

Predictors and Moderators of Post-traumatic Stress Disorder: An Investigation of Anxiety Sensitivity and Resilience in Individuals with Chronic Pain

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Abstract

Introduction: Anxiety sensitivity has been proposed as a psychological vulnerability factor for post-traumatic stress disorder (PTSD). Studies have also supported the protective role of resilience for overcoming the negative effects of trauma exposure. Given the linkages between anxiety sensitivity, resilience, trauma exposure and post-traumatic stress, this study explored the potential moderating roles of anxiety sensitivity and resilience on the association between trauma history and PTSD symptoms in a sample of individuals with chronic pain. **Materials and Methods:** A total of 100 patients with chronic pain were recruited from a large public hospital. Patients who had pain lasting for more than 3 months and a pain intensity rating of at least 4/10 were included. The study participants were administered measures of PTSD symptoms (PTSD Checklist – Civilian Version), resilience (Brief Resilient Coping Scale) and anxiety sensitivity (Anxiety Sensitivity Index). **Results:** An analysis of outcome measures indicated that anxiety sensitivity and resilience were independently associated with PTSD symptoms, where β s were 0.57 and -0.23, respectively. The relationship between trauma and PTSD symptom severity was also moderated by anxiety sensitivity. Trauma history was associated with higher PTSD symptom severity only in those with high anxiety sensitivity. However, contrary to the hypotheses, resilience did not serve as a moderator. **Conclusion:** There are potential benefits of PTSD interventions that increase resilience and decrease anxiety sensitivity in individuals with chronic pain, especially for those who have experienced a traumatic event. Given that the presence of PTSD symptomatology in chronic pain populations negatively impact patient well-being, it would be important for clinicians to assess, monitor and treat PTSD in individuals with chronic pain.

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Key words: Singapore, Trauma exposure

Introduction

Traumatic events and the way in which people cope with them play a crucial role in the development of post-traumatic stress disorder (PTSD). Due to considerable differences in assessment strategies, sampling and other design features, there is significant variation in the prevalence of PTSD, ranging from 3% to 58%.^{1,2} Chronic pain often co-occurs with PTSD, which may be due in part to the physical injuries sustained during the traumatic event or underlying physiological dysregulation associated with PTSD.^{3,4} Research examining the nature of this co-occurrence has

found that 34% to 50% of the general population referred for the treatment of chronic pain have significant PTSD symptomatology or are diagnosed with PTSD.³⁻⁵ The co-occurrence of these conditions is also associated with a worse prognosis with pain treatment, greater use of opioid medications and increased work and social impairment, and creates considerable personal and societal costs.^{5,6}

In a focused review of research in this area, Asmundson et al found that a significant percentage of patients with chronic pain displayed PTSD symptoms, highlighting the overlap in the 2 conditions.³ A possible link between trauma

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exposure, comorbid PTSD and chronic pain symptoms may be related to the role that anxiety sensitivity plays in both conditions. Anxiety sensitivity can be defined as the extent to which a person is sensitive to the experience of anxiety, due to their belief that the anxiety may result in negative social, psychological or physical consequences.^{7,8} Anxiety sensitivity is viewed as a trait and thought to be a risk factor for the development of anxiety disorders.^{9,10} Importantly, many PTSD symptoms involve arousal-related sensations (e.g. palpitations, intrusive thoughts, re-experiencing symptoms, concentration difficulties) which people with anxiety sensitivity may be particularly responsive to. As a result, individuals with an elevated level of anxiety sensitivity may be more likely than those with lower levels of anxiety sensitivity to experience the negative consequences of trauma exposure.^{11,12}

Consistent with these ideas, recent studies report that anxiety sensitivity is consistently related to PTSD symptoms in trauma-exposed individuals.^{13,14} Anxiety sensitivity may be relevant to PTSD symptoms in at least 2 ways: first, anxiety sensitivity may moderate or amplify symptoms following traumatic event exposure.¹⁵⁻¹⁷ In other words, compared to trauma-exposed individuals with low anxiety sensitivity, those with elevated anxiety sensitivity may evaluate the initial hyperarousal sensations as more overwhelming, which may then further exacerbate such symptoms and lead to other PTSD symptoms (e.g. flashbacks).^{16,17} Second, individuals with high anxiety sensitivity may be more likely to avoid reminders of a traumatic event, thereby preventing extinction of learned trauma-related fear.¹⁸

Based on the available research, briefly reviewed above, it is reasonable to hypothesise that people who have persistent pain with higher anxiety sensitivity may be more likely than those with lower anxiety sensitivity to report PTSD symptoms when exposed to trauma. Traumatic exposure often results in some acute stress symptoms, which may progress to PTSD or other comorbid conditions in some individuals.¹⁹ Thus, among people who are exposed to traumatic events, individual differences in anxiety sensitivity can be viewed as a trait variable or risk factor that may demonstrate meaningful associations with post-traumatic stress symptom levels. Simply put, initial symptoms of PTSD following traumatic incidents may be worse in individuals who get overwhelmed or find bodily sensations anxiety-inducing, while other individuals who are relatively less aversive to the somatic arousal from initial symptoms of PTSD post-trauma are not likely to appraise bodily sensations as signs of illness or threat.

Traditionally, the focus of the discussion of PTSD symptoms has been on vulnerability and risk factors, including anxiety sensitivity. In recent years, the role of

possible protective factors, including resilience, has been getting more consideration. Resilience was first discussed within the context of trauma and PTSD, and continues to be seen as a salutogenic factor that could potentially buffer the negative effects of trauma and PTSD.^{20,21} The Brief Resilient Coping Scale (BRCS) is a measure of resilience which assesses an individual's tendencies to cope with stress in an adaptive manner.²² It was developed on the assumption that people who endorse resilient coping behaviours are more likely to have resilient traits. It would follow that resilient traits might also be important for people with chronic pain and to understand the relationship between traumatic events and PTSD symptomatology.

In addition to its significance in the context of trauma and PTSD, the protective role of resilience had also been examined in samples of individuals with chronic health conditions. In a systematic review of 12 articles involving patients of various chronic diseases, Cal et al found that resilience was positively associated with better quality of life and negatively correlated with illness progression and psychiatric symptoms which are common among chronic illness populations.²³ The role of resilience was also studied more specifically in a sample of patients with chronic pain, where resilience was used as a framework to understand how people with chronic pain live adaptive lives.²⁴ Some studies using chronic pain samples have similarly found that resilience was positively associated with better adjustment in terms of pain intensity, functional impairment, anxiety and depression symptoms.²⁵⁻²⁸ These studies illustrate the potential importance of resilience to adjustment in chronic pain populations, especially given its links to PTSD which is often comorbid with chronic pain.

There have been a number of studies demonstrating the moderating effect of resilience on the relationship between trauma exposure and PTSD symptoms. Fincham et al found that resilience moderated the relationship between childhood abuse and PTSD symptoms in adolescents, such that having greater resilience weakened the association.²⁹ In American veterans, while resilience was shown to attenuate the risk of PTSD diagnosis after controlling for trauma exposure, resilience also interacted with combat exposure, such that those higher in resilience evidenced weaker associations between combat exposure and a diagnosis of PTSD.³⁰ In a study of Korean firefighters, trauma exposure had both direct and indirect effects (through perceived stress levels) on PTSD symptomatology.³¹ Comparing those who experienced similar levels of trauma exposure, firefighters with high levels of resilience were protected from both the direct and indirect impact of traumatic stress.

Studies that demonstrate the possible moderating role of resilience on the relationship between trauma exposure and PTSD symptoms have been relatively rare in chronic

pain studies. A study, conducted on women alone, found that trauma-exposed patients with chronic pain without significant PTSD symptoms had higher scores in resilience and pain acceptance than trauma-exposed patients with chronic pain who endorsed significant PTSD symptoms.³² This suggests that not all trauma-exposed chronic pain patients would have significant PTSD symptoms, and that resilience could potentially play a role in determining whether PTSD symptoms would develop following traumatic events.

Given the linkages described above between resilience, trauma exposure and post-traumatic stress, it would be reasonable to expect that the relationship between trauma and PTSD symptoms in chronic pain populations may be moderated by resilience. To be more precise, the commonly observed positive associations between trauma and PTSD symptoms should be weakened in the presence of higher resilience. Similarly, in individuals with lower resilience, the deleterious effects of traumatic exposure may be more pronounced in the context of greater PTSD symptom severity. Having conducted a study that jointly examined the effects of resilience and anxiety sensitivity in the management of chronic pain, Ruiz-Parragá et al suggested that vulnerability variables (which includes anxiety sensitivity) and protective variables (which includes resilience) may independently affect chronic pain-related outcomes.²⁸ Thus, there is relevance in examining both of these factors within a single study to elucidate how these risk and protective factors may work together in the relationship between trauma exposure and its associated negative outcomes, or more specifically PTSD symptoms.

While preliminary research is supportive, additional research on the interaction of anxiety sensitivity and PTSD symptoms could help clarify the role of anxiety sensitivity as a potential vulnerability factor that contributes to the development of PTSD. We hypothesised that individuals endorsing greater anxiety sensitivity would demonstrate a stronger association between a history of trauma and severity of PTSD symptoms, while those endorsing greater resilience would demonstrate a weaker association. In addition, we examined the potential role of anxiety sensitivity and resilience as having direct effects on PTSD symptoms. We hypothesised that anxiety sensitivity and resilience would be uniquely associated with PTSD symptom severity, even when controlling for the other.

Materials and Methods

Design

This was a cross-sectional study using a convenience sample.

Participants

A total of 100 participants between the ages of 21 and 80 years, and proficient in English were recruited for this study based in Singapore. A power analysis indicated that a sample size of 100 would allow the detection of a medium effect size at a power of 93% for the hypothesised moderation effects, and a power of 94% for the hypothesised main effects.³³

The participants were patients who reported that they had chronic low back and/or knee pain for more than 3 months, with an average pain intensity in the past week of at least 4 out of 10 (10 being the most intense). They were recruited from the National University Hospital (NUH) Orthopaedic Spine Clinic, Anaesthesia Pain Clinic and the Rheumatology Clinic through referrals. Table 1 has more details on the sample characteristics.

Demographic Information

All participants were asked to provide information regarding their age, gender, ethnicity, marital status and employment status.

Table 1. Demographic Information of Sample

Variable	Mean (SD)	No. of Participants (%)
Age (years)	48.05 (15.85)	
Gender		
Female		47 (47)
Male		53 (53)
Race		
Chinese		64 (64)
Malay		10 (10)
Indian		20 (20)
Other		6 (6)
Employment status		
Employed full-time		50 (50)
Employed part-time		6 (6)
Retired		18 (18)
Homemaker		11 (11)
Unemployed		3 (3)
Not working due to pain		12 (12)
Marital status		
Married, living together		59 (59)
Married, living separately		3 (3)
Divorced		6 (6)
Single, never married		28 (28)
Widow or widower		4 (4)
Has experienced physical, emotional and/or sexual trauma		56 (56)

SD: Standard deviation

Trauma History

Participants were asked to indicate whether they had a history of trauma by checking 1 or more of the boxes that indicated “physical”, “emotional” or “sexual” trauma, or “none”.

PTSD Symptoms

The PTSD Checklist – Civilian Version (PCL-C) was used to assess PTSD symptoms.³⁴ The 17 PCL items are based on the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R) criteria for PTSD. Each item describes a PTSD symptom, and respondents indicate the severity of each one in the past month on a 5-point (1 = ‘Not at all’ to 5 = ‘Extremely’) Likert scale. The PCL-C is scored by summing all responses, with higher scores indicating greater PTSD symptom severity. The scale has demonstrated excellent internal consistency (Cronbach’s $\alpha = 0.97$) and test-retest reliability over a 3-day interval ($r = 0.96$).³⁴ It has also demonstrated convergent validity through its strong association with other PTSD measures.³⁴ The internal consistency (Cronbach’s alpha) of the PCL-C in the current sample was 0.95, indicating excellent reliability.

Anxiety Sensitivity

We used the 16-item Anxiety Sensitivity Index (ASI) to assess anxiety sensitivity.⁸ Each item is rated on a 0 (‘Very little’) to 4 (‘Very much’) scale. The ASI is scored by summing all responses, and higher scores indicate greater anxiety sensitivity. ASI demonstrates adequate test-retest reliability ($r = 0.75$ over a 2-week interval), 8 and also excellent internal consistency (Cronbach’s $\alpha = 0.90$).³⁵ In the current sample, the ASI scores also demonstrated an excellent level of internal consistency (Cronbach’s alpha = 0.94). Median-split as well as extreme scores (1 SD below mean and 1 SD above mean) have both been used in various studies to classify participants into high versus low anxiety sensitivity groups.³⁶⁻³⁸ The median split method was chosen in the current study so that groups with sufficient sizes could be generated for analysis.

Resilience

The Brief Resilient Coping Scale (BRCS) measures an individual’s tendencies to cope with stress in a resilient manner.²² The BRCS has 4 items (e.g. “I look for creative ways to alter difficult situations”), each of which is rated on a 1 (‘Not true at all’) to 5 (‘Very true’) Likert scale. The BRCS is scored by summing all responses, with higher scores indicating greater resilience. In the scale development study, the BRCS demonstrated marginal internal consistency (Cronbach’s $\alpha = 0.69$) and adequate test-retest reliability

over a 6-week interval in the original scale development study ($r = 0.71$, $P < 0.001$).²² It also exhibited convergent validity through its association with other resilience-related scales, such as measures of psychological well-being. In the current sample, the internal consistency coefficient was 0.88, indicating a good level of reliability.

Procedure

The participants were referred by doctors in the aforementioned NUH clinics for possible participation in the study if they had met the study inclusion criterion. Research assistants met potential participants and explained the study to them. If they expressed interest, written consent was obtained and the participants would complete the self-report measures. At the end of the study, each participant was thanked for his/her participation and received S\$50 as a token of appreciation.

Data Analysis

We first computed means and standard deviations (continuous variables) or percentages (categorical variables) of the demographic variables for descriptive purposes. Next, we examined the associations between the demographic variables and the study criterion variables in order to determine whether (and which) demographic variables would need to be controlled in the planned regression analysis. We also evaluated the distributions of the study variables (for skewness and kurtosis) and associations among the study variables (for multicollinearity) to ensure that they met the assumptions for the analyses, as well as to understand the simple (zero-order) associations between PTSD symptoms and the factors hypothesised to be associated with PTSD symptoms. We then performed a single hierarchical multiple regression analysis to test the study hypotheses. The criterion variable was the total symptom severity score of the PCL-C. Any demographic variables that were significantly associated with the variables of interest were controlled for by entering them in Step 1. The absence/presence of traumatic event exposure was entered in Step 2. In Step 3, we entered the measures of anxiety sensitivity and resilience. Finally, in Step 4, we entered 2 interaction terms (anxiety sensitivity [centred, to minimise multicollinearity among the predictor variables] X trauma history and resilience [centred] X trauma history). In the event that 1 or both of the interaction terms made a statistically significant contribution to the prediction of PTSD symptoms, we planned to perform independent samples t-tests to examine the relationship between trauma exposure and PTSD symptoms in participants with low versus high levels on the predictor variable(s) (i.e. anxiety sensitivity or resilience) associated with the significant interaction term(s).

Results

Demographic Information of Sample

Table 1 presents the demographic information for the study sample. For the most part, the demographic variables did not correlate significantly with the study criterion variables. The only 2 exceptions were a weak association between marital status and anxiety sensitivity ($r = 0.24$, $P < 0.05$) and between marital status and PTSD symptoms ($r = 0.24$, $P < 0.05$). Therefore, marital status, as part of the demographic variable, was controlled by entering it in the regression analyses in the first step.

Tests for Assumptions of the Planned Regression Analyses

Table 2 presents the means and standard deviations of the study variables, as well as information about the distribution of the continuous variables. As can be seen, the skewness of the continuous variables ranged from 0.64 to 1.13 and kurtosis values ranged from 0.24 to 0.61. Therefore, the skewness and kurtosis of the 3 variables fall within the acceptable range of -2 to 2, and did not require transformation prior to use in the regression analyses.

The associations among the study variables are also presented in Table 2. The association between anxiety sensitivity and resilience was low and non-significant ($r = -0.07$), as was that between trauma history and resilience ($r = 0.04$), while the association between trauma history and anxiety sensitivity was negative and significant ($r = -0.22$, $P < 0.05$). In short, the strength of the associations among the independent variables did not reach the level needed (i.e. ≥ 0.70) to indicate a concern that multicollinearity would bias the results.³⁹

Zero Order Associations between the Study Predictors and PTSD Symptoms

Table 2 also includes the correlations between the study predictors and PTSD symptoms. Anxiety sensitivity was

significantly and strongly positively correlated with total PTSD score ($r = 0.63$, $P < 0.01$). Resilience was significantly and moderately negatively correlated with total PTSD score ($r = -0.28$, $P < 0.01$). Exposure to traumatic events was also significantly and moderately positively correlated with total PTSD score ($r = 0.35$, $P < 0.01$).

Test for Moderation Effect of Anxiety Sensitivity/Resilience

Table 3 contains the results of the regression analysis that tested the hypothesised moderation effects of anxiety sensitivity and resilience on the associations between trauma history and PTSD symptoms. Consistent with the univariate analyses, trauma exposure, high anxiety sensitivity and low resilience correlated with higher PTSD symptom severity.

Neither of the interaction terms (resilience X trauma history and anxiety sensitivity X trauma history) accounted for a statistically significant proportion of additional variance in PTSD symptoms. However, the anxiety sensitivity X trauma history situation approached statistical significance ($P = 0.051$), which suggested a trend worth studying further. The nature of this interaction was examined in 2 follow-up independent samples t-tests, the results of which are presented in Table 4. While trauma exposure was associated with higher PTSD symptom severity in participants with high anxiety sensitivity, trauma exposure was unrelated to PTSD symptom scores among participants with low anxiety sensitivity.

Test for Direct Effect of Anxiety Sensitivity/Resilience

Table 3 presents the findings from the regression analyses that tested the potential independent direct effects of anxiety sensitivity and resilience on PTSD symptoms. Both anxiety sensitivity and resilience were still significantly associated with PTSD symptoms even after the other variable was controlled. It should be noted that the standardised coefficient for anxiety sensitivity was greater in magnitude than that for resilience.

Table 2. Variable-related Information and Zero-Order Correlations between Variables

Variable	Mean (SD)	Skewness (SE)	Kurtosis (SE)	Zero-Order Correlations		
				1	2	3
Anxiety sensitivity	19.25 (14.04)	0.64 (0.24)	-0.24 (0.48)			
Resilience	14.45 (3.57)	-0.64 (0.24)	0.61 (0.48)	-0.07		
Trauma history	-	-	-	0.22*	-0.04	
PTSD symptoms	32.60 (14.81)	1.13 (0.24)	0.40 (0.48)	0.63 [‡]	-0.28 [†]	0.35 [‡]

PTSD: Post-traumatic stress disorder; SD: Standard deviation; SE: Standard error

* $P < 0.05$.

[†] $P < 0.01$.

[‡] $P < 0.001$.

Table 3. Results of Regression Analysis Predicting PCL-C Severity Scores

Step and Predictor	R ^{2§}	ΔR ^{2§}	F (ΔR ^{2§})	β to enter	t Value	VIF
Marital status	0.06	0.06	5.73*	0.24	2.39*	1.00
Trauma history	0.18	0.12	14.19‡	0.35	3.77‡	1.00
Primary study predictors	0.50	0.33	30.94‡			
Anxiety sensitivity				0.54	7.06‡	1.12
Resilience				-0.23	3.10†	1.01
Interaction terms	0.54	0.04	3.76*			
Anxiety sensitivity X trauma history				0.14	1.98	1.03
Resilience X trauma history				-0.12	1.72	1.04

PCL-C: Posttraumatic Stress Disorder Checklist – Civilian Version; VIF: Variance inflation factor

* $P < 0.05$.

† $P < 0.01$.

‡ $P < 0.001$.

§Refers to the coefficient of multiple determination.

||Refers to the standardised partial regression coefficient of the respective predictor.

Discussion

The results provide support for the hypothesis that anxiety sensitivity and resilience are uniquely associated with PTSD symptoms independent of the other in individuals with chronic pain. Moreover, we found a trend for the relationship between trauma and PTSD symptom severity which was moderated by anxiety sensitivity. However, contrary to the study hypotheses, resilience did not serve as a moderator in the association between trauma history and PTSD symptom severity. These findings have important theoretical and clinical implications for people with persistent pain conditions. While there is a developing literature on the relationship between anxiety sensitivity and resilience with PTSD and chronic pain, there is no extensive research literature on the role of anxiety sensitivity and resilience in PTSD level among individuals with chronic pain in Asia. This paper therefore tries to draw on what research there is as well as contribute to the body of research within an Asian population.

The positive association found between anxiety sensitivity and severity of PTSD symptoms – the higher the anxiety

sensitivity, the more severe the PTSD symptoms – is consistent with previous findings.^{3,16,40-45} This is unsurprising because anxiety sensitivity is a cognitive vulnerability characteristic reflecting sensitivity towards anxiety and anxiety-related sensations,⁷ and many PTSD symptoms are clearly anxiety-related sensations. The negative association between resilience and PTSD symptoms found in the current study is also consistent with previous findings.^{20,21} While the importance of both anxiety sensitivity and resilience has been replicated in this study, this study also shows that each variable explains the unique variance in PTSD symptoms, suggesting that anxiety sensitivity and resilience may affect PTSD symptoms through different pathways or mechanisms. In addition, the finding that the magnitude of the standardised coefficient of the relationship between anxiety sensitivity and PTSD is greater than that between resilience and PTSD suggests the possibility that anxiety sensitivity may be the more important of the 2 in predicting PTSD symptom severity in a chronic pain population.

The direct and independent effects of resilience and anxiety sensitivity on PTSD symptoms in this cross-

Table 4. Independent Samples t-Tests Comparing Relationship between PTSD Symptom Scores and Trauma History for Those with High versus Low Anxiety Sensitivity

	Trauma			No Trauma			t Value
	n	Mean	SD	n	Mean	SD	
Low anxiety sensitivity	22	26.41	8.22	26	23.04	7.54	1.48
High anxiety sensitivity	32	45.22	16.34	16	33.06	11.66	2.96†

SD: Standard deviation

* $P < 0.05$.

† $P < 0.01$.

sectional study cannot be regarded as evidence supporting a conclusion that both of these factors have a causal impact on PTSD symptoms. While such a finding could occur if either or both have an influence on PTSD symptoms, this finding could also occur if PTSD symptoms have a causal impact on resilience and anxiety sensitivity, or if all 3 were influenced by an additional variable or variables. An important next step is to determine whether either resilience or anxiety sensitivity has a causal impact on PTSD symptoms in people with chronic pain. This could be done, for example, through an experimental design in which resilience is increased (e.g. Thompson, Arnkoff and Glass)⁴⁶ or anxiety sensitivity is decreased (e.g. Smits, Berry, Tart and Powers)⁴⁷ and where the impact of changes in these factors on reducing PTSD symptoms is evaluated. Such research may be particularly important, given the evidence of the associations between a history of trauma and function.^{48,49} Anything that can be done to help individuals improve function in the light of a trauma history would be beneficial.

The findings that anxiety sensitivity showed a trend to moderate the association between trauma exposure and PTSD symptoms in people with chronic pain – in which trauma exposure predicted greater PTSD symptom severity only in those with elevated anxiety sensitivity and not in those with low anxiety sensitivity – suggest the possibility that higher anxiety sensitivity could potentially be a vulnerability factor in the development of PTSD symptoms for those who have experienced or will experience trauma in their lives. This vulnerability factor could potentially result in greater PTSD symptom severity through amplifying PTSD symptoms and/or preventing the extinction of trauma-related fear.^{16,18} However, given that this finding did not quite reach statistical significance support, there is a need for more research to closely examine this potential moderating role for anxiety sensitivity. For example, longitudinal research could be used to determine if those with higher levels of anxiety sensitivity are more prone than those with lower anxiety sensitivity to develop more PTSD symptoms over time following trauma. Such research could also examine the trajectory of fear reduction following trauma as a function of anxiety sensitivity. It also supports the potential role of research in the development of evidence-based treatments such as cognitive-behavioural therapy for anxiety sensitivity reduction,^{13,39,50} in order to understand the mechanisms by which these treatments reduce anxiety sensitivity and evaluate the benefits of such treatments when provided soon after traumatic events.

In the context of chronic pain, we know that the presence of psychological dysfunction can interfere with successful treatment outcomes.^{51,52} Previous preliminary research suggests that PTSD treatment alone can have a beneficial effect on individuals with chronic pain by

reducing general negative mood state, decreasing avoidant behaviours, promoting emotional regulation and developing positive coping strategies.⁵³ These findings, especially when considered in light of the current study, suggest that the presence of PTSD symptomatology in chronic pain populations may have a significant negative impact on patient well-being. It would be important for clinicians to assess, monitor and treat PTSD when indicated in individuals with chronic pain in order to achieve the best outcomes. According to pain research, it would be expected that symptoms commonly associated with PTSD including hypervigilance,⁵⁴ sleep disruption and anxiety,⁵⁵ would worsen pain outcomes.⁵⁶ Therefore, effective treatment of these symptoms would also reduce the person's pain experience.

There are a number of important study limitations that should be considered when interpreting the results. Perhaps, most importantly (and as already mentioned), due to the cross-sectional design used by the study, causality effects (in either direction) cannot be determined. However, the findings do support the need for longitudinal and experimental research that could evaluate and establish such causal relationships, if they exist. A second limitation of the study is that we assessed trauma exposure relatively broadly (i.e. as the absence or presence of physical/emotional/sexual trauma). It is possible that stronger or more nuanced associations might have been revealed had more specific elements of the participants' trauma history (e.g. the duration of the trauma, number of traumatic events, type and severity of trauma) been assessed. It would be useful to determine in future studies, if such assessment procedures had helped to further clarify the impact of trauma and the factors that had moderated this impact. A third limitation was the reliance on participants' self-report for the assessment of all variables. This might have resulted in stronger associations among the variables (due to shared method variance) than what exist in the population. Future studies could address this issue by assessing trauma more objectively, for example, by studying groups of individuals who have recently been exposed to an objective traumatic event or by assessing the history and severity of trauma from sources other than the study participants, such as a family member who knows the participant's history. Finally, the study is also limited by its relatively small sample size. While the sample size was clearly adequate for important associations to emerge, a larger sample size may have increased the chances of detecting, for example, a moderating role for resilience.

Conclusion

In recent decades, there has been an increasing recognition that chronic pain represents much more than a simple physical or medical condition.⁵⁷ Contemporary

views and research support the importance of taking a biopsychosocial view in the understanding and treatment of chronic pain.³ The findings from the current study are in line with this approach. We investigated the hypothesised interconnectedness between anxiety sensitivity, resilience, trauma exposure and PTSD symptoms within a clinical population with chronic pain. The results showed that anxiety sensitivity and resilience were both associated with PTSD symptom severity independent of the other. The findings also suggest the possibility that anxiety sensitivity might moderate the associations between trauma history and PTSD symptoms. The findings warrant further research to examine the potential benefits of treatments which increase resilience and decrease anxiety sensitivity in individuals with chronic pain, especially for those who have recently experienced a traumatic event.

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