in a sample of individuals affected by mass violence. The current study employs the ASI-3 (Taylor et al., 2007) to examine the hypotheses that each dimension of anxiety sensitivity is uniquely predictive of posttrauma stress symptomatology following a campus mass shooting.

The present study also examines the role of anxiety sensitivity in the structural relationships among symptom clusters associated with PTSD. Research has suggested that the hyperarousal symptom cluster is the best predictor of subsequent symptom severity (Schell et al., 2007). In addition, although there is some evidence for a relationship between anxiety sensitivity and PTSD, currently a clear understanding of the functional role of anxiety sensitivity in relation to posttrauma stress symptomatology is lacking. Since anxiety sensitivity is a fear of anxiety-related sensations, we hypothesized that the relationships between hyperarousal symptoms and other posttrauma symptom dimensions would be stronger at higher levels of anxiety sensitivity.

Method

Participants

The mass shooting on the Northern Illinois University (NIU) campus on the afternoon of February 14, 2008, was the fourth deadliest university shooting in US history. In brief, a gunman entered a lecture hall and opened fire, killing five students, injuring 18 others, and then killing himself. At the time of the mass shooting, a longitudinal study of sexual revictimization among female undergraduate students at NIU was underway. This provided a unique opportunity to assess posttrauma stress symptomatology following the mass shooting (Time 2) using a sample where pre-shooting variables of interest (i.e., posttrauma stress symptoms and other psychological symptoms) had already been obtained (Time 1). The Time 1 longitudinal study included 1,045 female participants over the age of 18 from introductory psychology courses at NIU who participated in the experiment in partial fulfillment of course credit. Time 1 data was collected from participants across four academic semesters, Fall 2006 ($n = 188$), Spring 2007 ($n = 202$), Fall 2007 ($n = 522$), and Spring 2008 ($n = 133$). Time 1 data collection was halted immediately after the occurrence of the mass shooting. Participants registered for the Time 1 assessment via an online sign-up system. The Time 1 assessment involved computer-administered questionnaires in private rooms at NIU. At Time 1, participants were asked to indicate whether they were willing to be recontacted about future research opportunities. Of the 1,045 participants who completed the Time 1 assessment, 885 (85%) consented to follow-up contact; participants that had agreed to be recontacted and were determined to have maintained enrollment at NIU at the time of the mass shooting ($N = 812$) were deemed eligible to participate in the post-shooting assessment.

Eligible Time 1 participants were sent an email invitation to an online follow-up survey 17 days following the mass shooting. Participants were invited to participate in a study about the mass shooting at NIU, with the option of receiving \$40 or course credit if enrolled in the Introductory Psychology course. The email contained an embedded link, which opened each participant's unique survey on a secure server at NIU. After providing informed consent, participants completed the brief (approximately 30 minutes) survey. Participants were provided a debriefing that included information about local mental health and crisis services, including directions for accessing an expedited referral for counseling.

Participants included 691 of the 812 eligible women (85%). Data collection took place over the course of approximately 10 weeks. The mean time between the mass shooting and the completion of the Time 2 assessment was 27 days and 80% completed the survey within 40 days. The sample was predominantly freshmen (73%; $n = 506$) or sophomores (18%; $n = 124$); non-Hispanic (91%; $n = 631$); and White (68%; $n = 469$) or Black/African-American (20%; $n = 139$). Five-hundred-and-twenty-four (76%) participants were on campus at the time of the shooting, 474 (69%) saw police or other emergency personnel, and 334 (48%) were in a building that was placed on lockdown. One-hundred-and-fifty-two (22%) participants saw people who were wounded and/or the bodies of people who had been killed, 44 (6%) heard gunfire, 24 (3%) were in the building in which the shooting occurred, and 15 (2%) saw the gunman. Eleven (2%) participants saw the gunman open fire, and three (.4%) were wounded. Two-hundred-and-thirty-five (34%) participants knew someone who had been wounded in the shooting and 159 (23%) knew someone who had been killed.

Measures

This study utilizes data from the Depression Anxiety Stress Scale 21 (DASS-21; Lovibond & Lovibond, 1995) and the Distressing Events Questionnaire (DEQ; Kubany, Leisen, Kaplan, & Kelly, 2000) administered at Time 1, and data from three Time 2 questionnaires: physical exposure to mass shooting, the DEQ (Kubany et al.) and the ASI-3 (Taylor et al., 2007).

The Depression Anxiety Stress Scale 21 is a 21-item measure that assesses three general symptom dimensions: depression (7 items; e.g., I felt that I had nothing to look forward to), anxiety (7 items; e.g., I felt I was close to panic), and stress (7 items; e.g., I found it hard to wind down). The DASS-21 was administered at both Time 1 and Time 2; however, for the purposes of the current study, only Time 1 DASS-21 scores were used. This measure appears appropriate for use with nonclinical samples (Lovibond & Lovibond, 1995). The internal consistencies (Cronbach's α) of the three dimensional scales in the current sample were .83 for the depression scale, .77 for the anxiety scale, and .83 for the stress scale.

The Distressing Events Questionnaire is a measure of PTSD, was administered both at Time 1 and Time 2. Using a 5-point response scale, the DEQ assesses symptoms of PTSD experienced in the past 30 days as specified in the DSM-IV-TR (APA, 2000). For Time 2, participants were instructed to answer the DEQ with respect to the mass shooting event. The DEQ has demonstrated very good psychometric properties (Kubany et al., 2000). In addition to a total score, the DEQ was used to construct indices of specific symptoms: Hyperarousal, Reexperiencing, Avoidance, and Numbing. The internal consistencies (Cronbach's α) of these scales in the current sample were .92 for the total symptom scale, .83 for the Hyperarousal symptom scale, .88 for the Reexperiencing symptom scale, .82 for the Avoidance symptom scale, and .79 for the Numbing symptom scale. In the current sample, 280 females had a score of 18 or more on the DEQ (indicating PTSD in females, following Kubany et al., 2000) post-shooting, indicating that a large portion of the sample (41%) had clinical symptoms of PTSD.

A 3-level ordinal variable (1 = *low*, 2 = *moderate*, and 3 = *high*) capturing physical exposure was created based on responses to the open-ended question, "Please describe how you learned about the mass shooting that took place on the NIU campus on February 14, 2008. Where were you when you first knew something was wrong?" Responses were coded into eight categories reflecting varying degrees of physical exposure by five coders; reliability was acceptable (Cronbach's $\alpha = .86$) based on a reliability analysis with a mixed 2-way intraclass coefficient and absolute consistency. The eight categories were collapsed into three levels. High physical exposure included individuals who reported seeing victims or blood in the vicinity of shooting. Moderate physical exposure included individuals who were

on campus at the time of the shooting. Individuals in this category may have reported seeing people running from the shooting, watching events unfold from windows above, or being “locked down” in a campus building. Participants also completed a 12-item measure of physical exposure (e.g., Did you see individuals who had been wounded or killed?) adapted from a measure created following the mass shootings at Virginia Tech in April 2007 (Littleton, Taquechel, & Axsom, in press). For the subset of participants who reported seeing individuals running from the shooting, but did not explicitly mention if the individuals were visibly wounded or bloody, responses were cross-checked against the “Did you see individuals who had been wounded or killed” question; participants indicating “yes,” were classified as high exposure while those indicating “no” were classified as moderate exposure. Low physical exposure included individuals who were not physically on campus during the shooting. One-hundred-and-sixty-four (24%) participants met criteria for low exposure, 432 (63%) met criteria for moderate exposure, and 94 (13%) met criteria for high exposure.

The Anxiety Sensitivity Index, Third Edition is an 18-item measure of anxiety sensitivity that assesses three dimensions: physical concerns, cognitive concerns, and social concerns. Items are rated on a 5-point Likert scale. The internal consistencies (Cronbach’s α) of these scales in the current sample were .92 for the total ASI-3 scale, .86 for the ASI-3 physical concerns scale, .89 for the ASI-3 cognitive concerns scale, and .83 for the ASI-3 social concerns scale. The second author was part of the research team formed following the mass shooting and arranged for the ASI-3 to be included at the post-shooting assessment.

Results

Given the directional nature of the hypotheses, one-tailed tests were used. Means, standard deviations, and correlations among key study variables are presented in Table 1. Tests of variance inflation indicated that multicollinearity was not a concern ($VIF < 4$; see O’Brien, 2007) in the included analyses. To examine the relationships between ASI-3 dimensions and posttrauma stress symptomatology, a multiple regression analysis was conducted. Post-shooting DEQ Total scores were used as the dependent variable. Physical exposure to the shooting was entered as a control variable. The three ASI-3 dimension scales were entered as predictors. In that multiple regression analysis, each of the ASI-3 dimensions was found to significantly predict posttrauma stress symptomatology, accounting for 23.1% of the variance. Specifically, DEQ total symptom severity was uniquely predicted by physical exposure ($\beta = .16, pr = .18, p < .01$), ASI-3 physical concerns ($\beta = 0.12, pr = .10, p < .01$), ASI-3 cognitive concerns ($\beta = 0.31, pr = .25, p < .01$), and ASI-3 social concerns ($\beta = 0.10, pr = .07, p < .05$). The regression model accounted for 26.6% of the variance in DEQ total symptom scores. Limiting analyses to only those in the moderate and high exposure groups ($n = 526$) revealed that the physical and cognitive anxiety sensitivity dimensions were significant predictors, but the social anxiety sensitivity dimension was not.

To determine whether the ASI-3 total scale moderated the relationship between the hyperarousal symptom scale and the other DEQ symptom scales, a hierarchical multiple regression was conducted, following Aiken and West (1991). The linear effects of the hyperarousal symptom scale and the ASI-3 total scale were entered in Step 1. The interaction term, calculated as the product of the standardized scores of hyperarousal symptom scale and ASI-3 total scale, was added in Step 2. When the reexperiencing symptom scale was the dependent variable, the hyperarousal symptom scale and the ASI-3 total scale were found to significantly predict the reexperiencing symptom scale and together accounted for 42% of the variance on Step 1 of the regression analysis (see Table 2). The interaction effect was also found to uniquely predict reexperiencing symptoms, $t(673) = 2.29, p < .05$.

The hyperarousal symptom scale and the ASI-3 total scale were also found to significantly predict the avoidance symptom scale and accounted for 28% of the variance on Step 1 of the regression analysis. However, the interaction effect was not found to uniquely predict the avoidance symptom scale, $t < 1$, on Step 2 of the regression analysis. The hyperarousal symptom scale and the ASI-3 total scale also significantly predicted the numbing symptom scale, and accounted for 50% of the variance on Step 1 of the regression analysis. The interaction effect was found to uniquely predict the numbing symptom scale, $t(673) = 2.18$, $p < .05$, on Step 2 of the regression analysis. When the avoidance symptom scale and numbing symptom scales were analyzed as a single dependent variable, the hyperarousal symptom scale and the ASI-3 total scale were found to significantly predict the measure $F(2, 674) = 384.52$, $p < .01$, and accounted for 53% of the variance on Step 1 of the regression analysis. The interaction effect was also found to uniquely predict the numbing/avoidance symptom scale, $t(673) = 1.83$, $p < .05$. Limiting analyses to only those in the moderate and high exposure groups ($n = 526$) revealed an identical pattern of significance: the interaction effect was significant in predicting reexperiencing and numbing symptoms, but not in predicting avoidance symptoms.

Follow-up Analyses

To examine the possibility that the observed relationships among the post-shooting variables were an artifact of pre-trauma symptom levels, these analyses were repeated with Time 1 DASS-21 depression, anxiety, and stress scales scores and Time 1 DEQ total symptom severity entered as covariates. To examine the relationships between ASI-3 symptom dimensions and posttrauma stress symptomatology, after controlling for these three pre-trauma scales, the AS-social concerns no longer significantly predicted DEQ total symptom severity ($\beta = 0.06$, $pr = .05$, $p > .05$). However, the AS-cognitive concerns and AS-physical concerns still predicted DEQ total symptom severity ($\beta = 0.26$, $pr = .21$, $p < .01$) and ($\beta = 0.12$, $pr = .094$, $p = .01$, respectively). Regarding whether anxiety sensitivity moderates the relationship between hyperarousal and other posttrauma symptoms, after controlling for Time 1 symptom scales, anxiety sensitivity still moderated the relationship between the hyperarousal symptom cluster and the reexperiencing symptoms cluster $t(612) = 2.63$, $p < .01$. However, the previous significant interaction effect testing whether anxiety sensitivity moderated the relationship between the hyperarousal symptom cluster and the numbing symptom cluster was only marginally significant $t(612) = 1.61$, $p = .053$. Similarly, the previous significant interaction effect testing whether anxiety sensitivity moderated the relationship between the hyperarousal symptom cluster and the combined numbing/avoidance symptom cluster was only marginally significant, $t(612) = 1.44$, $p = .075$.

Additional analyses were also conducted to examine the specificity of the moderating role of anxiety sensitivity. Anxiety sensitivity was hypothesized to moderate the predictive relationships of hyperarousal, but not the predictive relationships of the other posttrauma stress symptom cluster scales. Accordingly, hierarchical regression analyses similar to those reported above were conducted, examining whether anxiety sensitivity moderated the predictive relationships of the other posttrauma stress symptom cluster scales.

In the first set of these follow-up regression analyses, the reexperiencing symptom scale and the ASI-3 total scale were entered. On the second step, the interaction effect (i.e., reexperiencing symptom scale $\times$ ASI-3 total scale) was entered. The dependent variables were the hyperarousal, avoidance, and the numbing symptom scales. In a second set of follow-up analyses, the avoidance symptom scale and the ASI-3 total scale were examined on Step 1, and the interaction effect (i.e., avoidance symptom scale $\times$ ASI-3 total scale) on Step 2. The dependent variables were the hyperarousal, reexperiencing, and the numbing symptom scales. In a third set of follow-up analyses, the numbing symptom scale and the ASI-3 total scale were examined on Step 1, and the interaction effect (i.e., numbing

symptom scale $\times$ ASI-3 total scale) on Step 2. The dependent variables were the hyperarousal, reexperiencing, and the avoidance symptom scales. Of relevance to the issue of specificity of the moderating role of anxiety sensitivity, none of the interaction effects in these nine follow-up regression analyses was significant after controlling for the linear components entered on Step 1 of the analyses.

Discussion

The current study provides evidence that both the physical concerns and cognitive concerns anxiety sensitivity dimensions are uniquely associated with overall posttrauma stress symptoms, and that the cognitive concerns dimension may be especially important. This finding differs somewhat from past research that has found that only one of the dimensions predicts posttrauma stress symptoms (Asmundson & Stapleton, 2008; Lang et al., 2002; Vujanovic, Zvolensky, & Bernstein, 2008). The mixed findings from past studies using an older version of the ASI may have been due to reliance on a measure that does not adequately measure anxiety sensitivity dimensions (Taylor et al., 2007). The current study used a measure of anxiety sensitivity that was specifically designed to measure the dimensions of anxiety sensitivity, providing a stronger test of the contribution of each facet of anxiety sensitivity. However, there are differences between past studies and the current study, such as the use of clinical versus nonclinical samples, and the type of trauma. Regardless, the finding that the cognitive concerns dimension seems particularly relevant to posttrauma stress symptoms is consistent with clinical observations (Taylor, 2004).

This study also found evidence that, cross-sectionally, anxiety sensitivity moderated the relationship between hyperarousal symptoms and reexperiencing symptoms, and between hyperarousal symptoms and numbing symptoms. Controlling for pre-shooting trauma levels did not eliminate the evidence of that anxiety sensitivity moderated the relationship between hyperarousal symptoms and reexperiencing symptoms, though it did partially explain the moderating role of anxiety sensitivity on numbing symptoms, and on numbing/avoidance symptoms. Contrary to predictions, anxiety sensitivity was not found to moderate the relationship between hyperarousal symptoms and avoidance symptoms when the avoidance cluster was examined alone. These findings might be due to the difference between the avoidance symptom cluster and other symptom clusters based on mode of processing. For example, Foa, Zinbarg, and Rothbaum (1992) have suggested that avoidance is an effortful and strategic process used in response to intrusive symptoms, whereas numbing is an automatic analgesia response resulting from uncontrollable overstimulation (i.e., reexperiencing). Therefore, concern about the meaning of arousal symptoms may have more of an effect on processes that are automatic in nature. The findings from the current study may also provide support for the relevance of conceptualizing avoidance and numbing symptoms as being distinct clusters given the differential prediction of the interaction of ASI and hyperarousal on each cluster.

In sum, the moderating role of anxiety sensitivity found in this study is consistent with the view of hyperarousal as driving the course of posttrauma stress symptoms (Schell et al., 2004), specifically when considering the observed specificity of the effects in the current study. Anxiety sensitivity appears to moderate the relationship of hyperarousal on other posttrauma stress symptom clusters in this study, but more convincing evidence of the moderating role of anxiety sensitivity would come from studies that examine the hypothesis prospectively or experimentally.

The effect of anxiety sensitivity appears modest in this study. Relevant to this issue, common method variance may have inflated the effect sizes in these analyses, including the estimation of the interaction effect. We note, however, that one of the predictors (i.e.,

hyperarousal) and the dependent variables were assessed using scales from the same measure (i.e., the DEQ), suggesting that the relationships between these variables are likely inflated due to common method variance. Thus, the reexperiencing and numbing measures are less methodologically distinct from the hyperarousal measure than they are from the anxiety sensitivity measure. Such strong relationships between the DEQ scales create stringent tests for examining the linear and moderating effects of anxiety sensitivity. Future research using multimethod assessment may be better able to estimate the magnitude of the linear and moderating effects of anxiety sensitivity. In addition, the effect sizes associated with anxiety sensitivity may be greater in clinical populations because of greater variance in the variables of interest. Evidence of a moderation effect of anxiety sensitivity is consistent with a functional relationship of hyperarousal with reexperiencing and numbing, but no predictions regarding how long it takes for the process to manifest were made. Thus, the concurrent assessment of anxiety sensitivity, hyperarousal, and the outcome variables (reexperiencing and numbing) may underestimate the magnitude of the relationships between these variables. Never-the-less, the evidence of a small moderation effect found in the current study does not, by itself, warrant targeting anxiety sensitivity in treatment or prevention.

Related to this issue, the measure of anxiety sensitivity is dimensional, but there is growing evidence that the latent structure of anxiety sensitivity is taxonic (e.g., Bernstein et al., 2006). Research on the latent structure underlying the ASI-3 items is needed, as well as clarification regarding the moderating role of the anxiety sensitivity taxon.

A central limitation to the current study centers on restrictions in generalizing the findings to symptoms consistent with a PTSD diagnosis. The majority of the sample likely would not have a level of exposure to the mass shooting consistent with current conceptualizations of a Criterion A stressor, which precludes the possibility of a PTSD diagnosis. Follow-up analyses were restricted to only those students who were considered to be in the moderate to high exposure groups in order to determine whether the observed findings were relevant for participants in those groups while excluding those participants who would clearly not have met Criteria A.

The short latency between the campus shooting and the launch of the Time 2 assessment is a strength of the study because a large proportion of the sample completed the assessment within 30 days of the shooting. This time frame is consistent with the study's focus on posttrauma stress symptoms, but raises questions about the applicability of these results to understanding PTSD, which requires the presence of symptoms for greater than 30 days. Thus, the symptoms assessed in the current study may be viewed as acute reactions to mass violence.

Another important limitation of this study is that the measure of posttrauma stress symptoms was not specifically designed to assess four symptom clusters (i.e., splitting the avoidance/numbing cluster). For example, the numbing cluster, as measured by the DEQ, only consists of two items since this cluster was not designed to be measured separately from the avoidance cluster. Another limitation is that anxiety sensitivity was only measured after the shooting. Although anxiety sensitivity is conceptualized as a relatively stable individual difference factor (Reiss & McNally, 1985), the findings of the current study do not constitute evidence that a pre-trauma elevation in anxiety sensitivity is a risk factor for the development of PTSD symptoms. Because anxiety sensitivity was assessed posttrauma, the index used in this study might also reflect appraisals that depend upon the posttrauma context, including the individuals' internal states. For example, anxiety sensitivity appears to increase after an unexpected panic attack (Schmidt, Lerew, & Joiner, 2000). Thus, the findings of the study might be interpreted as implicating the valence of anxiety sensations,

as perceived by the individual following the trauma. The degree to which these perceptions are influenced by stable individual difference factors that existed prior to the trauma is an open question for possible future research. There are some prospective studies, however, that do implicate pre-trauma levels of anxiety sensitivity (Keogh et al., 2002; Asmundson et al., 2002).

We also note that the sample consisted of only female undergraduate students taking an introductory psychology course, limiting the ability to generalize the current findings. This limitation is especially pertinent given research suggesting differences between females and males, both in terms of prevalence and chronicity of PTSD symptoms (see Norris, Foster, & Weisshaar, 2002), and in terms of the association between anxiety sensitivity and posttrauma stress symptoms (Feldner, Zvolensky, Schmidt, & Smith, 2008). Limits to generalizability may also be associated with the nature of the traumatic experience of focus in the present study. Because all participants in the study completed the DEQ related to the mass shooting, results are limited to reactions to that singular traumatic event. In addition, the reported relationships between anxiety sensitivity and posttrauma stress symptoms in the current study are cross-sectional, precluding conclusions about the direction of effects. The specificity of the moderation effects observed, however, partially increases confidence in the view that hyperarousal leads to other posttrauma stress symptoms. Clearly, additional research is needed to better understand the structural relationship among PTSD symptom clusters.

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Table 1

Means, Standard Deviations, and Correlations among Time 2 Study Variables

Variables	Mean	SD	Range	1	2	3	4	5	6	7	8	9
1. Physical exposure	1.90	0.60	1–3									
2. ASI-3 Physical Concerns	9.71	4.72	1–28	-.01								
3. ASI-3 Cognitive Concerns	9.03	4.65	4–29	.01	.67**							
4. ASI-3 Social Concerns	13.08	5.47	3–30	.04	.62**	.59**						
5. ASI-3 Total	31.86	12.83	14–82	.02	.87**	.86**	.86**					
6. DEQ Hyperarousal Symptoms	7.59	5.09	0–20	.15**	.36**	.40**	.35**	.43**				
7. DEQ Reexperiencing Symptoms	3.71	4.22	0–20	.18**	.26**	.33**	.19**	.30**	.63**			
8. DEQ Avoidance Symptoms	1.63	1.99	0–8	.08*	.24**	.29**	.24**	.30**	.50**	.72**		
9. DEQ Numbing Symptoms	3.87	3.80	0–19	.12**	.38**	.44**	.32**	.44**	.68**	.53**	.49**	
10. DEQ Total Symptoms	16.49	12.35	0–66	.17**	.39**	.46**	.36**	.47**	.89**	.85**	.73**	.85**

Note. ASI-3 = Anxiety Sensitivity Index – 3, DEQ = Distressing Events Questionnaire.

* two-tailed $p < .05$.

** two-tailed $p < .01$.

Table 2

Results of Hierarchal Multiple Regression Analyses Predicting PTSD Symptom Clusters.

Predictors	Reexperiencing			Avoidance			Numbing		
	Change in R^2	r	p	Change in R^2	r	p	Change in R^2	r	p
Step 1	.417**			.276**			.501**		
Hyperarousal		.64**	.58**		.51**	.44**		.69**	.62**
ASI-3 Total Scores		.34**	.06		.33**	.13**		.44**	.18**
Step 2	.005*			.000			.003*		
Hyperarousal X									
ASI-3 Total Scores			.09*			.01			.08*

Note. $N=664$.* one-tailed, $p < .05$.** one-tailed, $p < .01$.