

**Title**

Somatization and COVID-19 related Posttraumatic Stress Disorder symptoms:

**The role of Sense of Threat**

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## **Abstract**

**Objective:** Somatisation is commonly associated with histories of trauma and PTSD. Although previous research has demonstrated that PTSD can predict somatic problems, there has been no examination of this at the level of PTSD symptom clusters and multi-dimensional assessment of somatic symptoms. We examined the association between the three ICD-11 PTSD symptom clusters (re-experiencing in the here and now, avoidance, and sense of threat), measured in relation to the COVID-19 pandemic as the stressor, and somatic symptoms while controlling for confounding variables.

**Methods:** Participants were a nationally representative sample of 1,041 adults from the general population of the Republic of Ireland. Physical health problems across the domains of pain, gastrointestinal, cardiopulmonary, and fatigue were assessed by the Patient Health Questionnaire, and PTSD symptoms were assessed using the International Trauma Questionnaire.

**Results:** Sense of threat was associated with the presence of pain ( $\beta=.254$ ), fatigue ( $\beta=.332$ ), gastro-intestinal ( $\beta=0.234$ ), and cardiovascular symptoms ( $\beta=.239$ ). Avoidance was associated with pain ( $\beta=.347$ ). Re-experiencing was not associated with any physical health variable.

**Conclusions:** In the context of COVID-19, the sense of threat symptoms in PTSD are most strongly related to somatic problems. Findings suggest that interventions addressing sense of threat symptoms might provide relief from somatisation.

**Keywords:** PTSD; Somatisation; Hyperarousal; Pandemic; Trauma

## **Acronyms**

ICD-11:	International Classification of Disease – 11 <sup>th</sup> Edition
PTSD:	Post-Traumatic Stress Disorder
PNES:	Psychogenic Non-Epileptic Seizures
ITQ:	International Trauma Questionnaire
PHQ:	Patient Health Questionnaire
SD:	Standard Deviation
CFI:	Comparative Fit Index
TLI:	Tucker Lewis Index
RMSEA:	Root Mean Square Error of Approximation
SRMR:	Standardized Root Mean Square Residual
HPA:	Hypothalamic Pituitary Adrenal
CBT:	Cognitive Behavioural Therapy

## **Introduction**

The experience of psychological distress in the form of physical symptoms without a known organic cause is known as somatisation. Somatisation can cause significant impairment to quality of life leading to repeated presentations to primary care settings [1]. The course of illness is often associated with a prolonged history of unenlightening medical investigations and treatments followed by a referral to psychiatric services. Co-morbid psychological disorders to somatisations is a contentious issue; many researchers identify that somatisation disorders are strongly but not exclusively linked to anxiety and depression [2], while others question the assumption that one causes the other, and the appropriateness of applying this conceptualisation across languages and cultures [3]. In an effort to increase the clinical utility of a diagnosis and refocus clinicians away from causation and towards the distress of the experiences, the ICD-11 redefined somatisation problems as Bodily Distress Disorder [4].

Somatisation has been repeatedly associated with a wide range of psychological disorders such as Posttraumatic Stress Disorder (PTSD) [2-3]. There are three criteria for a diagnosis of ICD-11 PTSD: re-experiencing of the trauma in the here and now, avoidance of reminders of the trauma, and a sense of current threat [4]. PTSD has been strongly associated with poor physical health and the presence of medical conditions [5], which is not surprising considering the disturbing impact of PTSD on sleep [6], the self-medicating use of alcohol and substances to suppress flashbacks and to cope with interpersonal contact [7]. A large meta-analysis found that individuals with PTSD were much more likely to be obese, to have poorer diets, to smoke, and to exercise less than the general population [8]. The impact of trauma and PTSD on physical health can be pervasive and complex, and it is important therefore to explore the relationship between PTSD and somatisation.

A comprehensive meta-analysis exploring the relationship between trauma, PTSD, and somatic syndromes found that individuals exposed to a traumatic event were 2.7 times more likely to meet criteria for a somatic syndrome such as fibromyalgia, chronic pain, chronic fatigue, irritable bowel syndrome, or temporomandibular disorder [9]. This finding held regardless of trauma type or the age of trauma exposure. Karatzias et al. [10] evaluated the trauma histories and symptomatology between those with organic neurological disorders and those with functional, or unexplained, neurological disorders. Childhood trauma - specifically physical neglect and sexual abuse - predicted belonging to a group characterised by having unexplained symptoms. This group also scored significantly higher on emotional dysregulation, stress, anxiety, and post-traumatic stress. Naturally, having significant unexplained ailments would cause psychological distress over time and it can be complicated to decipher whether somatisation is caused by or is the cause of psychological difficulties.

One avenue for understanding the relationship between trauma and somatisation is through observing the impact of psychological treatments on somatisation symptoms. Psychogenic Non-Epileptic Seizures (PNES) are another form of somatisation that have been associated with greater trauma exposure and in particular with histories of sexual and physical abuse [11]. In a small trial (n=18) which used prolonged exposure therapy for those with PTSD and PNES, 81% of treatment completers (n=16) documented a cessation of seizures by the end of therapy as well as a reduction in PTSD and depression symptoms [12]. There is a clear, albeit not well understood, relationship between trauma, PTSD, and physical manifestations of distress. Further understanding the mechanisms of change would enable clinicians to identify those in need and direct effective interventions more quickly.

As somatisation is linked to adverse events and PTSD it is particularly pertinent to understand amidst times of societal distress, the COVID-19 pandemic provides an opportune context in which to study the relationship between these variables. This has been a global

crisis in which societies were required to respond to a life-threatening disease incredibly quickly. The COVID-19 pandemic has necessitated dramatic lifestyle changes such as social distancing, isolation, and taking significant precautions against exposure and transmission of the coronavirus. In particular, the global uncertainty and risk of viral transmission could be reasonably expected to elevate sense of threat symptoms, in particular. The sense of threat symptoms in ICD-11 reflect hyperarousal and hypervigilance, and these symptoms can sensitise individuals to stressors which are of increased intensity and frequency during a pandemic. Hyperarousal alone has been shown to drive the development of the other core PTSD symptoms of avoidance and re-experiencing, of developing chronic PTSD, and of poor response to treatment [13-14].

One study with trauma-exposed war civilians demonstrated that hyperarousal and avoidance partly mediated the relationship between trauma exposure and somatic symptoms [15]. It could be hypothesised that in the context of COVID-19 increased hyperarousal might drive an increase in other post-traumatic sequelae, and somatisation. Somatisation symptoms could theoretically be adversely affected by elevations in stress and hyperarousal. Additionally, physical health behaviours are likely to have changed during COVID-19 pandemic including reductions in physical activity, sleep impairment, poorer diet, and an increase in maladaptive coping behaviours such as smoking or substance use. As a virus which causes physical symptoms is the key threat, the elevated attention to threat in PTSD [16] may additionally influence the experience of physical symptoms during the pandemic.

Although there is an emerging understanding of the relationship between PTSD symptoms and somatisation, there is a need to further delineate which particular symptom clusters are of most relevance to this relationship. Previous research tended to analyse the relationship between these constructs as the diagnostic level (i.e. presence of PTSD or physical symptoms), whereas analysis at the symptom-level might provide more insight into the nature

of this relationship, particularly as it occurs in the general population. Based on previous research, there is a specific need to examine the role of hyperarousal in relation to somatisation. This could inform how to target psychological interventions for specific groups to improve their clinical efficacy. To date, the relationships between PTSD symptoms and somatisation symptoms during the COVID-19 pandemic has yet to be assessed. Assessing PTSD and somatic symptoms at the population level during a period of elevated stress and threat may provide further insights into this relationship.

Although previous research has demonstrated that PTSD symptoms are associated with somatic symptoms, there has been no systematic examination of this at the level of symptom clusters for ICD-11 PTSD and multi-dimensional assessment of somatic symptoms. Furthermore, the extant evidence of the severity of PTSD symptoms in the general population, and their association with other psychological variables, in Western countries during pandemic quarantine is sparse. The primary aim of this study was to test for an association between the three ICD-11 PTSD symptom clusters, measured specifically in response to people's experience of the COVID-19 pandemic, and somatic symptoms while controlling for a multitude of potentially confounding variables. It was predicted that there would be a positive association between all PTSD symptom clusters and different forms of somatic symptoms, and that the sense of threat symptom cluster may have the largest effect.

## **Materials and Methods**

An online research panel representative of the general adult population of the Republic of Ireland was used to recruit 1,041 participants using stratified quota sampling to ensure that the sample characteristics of sex, age, and region of Ireland matched known population parameters from the 2016 Irish census. Data collection took place from 31<sup>st</sup> March 2020 (31 days after the first confirmed case of COVID-19 in the Republic of Ireland, 19 days after the

first physical distancing measures were enacted, and two days after it was announced that people were not to leave their homes) until 5<sup>th</sup> of April 2020. Participants had to be aged 18 years or older at the time of the survey, residing in Ireland, and be able to complete the survey in English. Participants were contacted by the survey company, Qualtrics, via email with an offer to participate. Consenting participants completed the survey online (median time of completion = 37.52 minutes) and were reimbursed by the survey company for their time. The ethics committees at the University of Sheffield and Ulster University approved the study. The sample characteristics are presented in Table 1.

## **Measures**

### *Demographic information*

Self-reported **sex** and age were recorded.

### *Pre-existing health problems*

Participants were asked “Were you diagnosed with a health condition (e.g. heart or lung disease; diabetes; cancer) before December 31st 2019 (i.e. before the start of the coronavirus COVID-19 outbreak)?” and the response options were ‘Yes’ (1) and ‘No’ (0).

### *Income*

Participants were asked “Please choose from the following options to indicate your approximate gross (before tax is taken away) household income in 2019 (last year). Include income from partners and other family members living with you and all kinds of earnings including salaries and benefits” to choose one of ten categories: “0-€19,999, €20,00-€29,999, €30,000-€39,999, €40,000-€49,999, €50,000-€59,999, €60,000-€69,999, €70,000-€79,999, €80,00-€89,999, €90,000-€99,000, €100,000 or more”.

### *PTSD symptoms*

Participants completed the International Trauma Questionnaire (ITQ) [17] which is the only self-report measure of ICD-11 PTSD and Complex PTSD symptoms. In this study, only the



six items measuring PTSD symptoms, and three items assessing functional impairment, associated with these symptoms were used. Participants were instructed to respond to all items in relation to their experience of the COVID-19 pandemic, and to indicate how much they have been bothered by each symptom in the past month. All items were answered using a five-point Likert scale ranging from ‘not at all’ (0) to ‘extremely’ (4). Two symptoms reflect the ‘re-experiencing in the here and now’ cluster (i.e., upsetting dreams and flashbacks), the ‘avoidance’ cluster (internal reminders and external reminders) and the ‘sense of threat’ cluster (hypervigilance and hyperarousal). Three items screened for functional impairment associated with relationships and social life, work or ability to work, and other important aspects of life, such as parenting, school/college work or other important activities. Diagnostic criteria for PTSD require a score of  $\geq 2$  (‘moderately’) for at least one of two symptoms from each of symptoms clusters, and at least one functional impairment item to be endorsed ( $\geq 2$ ). Internal reliability for the PTSD scores in this sample was excellent ( $\alpha = .91$ ).

#### *Somatic symptoms*

Somatic symptoms were measured using the Patient Health Questionnaire (PHQ-15) [18]. The PHQ-15 is a 15-item self-report measure that asks participants, “Over the last 2 weeks, how often have you been bothered by any of the following problems?” and lists 15 commonly reported physical complaints. The response options are “Not bothered at all” (0), “Bothered a little” (1), and “Bothered a lot” (2). The scale was scored using the factor analytic based multi-dimensional approach proposed by Cano-García et al. [19]: summed scores were created to represent pain symptoms (1. back pain, 2. pain in arms, legs, or joints, 3. headaches) gastrointestinal symptoms (1. stomach pain, 2. pain or problems during sexual intercourse, 3. constipation, loose bowels, or diarrhoea, 4. nausea, gas, or indigestion), cardiopulmonary symptoms (1. chest pain, 2. Dizziness, 3. feeling your heart pound or race,

4. shortness of breath), and fatigue symptoms (1. trouble sleeping, 2. feeling tired or having low energy). The ‘menstrual problems’ item was excluded due to its **sex-specific** nature that would preclude analysis of the entire sample. Item 9 (fainting spells) was also excluded as it had previously been found to have low endorsement rates [20]. A total scale score, of the 13 items, was also computed. **Internal reliability of the scale scores was excellent ( $\alpha = .88$ ).**

## **Analysis**

Descriptive statistics were calculated, means and SD for continuous variables and counts and percentages for categorical variables, and correlations were estimated. The main structural equation modelling analyses were conducted in two stages, as proposed by Anderson and Gerbing [21]. First, a confirmatory factor analysis (CFA) measurement model was specified to assess the latent structure of the ITQ and PHQ. The six ITQ items were specified as measuring three latent variables (Re-experiencing in the here and now, Avoidance, and Sense of Threat) and the 13 PHQ items were specified as measuring four latent variables (Pain, Gastro(intestinal), Cardio(pulmonary), Fatigue). Each item was specified to load only on its respective factor, all factors were allowed to correlate and the unique variances were all uncorrelated. Next, in the structural model, the four somatisation factors were regressed on to the three PTSD variables, and all of the covariates. This model is presented in Figure 1. Additionally, the structural equation model was retested where the four somatization factors were replaced with a single summed score of the 13 PHQ items to represent general somatisation.

Figure 1 about here

All of the models were specified and estimated in Mplus 8.1 [22] using robust maximum likelihood [23]. The fit of the models were assessed using standard criteria: a non-significant chi-square ( $\chi^2$ ) test, Comparative Fit Index (CFI) [24] and Tucker Lewis Index (TLI) [25] values greater than .90; Root-Mean-Square Error of Approximation (RMSEA)

[26] with 90% confidence intervals (RMSEA 90% CI); and Standardized Root-Mean-Square Residual (SRMR) values of .08 or less, all reflect acceptable model fit [27].

## Results

Table 1 shows the socio-demographic characteristics of the sample.

Table 1 about here

In total, 17.7% of the sample met criteria for ICD-11 PTSD with COVID-19 as the stressor.

Table 2 shows the bivariate correlations among the study variables. The three ITQ symptoms clusters were positively correlated with one another ( $r = .646 - .781$ ), as were the four PHQ subscales ( $r = .459 - .867$ ), and the correlation among these variables were positive, weak-to-moderate and statistically significant ( $r = .282$  to  $.371$ ). The CFA of the ITQ and PHQ items was acceptable in terms of model fit ( $\chi^2 (131) = 281.506, p < .001$ ; RMSEA = .033, 90% C.I. = .028 - .039; CFI = .974; TLI = .966; SRMR = .034).

Table 2 about here

The structural equation model represented in Figure 1 fit the data well ( $\chi^2 (179) = 409.893, p < .001$ ; RMSEA = .035, 90% C.I. = .031 - .040; CFI = .966; TLI = .952; SRMR = .034), and the regression estimates are presented in Table 3. The Sense of Threat symptom cluster was significantly associated with all PHQ subscales, and the Avoidance was associated with pain ( $\beta = .347$ ).

When the model was re-estimated with the total PHQ score as the criterion variable ( $\chi^2(21) = 54.715, p < .001$ ; RMSEA = .039, 90% C.I. = .027 - .052; CFI = .990; TLI = .976; SRMR = .013), the only PTSD symptom cluster associated with somatisation was Sense of Threat ( $\beta = .279$ ).

Table 3 about here

## Discussion

We sought to explore whether the three PTSD symptom clusters of re-experiencing in the here and now, avoidance, and sense of threat were associated with somatisation variables during the COVID-19 pandemic. It was found that the sense of threat symptom cluster was significantly associated with all PHQ subscales, and avoidance was significantly associated with the presence of pain. Re-experiencing in the here and now was not associated with any of the somatisation symptom clusters. Thus, our results highlight the important role of hyperarousal and hypervigilance, in particular, in the experience of somatisation. These findings extend previous research regarding the relationship between sense of threat and somatisation by demonstrating that their association is also identifiable within a general population sample. Chronic hyperarousal in PTSD is understood to alter the stress response of the body via the Hypothalamic-Pituitary-Adrenal (HPA) axis [28]. A previous meta-analysis by Miller et al. [29] discussed that chronic stress from traumatic experiences can lead to poor physical health. Dysfunction in the HPA axis has been associated with somatic syndromes including irritable bowel syndrome [30], low cortisol in chronic fatigue [31], pathway sensitisation in chronic pain [32], and reduced adrenal activity in fibromyalgia [33]. Both chronic hyperarousal and somatic symptoms are strongly associated with HPA-axis dysfunction and the present findings indicate the role of the PTSD sense of threat symptom cluster in the presentation of somatic symptoms. Importantly, the present study identified an association between sense of threat symptoms and somatisation, however, due to the cross-sectional nature we could not infer causation. It is, therefore, equally plausible that somatisation could drive sense of threat symptoms. For example, those with physical symptoms during the COVID-19 pandemic may have an increased sense of threat in relation to these. Longitudinal analyses would be necessary to delineate the direction of this relationship.

Clinically, for those presenting with somatisation and experiencing PTSD symptoms it may be useful to tackle states of arousal. A review on CBT interventions for PTSD which also measured the impact on somatic symptoms reported reductions in medically unexplained symptoms, self-reported physical ill health, and levels of chronic pain [34]. A study on combat veterans with PTSD demonstrated that by adding in controlled breathing to treatment resulted in physiological changes in Heart Rate Variability, a proxy for the autonomic nervous system function, and significantly improved response to treatment than those not in the breathing condition [35]. For those presenting to trauma-specific psychological services it may indicate a benefit to focus on soothing the threat system during initial stages of therapy if somatisation symptoms are prominent. At a service level, one approach which aims to increase a sense of safety in patients is the development of trauma-informed care [36]. This approach recognises the pervasive impact trauma can have on an individual's sense of threat and beliefs about themselves, others, and the world. Medical settings may enhance an individual's sense of threat if they have previously experienced trauma and are now experiencing distressing physical symptoms. For example, long periods in busy, loud waiting areas, being intimately physically assessed by a stranger in a position of power, or awaiting test results may all heighten the arousal system and potentially contribute to somatisation symptoms [37]. Clinical interventions that might benefit from recognising the impact of hyperarousal on somatic symptoms and engagement in medical care would be to redesign services in line with a trauma-informed care approach.

The finding that avoidance **is associated with** pain symptoms is particularly pertinent in the context of the COVID-19 pandemic. Avoidance of trauma reminders may be inadvertently reinforced during societal lockdown. If the mechanism by which avoidance **relates to pain** is through reduced physical activity, then reduced activity in lockdown might lead to an increase in pain symptoms. The Perpetual Avoidance Model [38] posits that

hyperarousal may increase pain sensations and reinforce maladaptive beliefs that activities will be painful leading to increased avoidance. This inactivity is theorised to increase perceived pain sensation which feeds into further inactivity. The authors suggest a focus of psychological interventions should be to reduce the avoidance which mutually maintains PTSD and pain symptoms. Furthermore, using relaxation and breathing exercises as biofeedback strategies to reduce perceived pain and increase a sense of control over the body.

The study includes a number of limitations including the use of self-report measures and a lack of temporal ordering of the data regarding PTSD and somatisation symptoms. Research that includes structured interviews over time would reduce bias and provide much greater depth to our understanding of trauma and somatisation. A key limitation is that our assessment of mental health difficulty was restricted to the presence of PTSD symptoms. The study design did not allow for associating those PTSD symptoms with the COVID-19 pandemic or with a prior traumatic event. Future research would benefit from including a trauma checklist. Furthermore, it was beyond the scope of the study to measure other mental health problems, however it is likely that symptoms such as depression and anxiety would be affected by the pandemic conditions and influence somatic symptoms. Our results can also be generalised only in western cultures. As mentioned previously, physical health problems are understood and experienced uniquely across cultures, and so the present findings must be understood within a Western context. For instance, studies have identified that refugee population report increased medically unexplained symptoms as compared to the general Western population [39]. Furthermore, physical health behaviours are known to be adversely affected in those with PTSD, in that sufferers are significantly more likely to have poor sleep, poorer diets, reduced levels of exercise, and increased levels of obesity, smoking, and substance abuse [8]. These factors will all impact on physical health and the body stress response. Thus it is a limitation of the current study that physical health behaviours were not

controlled for in analysing the relationship between PTSD symptoms and somatisation symptoms. Furthermore, there is evidence that physical health problems differ for those exposed to different types of trauma, such as torture survivors [38], although this study only dealt with PTSD symptoms during COVID-19. Hyperarousal has been theorised to sensitise the threat system to future traumas, increasing the physiological response to subsequent stressors [40] and so multiple trauma exposure may be another complicating factor which unfortunately was not considered in the present study.

Future research is required to expand upon these findings by looking at whether this relationship holds across different types of trauma such as physical, sexual, emotional, neglect, multiple traumatisation, and the age at which these were experienced. Furthermore, the time since trauma may be an important factor to focus on as it may be hypothesised that the longer an individual has been in a state of hyperarousal the stronger the association with somatisation symptoms. Although the relationship between hyperarousal and somatisation is becoming clearer, the mechanism by which this occurs is not yet known. Further research, which assesses the biomarkers of hyperarousal, as well as including potential moderators such as levels of physical activity, health behaviours, substance use, and sleep, may help to outline this relationship further and therefore target interventions more effectively.

In conclusion, the current findings demonstrate the relationship between the ICD-11 PTSD symptom clusters and different somatic symptoms. This study highlights the key role of the PTSD sense of threat symptoms in relation to unexplained physical ailments, and also points to a significant relationship between PTSD avoidance symptoms and pain. Conducting this study in the context of the COVID-19 pandemic is a significant strength and our findings indicate a meaningful relationship between PTSD and somatization during this crisis. These finding can help in the development and refinement of psychological interventions aimed at alleviating psychological distress in this population during this time of crisis.

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**Table 1.** Sociodemographic characteristics of the Republic of Ireland sample.

	<b>%</b>
	<b>n=1041</b>
<b>Sex</b>	
Female	51.5
Male	48.2
<b>Age</b>	
18-24	11.1
25-34	19.2
35-44	20.6
45-54	15.9
55-64	21.0
65+	12.2
<b>Birthplace</b>	

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Ireland	70.7
<b>Region of Ireland</b>	
Leinster	55.3
Munster	27.3
Connaught	12.0
Ulster	5.4
<b>Ethnicity</b>	
Irish	74.8
Irish Traveller	0.3
Other White background	17.3
African	1.9
Other Black background	0.3
Chinese	0.4
Other Asian	3.2
Mixed Background	1.8
<b>Living location</b>	
City	24.5
Suburb	18.1
Town	26.8
Rural	28.8
<b>Highest Education</b>	
No qualification	1.2
Finished mandatory schooling	6.4
Finished secondary school	22.4
Undergraduate degree	22.5

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Postgraduate degree	19.8
Other technical qualification	27.9
<b>2019 income</b>	
0-€19,999	24.6
€20,000-€29,999	21.3
€30,000-€39,999	19.5
€40,000-€49,999	12.7
€50,000+	21.9
<b>Employment status</b>	
Full-time (self)/employed	43.3
Part-time (self)/employed	15.7
Retired	15.0
Unemployed	8.4
Student	6.3
Unemployed (disability or illness)	5.6
Unemployed due to COVID-19	5.7
<b>Religion</b>	
Christian	69.8
Muslim	1.6
Jewish	0.2
Hindu	1.1
Buddhist	0.6
Sikh	0.1
Other religion	3.8
Atheist	15.3

Agnostic	7.5
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**Lone adult in household**

Yes	18.4
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**Children in the household**

Yes	39.7
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Mean	44.97				1.481	1.487	2.103	1.173	1.227	.599	1.202	4.203
SD	15.76				2.024	2.051	2.215	1.421	1.615	1.294	1.231	4.494

**Table 3.** Standardised Regression Coefficients for Model of Association with Somatic Symptoms.

	Gastro	Cardio	Fatigue	Pain	Total PHQ
Age	-0.161***	-0.139***	-0.066	-0.006	-0.100**
Sex	0.045	0.012	0.182***	0.178***	0.107***
Health	0.155***	0.230***	0.160***	0.188***	0.200***
Income	0.082*	0.025	-0.048	0.016	0.021
Re-experiencing	0.033	0.201	0.120	-0.169	0.056
Avoidance	0.127	-0.031	-0.059	0.347*	0.107
Sense of Threat	0.234***	0.239**	0.332***	0.254**	0.279***
R-squared	0.238***	0.259***	0.246***	.256***	.273***

**Figure 1.** Latent Variable Model with PTSD Symptom Clusters Loading onto Somatic Symptom Clusters.