Application of Western models of posttraumatic stress disorder in Nepal: Confirmatory factor analysis in earthquake survivors and in spinal cord injury patients

Original Article

Journal of Pacific Rim Psychology
Volume 19: 1–18

DOI: 10.1177/18344909241310095
journals.sagepub.com/home/pac
Sage

Application of Western models of posttraumatic stress disorder in Nepal: Confirmatory factor analysis in earthquake survivors and in spinal cord injury patients

Siobhán M. Griffin[1], Khagendra Acharya[2], Bikash Parajuli[3], Grace McMahon[1], Chérie Armour[4] and Orla T. Muldoon[1,5]

Abstract

Posttraumatic stress disorder (PTSD) is often diagnosed by counting the number of symptoms experienced in specified symptom clusters, as outlined by the American Psychiatric Association's *Diagnostic and Statistical Manual* (DSM) of mental illness. However, PTSD measurement tools and this method of diagnosing and treating PTSD, even in non-Western countries, is based on Western concepts of the underlying factor structure. While some research has suggested that PTSD is a disorder found in Western, or "WEIRD" (White, Educated, Industrialized, Rich, and Democratic) countries and it may not translate to non-Western cultural contexts, other research has documented PTSD in a variety of non-Western countries including India, China, and the Philippines. We examined if the underlying factor structure of PTSD was evident in another non-Western context—in Nepal. We translated and back-translated the PTSD Checklist Specific Stress Version (PCL-S), adapting it for use with populations with low literacy affected by two life changing traumas. We then tested a series of theoretical models of PTSD across two different trauma samples—in survivors of the 2015 earthquake ($N = 392$) and in people who experienced a life-changing spinal cord injury ($N = 163$). Using confirmatory factor analysis, we found some evidence that PTSD symptoms appear to map onto Western factors, with evidence of the four-factor Dysphoria model (Re-experiencing, Avoidance, Dysphoria, and Hyperarousal symptoms) in both populations, and demonstrating scalar invariance across samples. However, exploratory factor analyses suggested a different underlying structure. Further, measurement invariance testing suggested gendered responses to PTSD items. The results demonstrate PTSD symptoms in this non-Western context somewhat fit hypothesized Western concepts of PTSD but point to a holistic approach to diagnosing PTSD in such contexts, as opposed to using clusters or PTSD cut-offs.

Keywords
Confirmatory factor analysis, earthquake, Nepal, PTSD, spinal cord injury, trauma

Received 27 February 2024; accepted 10 December 2024

Highlights

- PTSD is often diagnosed using Western concepts of its underlying factor structure.
- We translated and adapted the PCL-S for use in Nepal.
- PTSD symptoms somewhat mapped onto Western clusters in two trauma samples in Nepal—in survivors of the 2015 earthquake and in people with a life-changing traumatic spinal cord injury.
- Results suggest taking a more holistic approach to PTSD diagnosis in such contexts, and advise against using clusters or score cut-offs in the diagnosis and treatment of PTSD.

[1]Centre for Social Issues Research, Department of Psychology, University of Limerick, Limerick, Ireland
[2]Department of Management Informatics and Communication, Kathmandu University, Dhulikhel, Nepal
[3]Department of Orthopedics and Traumatology, Dhulikhel Hospital/ Kathmandu University Hospital, Dhulikhel, Nepal
[4]Research Centre for Stress Trauma & Related Conditions (STARC), School of Psychology, Queen's University Belfast, Belfast, Northern Ireland
[5]School of Psychology, Queen's University Belfast, Belfast, Northern Ireland

Corresponding author:
Siobhán M. Griffin, Department of Psychology, University of Limerick, Limerick, Ireland.
Email: siobhan.griffin@ul.ie

Posttraumatic stress disorder (PTSD) is the experience of severe or sustained psychological and behavioral symptoms after a traumatic life event (American Psychological Association, 2017). Diagnostic measures that assess the incidence of PTSD revolve around identifying symptoms in predefined clusters or factors, such as symptoms relating to re-experiencing trauma, hyperarousal, and avoidance. The exact number of factors is debated, and a variety of different latent structures have been found (for a review see Armour et al., 2016). However, factor analytic research largely focuses on Western populations. Indeed, the concept of PTSD is sometimes argued to be a culture-bound Western disorder; that within non-Western populations certain events may not be seen as traumatic, and that the wording of items measuring PTSD does not take culture and the subjective meaning of the experience into account (Marsella et al., 1996; Patel & Hall, 2021; Summerfield, 2001; Young, 1997). While PTSD has been diagnosed cross-culturally (e.g., Marsella et al., 1996; Stein et al., 2013), prevalence rates vary widely, suggesting measurement issues with the diagnostic algorithms for PTSD (see also; Elhai et al., 2009; Forbes et al., 2011). It is important to examine if the underlying theoretical latent structure exists in non-Western populations if we are to have confidence in the cross-cultural validity of PTSD diagnoses. Therefore, we tested the factor structure of a commonly used PTSD measurement instrument, the PTSD Checklist Specific Stress Version (PCL-S; Weathers et al., 1993) based on the DSM-IV criteria (American Psychiatric Association, 1994) translated into Nepali, across two populations in Nepal and in the context of two trauma experiences—post-earthquake and after a traumatic life-changing spinal cord injury (SCI).

To fully understand the nature of the post-traumatic sequelae, Davis et al. (2015) highlight the collective or group-level component of trauma and the need for research to consider the scale of the trauma together with its cultural context. Nepal is replete with specific cultural, societal, and historical nuances associated with trauma. Culturally, for societies like Nepal who are struggling with basic infrastructure and severe poverty, the economic and social impacts of trauma (such as earthquakes) are often chronic and enduring. This is unlike the predominant acute conceptualization of trauma associated with PTSD in the West. Indeed, in Nepal there is no specific term that describes post-traumatic stress in the Nepali language or other languages spoken in Nepal (Kohrt & Hruschka, 2010). One idiom of distress widely used is *dukkha* (suffering, trouble, hardship). Dukkha is considered to be an inevitable and constant aspect of everyday life. As Hepburn (2017) notes, the word dukkha is far more commonplace than its counterpart *sukkha* (happiness, or more realistically, contentment with the lack of obvious, intrusive suffering). In this way, in Nepal this form of distress is not only socially acceptable but also a fundamental feature of human life. Dukkha is a normal part of everyday life.

Nepal has a long history of trauma. The Nepalese Civil War, fought between the Communist Party of Nepal Maoist (CPN-Maoist) and the Government of Nepal, was a bloody period in Nepali history from February 1996 to November 2006. Micro-data on the violence indicate that 15,021 cases of severe violence were perpetrated during the period (Joshi & Pyakurel, 2015). Of this figure, 13,234 were fatalities and 1,787 were cases of disappearances. Besides these casualties, 75,000 people were injured, and 250,000 were internally displaced. As Nepal emerged from this period of political violence, the devastating earthquake of April 2015 and its aftershocks occurred. The toll was again high with approximately 900 fatalities and 22,000 injured across Nepal. Alongside this is the occurrence of other traumas, including daily road traffic accidents that arise from poor policing and roads infrastructure and high incidence of falls resulting in SCIs due to the nature of work (often agricultural) and poor infrastructure (e.g., falls from trees, rooftops, cliffs), with the exact incidence of SCIs difficult to calculate (for reviews see; Karkee & Lee, 2016; Parajuli et al., 2020).

Furthermore, it is worth noting that the effects of trauma, including that experienced from the earthquake and road traffic accidents, are felt differently by ethnic, gender, and caste groups in Nepal. Although caste-based discrimination was made illegal in 1964, and the re-establishment of multiparty democracy in 1990 described Nepal as a multiethnic, multilingual, democratic state in which all citizens were equal, the number of cultural groups in Nepal is debated. The Central Bureau of Statistics (CBS) data records 126 different caste/ethnic groups and has recognized 63 groups in the Janajati ethnic group category. The legal and sociocultural norms that persist mean that women, and socially excluded low-caste and ethnic groups, experience far greater poverty and disadvantage. These issues are also intersectional, with gender disparities highest in the lowest caste and ethnic groups—for example, trafficking and servitude of low-caste women and girls is a pressing social concern (United National Office on Drugs and Crime (UNODC), 2009). Research has highlighted how social group memberships have strong influences on who experiences trauma, and how the trauma is experienced (Muldoon, 2024). For instance, in Nepal it is usually individuals from lower-income groups (or those lacking regular income) and males that are affected by SCIs from falls or motor vehicle accidents (Adhikari et al., 2020; Willott et al., 2021), and those with lower-income and lower-caste status who feel the burden of SCIs more (Sinha et al., 2022). Likewise, after the 2015 earthquake and aftershocks individuals in low-caste households and households without an adult male were less likely to receive aid (Panday et al., 2021; Pathak & Schündeln, 2022), and more likely to suffer indirect effects such as domestic violence, prostitution, and economic and psychological distress (Arora, 2022).

The factor structure of PTSD

It is worth noting that there is controversy around the exact underlying latent structure of PTSD, and much theoretical and empirical research has tested different underlying latent structures (for reviews see Armour et al., 2016; Elhai & Palmieri, 2011). A three-factor model was initially proposed by the fourth *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association, 1994), where a PTSD diagnosis could be made by evidence of: one symptom relating to Re-experiencing the event, three symptoms relating to Avoidance of stimuli associated with the trauma and numbing, and two symptoms of Hyperarousal. However, this model has been contested, and is argued to be a poor fit empirically and fails to capture the underlying symptom structure of PTSD (Asmundson et al., 2004; Baschnagel et al., 2005; Elhai & Palmieri, 2011; Yufik & Simms, 2010). Since this three-factor model was proposed, three other models have received the most support, and these appear to fit PTSD symptoms more accurately (for reviews see Armour et al., 2016; Yufik & Simms, 2010); the four-factor Emotional Numbing model (King et al., 1998), the four-factor Dysphoria model (Simms et al., 2002), and the five-factor Dysphoric Arousal model (Elhai, Biehn, Armour, et al., 2011). Table 1 presents these different models and their hypothesized underlying latent factors.

The present research focuses on the specified models in Table 1 as we employed the PCL-S (based on the DSM-IV), but it is worth noting the publication of the DSM-5 (American Psychiatric Association, 2013) only made some slight changes to the items used to assess PTSD. The DSM-5 specifies a four-factor model (American Psychiatric Association, 2013), consisting of Intrusion (Criterion B), Avoidance (Criterion C), Negative alterations in cognitions and mood (Criterion D), and alterations in Arousal and reactivity (Criterion E). Researchers have shown that datasets based on these two versions can be pooled (with transformations) due to the high concordance between the items (Moshier et al., 2019; Rosellini et al., 2015). For instance, Criterion D symptoms (in the DSM-5) are similar to that proposed by the Emotional Numbing factor, with the addition of two new symptoms (distorted blame of self or others for the trauma, and a negative emotional state) and the change of one symptom (a sense of a foreshortened future was replaced with negative expectations of self, others, or the world). Similarly, Criterion E symptoms appear to map onto the Hyperarousal factor with the addition of one new symptom (self-destructive behavior) and irritability/anger changed to aggressive behavior. Overall, this research has shown the four-factor DSM-5 closely represents the four-factor DSM IV Numbing model (King et al., 1998) but with a greater emphasis on dysphoria-related symptoms (Liu, Wang, Cao, Wang, et al., 2014).

Numerous studies have provided support for the Emotional Numbing model, the Dysphoria model, and the Dysphoric Arousal model, showing that these models have better fit than three-, two-, and one-factor models (e.g., Armour, Carragher, et al., 2013; for reviews see Armour et al., 2016; Yufik & Simms, 2010). The two four-factor models (Emotional Numbing and Dysphoria) appear similar; when they are compared against each other they appear to have similar indices of fit. However, the Dysphoria model appears to fit the data better more consistently than the Emotional Numbing model—but only marginally so (Yufik & Simms, 2010). Research comparing the five-factor Dysphoric Arousal model to these two four-factor models generally show the five-factor Dysphoric Arousal model is marginally superior (Armour, Carragher, et al., 2013; Armour et al., 2016). Indeed, much research has found support for this five-factor model (e.g., Armour, Carragher, et al., 2013; Hansen et al., 2012; Pietrzak et al., 2012), but of note this model was conceptualized only a few years prior to changes in the nosology of PTSD in the newer DSM-5 and thus had a shorter time for testing compared to other models. Importantly, regardless of the model tested, research using confirmatory factor analysis to test the underlying structure of PTSD has focused largely on Western populations (e.g., Armour, Carragher, et al., 2013; Hansen et al., 2012; Marshall, 2004; McWilliams et al., 2005; Pietrzak et al., 2012).

Prior CFA work on PTSD models across cultural contexts

Only a handful of studies have examined the structure of PTSD in non-Western populations despite the Global South being far more affected by traumatic experiences including war, earthquakes, and disability (Muldoon et al., 2019). However, evidence of PTSD symptoms fitting the hypothesized four- or five-factor structure have been found in non-Western populations, with the five-factor Dysphoric Arousal model showing good fit in: a Malaysian sample in response to a tsunami using a diagnostic interview (Armour, Raudzah Ghazali, et al., 2013); India following a natural disaster and displacement using the PCL-S (Charak et al., 2014); Rwanda following genocide using the PCL-C (Fodor et al., 2015); China following a traumatic spinal cord injury using the PCL-S (Liu, Wang, Cao, & Zhang, 2014); and in a civilian sample in the Philippines using the Harvard Trauma Questionnaire (HTQ; Mordeno et al., 2014). The Dysphoria model, meanwhile, was found to best represent the latent structure of PTSD in refugees in West Africa using the PSDS (Vinson & Chang, 2012). Interestingly, Michalopoulos and colleagues (2015) compared the fit of four established Western models (the three-factor DSM-IV, the four-factor Numbing model, and

Table 1. Factor structures of some hypothesized PTSD models

Model	Underlying Constructs	Examples of Support Found	Examples of Measurement Tools Used
Four-factor Emotional Numbing	Re-experiencing, Avoidance, Numbing, Hyperarousal	Asmundson et al. (2003); Carvalho et al. (2015); DuHamel et al. (2004); Elhai, Naifeh, et al. (2011); Maestas et al. (2011)	PTSD Checklist Civilian Version (PCL-C; Weathers et al., 1993), PTSD Checklist Military Version (PCL-M; Weathers et al., 1993), PTSD Symptom Scale Self-Report (PSS-SR; Foa et al., 1993)
Four-factor Dysphoria	Re-experiencing, Avoidance, Dysphoria, Hyperarousal	Baschnagel et al. (2005); Boelen et al. (2008); Elhai, Biehn, Naifeh, et al. (2011); Elklit et al. (2010); Frankfurt et al.(2015); Gauci & MacDonald (2012)	Posttraumatic Diagnostic Scale (PTDS; Foa et al., 1997), PSS-SR (Foa et al., 1993), PCL-Specific Stressor Version (PCL-S; Weathers et al., 1993). PCL-C (Weathers et al., 1993), The Harvard Trauma Questionnaire Part IV (HTQ; Mollica et al., 1992)
Five-factor Dysphoric Arousal	Re-experiencing, Avoidance, Numbing Dysphoric Arousal, Anxious Arousal	(Armour, Raudzah Ghazali, et al., 2013); Armour, O'Connor, et al. (2013); Harpaz-Rotem et al. (2014); Liu, Wang, Cao, & Zhang (2014); Mordeno (2012); Pietrzak et al. (2012); Wang et al. (2011)	Posttraumatic Stress Diagnostic Scale (PDS; Foa, 1995), HTQ (Mollica et al., 1992), PCL-M (Weathers et al., 1993), PCL-S (Weathers et al., 1993), PCL-C (Weathers et al., 1993)

four-factor Dysphoria model, and the four-factor DMS-5 model) using the Harvard Trauma Questionnaire, and showed that the Numbing model showed the best fit in sexual violence survivors the Democratic Republic of Congo and in Burmese refugees in Thailand, but none of these models showed adequate fit in torture survivors in Iraq. More recently, work using DSM-5 criteria has also found evidence of PTSD symptoms in non-Western countries mapping onto proposed factors (e.g., Brunnet et al., 2021; Ibrahim et al., 2019).

Overall then it appears that the hypothesized underlying latent factors of PTSD exist in a number of cultural contexts. This suggests that PTSD may be a universally experienced phenomenon. However, there is also a school of thought that suggests posttraumatic symptoms are culture-specific (e.g., Bracken, 1998; Young, 1997). For example, some research has argued that while Re-experiencing symptoms appear universal, other symptoms like Avoidance and Numbing may be culture dependent (Marsella et al., 1996; Marsella & Christopher, 2004; McCall & Resick, 2003). It remains the case that most models and measurement tools examining traumatic stress are the result of studies employing samples from Western, industrialized countries (Yeomans & Forman, 2009). To avoid category fallacy, that is assuming that constructs created in one cultural context exist in others (Kleinman, 1977), more research is needed to confirm that PTSD is a construct evident in a variety of cultures and in response to a range of traumatic events (Marsella et al., 1996). In fact, Fodor et al. (2015) highlighted that research applying Confirmatory Factor Analysis (CFA) in non-Western samples is lacking. If the proposed factor structure of PTSD does not exist in a variety of non-Western populations it may lead to errors in identifying individuals with PTSD, or misdiagnosing people as not having PTSD, which over time may result in the development of long-term mental disorders and prolong suffering (Agger et al., 1995).

The present research

In the present research we explored if the factor structure of PTSD exists in Nepal across two samples—the 2015 earthquake and a life-changing spinal cord injury. These samples were chosen on the premise that they experienced very different traumas. Individuals affected by the earthquake experienced a large-scale group-level trauma, where many people around them experienced the event also—they therefore had other people to relate to and draw resources from during this time. Whereas experience of a spinal cord injury is quite an individual-level trauma. Furthermore, examining the factor structure of PTSD across more than one type of trauma serves to increase the generalizability of our results.

We examined if PTSD symptoms in these populations fit hypothesized underlying latent structures by testing five models using CFA: (1) a one-factor solution (primarily as a comparison model), (2) the three-factor DSM-IV model (American Psychiatric Association, 1994), (3) the four-factor Emotional Numbing model (King et al., 1998), (4) the four-factor Dysphoria model (Simms et al., 2002), and the (5) five-factor Dysphoric Arousal model (Elhai, Biehn, Armour, et al., 2011). We explored each of these model structures to see if any, or all, fit data from this non-Western context, and we also compared the fit of these models to explore which fit the data best. Furthermore, given the diverse nature of the two samples and the potential inapplicability of Western models we conducted Exploratory Factor Analysis (EFA) on each sample

Table 2. Participant demographics

	Sample 1—Earthquake (N = 392)		Sample 2—SCI (N = 163)	
	n	%	n	%
Education (in years)				
Uneducated	5	1.28	30	18.4
Primary education (1–8)	113	28.8	48	29.4
Secondary education (9–12)	101	25.8	71	43.6[a]
University education	122	31.1	13	7.9[b]
Undisclosed	51	13.01	–	–
Income in Nepalese rupees (Euro equivalent)				
No regular income	–	–	151	92.6
<रु15,000 (<€116)	9	2.3	3	1.8
रु15,000–29,999 (€116–232)	21	5.4	3	1.8
रु30,000–44,999 (€232–348)	18	4.6	4	2.5
रु45,000–59,999 (€348–386)	29	7.4	–	–
>रु60,000 (> €386)	223	56.9	1	0.6
Undisclosed	92	23.5	1	.6

[a]In Sample 2, 41 people (25.2%) completed lower secondary education (9–10 years of education) and 30 (18.4%) completed higher secondary education (11–12 years). [b]In Sample 2, 10 people (6.1%) had a bachelor's degree and 3 (1.8%) had a Master's degree. These details were not collected in Sample 1.

to use a data-driven approach to explore the underlying factors. Given the relevance of group memberships, particularly gender, to the study of trauma (Muldoon, 2024; Muldoon et al., 2019), we also tested measurement invariance across gender.

To our knowledge, this is the first study to examine the underlying factor structure of PTSD symptoms in Nepal. Understanding the clusters of symptoms of PTSD in this cultural context can aid in assessing and diagnosing PTSD, and in turn the delivery of clinical interventions.

Methods

Translation, participants, and procedure

The second (KA) and last author (OM) reviewed all items of the English scale and considered their appropriateness to the Nepali context. Next the second author (KA) who is bilingual (English and Nepali) translated all items. This translation was then reviewed by another bilingual speaker and back-translated to ensure the meaning of the items held. Items where the meaning was seen to have been compromised were further discussed between the second author (KA) and the other translator, until agreement was reached that the intended meaning of the item had been retained in the translation.

A priori power analyses were conducted using the semPower 2 package (Moshagen & Bader, 2023b) for *R* statistical programming (R Core Team, 2021). Based on a power of 80%, an alpha error level of .05, a RMSEA of at least .05, a sample size of 170 was needed to ensure adequate power (Moshagen & Bader, 2023a).

Sample 1: Community sample affected by the 2015 earthquake. Six months after the April 2015 earthquake in Nepal, 392 Nepali people (207 male, 177 female, 1 third gender, and 7 people did not report their gender) directly affected by the earthquake were recruited to take part in the study. Participants were 15–84 years of age ($M = 35.18$, $SD = 16.59$) and were living in eight of the fourteen districts declared by the government of Nepal as the most affected by the earthquake (Gorkha, Dhading, Nuwakot, Kathmandu, Lalitpur, Bhaktapur, Kavrepalanchowk, and Sindhupalchowk), where there was a significant loss of life. Table 2 displays further participant demographics.

Full ethical approval was provided by the host university prior to commencement of the project (approval number: 2014_11_15_EHS). Data were collected over a one-week period by the second and last authors (KA & OM) in liaison with a team of university students in Nepal trained in the administration of the survey. The second author (KA) worked with gatekeepers in affected communities to make contact with interested participants in the field. Informed consent was obtained from all participants. Given the political, social, and economic climate, literacy rates in Nepal tend to be low—particularly among women and those from lower-caste groups (Dhakal, 2018; NPHC, 2011). Although in recent years, due to significant investment and literacy programs, literacy rates have increased, at the time of the present research, literacy rates were approximately 66% (World Bank, 2016). For participants who struggled with literacy or numeracy the questions were read to them on a one-on-one basis so that understanding could be checked (60% of the sample) and answers recorded. The second (KA) and last author (OM) trained twenty graduate and final year university students in Nepal to administer the surveys in this way to ensure they could check that participants understood the questions, the importance of facilitating free responses, as well as participants right to withdraw. The remaining 40% of the sample had good literacy and numeracy so completed the questionnaires themselves in paper/pen format. All respondents received a full explanation of the purpose of the survey prior to completing it. This was provided in writing and also, given low levels of literacy, was explained to participants when invited to participate. The confidentiality and anonymity of all responses was assured; participants were also given the opportunity to refuse to participate and/or to withdraw at any time. Where respondents appeared to be particularly distressed, follow-up support was made available.

Sample 2: Nepali people affected by a spinal cord injury (SCI). One hundred and sixty-three participants completed PTSD measures one month following a SCI (123 males, 40 females). Participants were 17–70 years of age ($M=$ 36.28, $SD=12.41$). Participants were recruited from admissions to the Spinal Injury Rehabilitation Centre for Nepal and the Kathmandu University Hospital in Nepal during 2020 and 2021 by the third author (BP) and a local research team. Participants suffering a SCI from a trauma or an accident (e.g., motor vehicle accident, a fall) were eligible for participation. However, participants with a SCI from atraumatic causes were not eligible (e.g., tumors). The International Standard for Neurological Classification of Spinal Cord Injury (Kirshblum et al., 2011) published by the American Spinal Injury Association (ASIA) was used to quantify neurological impairment due to the SCI. The majority of patients (64%) had a T1-S4/5 injury ASIA-A (most severe), ASIA-B, or ASIA-C. The percentage of patients who had a C1–C4 injury ASIA-A, ASIA-B, or ASIA-C was 13.4%. Among the patients with ASIA-A and ASIA-B injuries, 89 patients (54.6% of total) were paraplegic (unable to move their lower limbs), and 22 patients (13.5% of total) were tetraplegic (unable to move both the upper and the lower limbs). Table 2 presents full demographics for the sample. Full ethical approval was obtained from the Institutional Review Committee (IRC) of Kathmandu University School of Medical Sciences (KUSMS) prior to commencement of the project, and informed consent was obtained from all participants. The translated PTSD items used in Sample 1 were employed to maintain consistency. Participants who were literate completed the measure independently, and participants who were illiterate were asked the questions by trained physiotherapists or the physician who checked for understanding.

Measures

PTSD checklist: Specific stress version (PCL-S). We used the 17-item PCL-S which identifies comparable rates of PTSD as the 20-item PCL-5 (based on the new DSM-5; Kaysen et al., 2021; LeardMann et al., 2021; Rosellini et al., 2015). This decision was based on the fact that it had been adapted for use with an illiterate population, as well as previously translated and back translated in 2013. In a region where research tolls are limited this was a serious consideration. We examined PTSD in relation in an earthquake that devastated large regions of the country in 2015, and also in 2021 with those affected by spinal injuries.

Participants were asked if they had experienced a particularly distressing event due to the earthquake (Sample 1) or due to their injury (Sample 2). Initial piloting testing of our translated measure revealed complications due to participant's limited literacy and numeracy, and unfamiliarity with responding to survey statements and Likert scales. To aid comprehension, a laminated picture of the Likert response format was used which showed five glasses with water increasing in volume, representing empty (1 = Not at all) to full of water (5 = Extremely/always). This response format has been tested and validated for use with populations with limited literacy previously (Tewari et al., 2012).

Data analysis plan

Exploratory Factor Analysis (EFA) was conducted to explore the underlying structure of PTSD in these two samples. The *EFA tools* package in *R* (Steiner & Grieder, 2020) was used. The factor structure of these data-driven models was then tested using CFA.

Confirmatory factor analysis (CFA) was conducted using R packages *lavaan* (Rosseel, 2012) and *semTools* (Jorgensen et al., 2022) to test the theoretically driven models and the EFA data-driven model. Item scores on the PCL-S were not normally distributed and therefore maximum likelihood estimation was used. All models were evaluated with goodness-of-fit statistics, including the comparative fit index (CFI), the Tucker–Lewis index (TLI), the standardized root–me[an square residual (SRMR; Bentler, 1990), and the root–mean square error of approximation (RMSEA; Steiger, 1990). Models with lower RMSEA, SRMR, and higher CFI are thought to be better fitting. While there are no strict cut-offs for evaluating fit indices, it is generally accepted that good fit is suggested when the RMSEA is .08 or lower (Browne & Cudeck, 1993), SRMR is .05 or lower (Diamantopoulos & Siguaw, 2000), and CFI is higher than .90. Chi-squared tests were conducted to assess absolute fit. However, as this is sample-size dependent it is likely to be significant and not an accurate assessment of the model fit (Kline, 2005).

To directly compare the goodness of fit of each model (the theoretical models outlined and the EFA data-driven models), the sample-size adjusted Bayesian Information Criterion (BIC)

Table 3. Sample 1 (earthquake)—Results of the EFA: pattern of factor loadings with proposed factor structure labels, with communalities and scale reliability (Cronbach's α) of each factor

		F1	F2	F3	Com.	α
Factor 1: Reexperiencing/Avoidance/Emotional symptoms						
B1	Repeated, disturbing memories, thoughts, or images	.797			.647	.845
B2	Repeated, disturbing dreams	.798			.705	
B3	Suddenly acting or feeling as if it were happening again (as if you were reliving it)	.726			.552	
B4	Feeling very upset when something reminded you of it	.336			.264	
C1	Avoid thinking about or talking about it or avoid having feelings related to it	.351			.155	
C2	Avoid activities or situations because they remind you of it	.542			.340	
C4	Loss of interest in things that you used to enjoy	.505			.322	
D4	Being "super alert" or watchful on guard?	.486			.247	
Factor 2: Dysphoria						
C3	Trouble remembering important parts		.559		.356	.863
C5	Feeling distant or cut off from other people		.732		.550	
C6	Feeling emotionally numb or being unable to have loving feelings for those close to you		.748		.618	
C7	Feeling as if your future will somehow be cut short		.462		.276	
D1	Trouble falling or staying asleep		.442		.264	
D2	Feeling irritable or having angry outbursts		.764		.600	
D3	Having difficulty concentrating		.598		.395	
Factor 3: Hyperarousal						
B5	Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of it			.556	.430	.786
D5	Feeling jumpy or easily startled			.401	.342	

Note: F = Factor.

was examined (Schwarz, 1978). A 10-point BIC difference represents a 150:1 likelihood that the model with the lower BIC value fits best. BIC differences between 6 and 10 points indicate strong support that the lower model is a better fit, while a value of more than 10 points indicates very strong support for a better fit (Raftery, 1995).

We then examined measurement-invariance of the best-fitting theoretical models across the two samples by conducting a multiple group confirmatory factor analysis (MGCFA). We also examined measurement invariance across gender. To test for different levels of invariance, we first examined configural invariance (same factor structure imposed on both groups); secondly, metric or measurement invariance (factor loadings constrained to be equal across groups); and thirdly, scalar invariance (factor loadings and intercepts constrained to be equal across groups). Metric invariance would mean that cross-sample comparisons are allowed, while scalar invariance allows mean comparison of the underlying constructs across samples.

Results

Sample 1: Community sample affected by the 2015 earthquake

Exploratory factor analysis. The mean PTSD score for the sample was 51.12 ($SD = 18.12$, range = 17–153).[1] Factorability of the data met recommended standards, Bartlett's test of sphericity was significant, χ^2 (136) = 2787.41, $p < .001$, and the Kaiser–Meyer–Olkin measure of sampling adequacy was high (KMO = .93). Parallel analysis using both EFA and maximum likelihood estimation suggested retaining three factors. Using maximum likelihood estimation, and an oblique (oblim) rotation, EFA with three factors showed good fit to the data, χ^2 (88) = 191.04, $p < .001$, CFI = .99, RMSEA = .06 [.05; .07], AIC = 15.04, and BIC = −323.44. Factor loadings, communalities, and Cronbach's α for each factor are presented in Table 3. However, communalities for a number of items were low; items B4, C1, C7, D1, D4 were below .3. The retained factors suggest the first factor relates to a mix of Reexperiencing, Avoidance, and Emotional Symptoms (items B1, B2, B3, B4, C1, C2, C4, D4), explaining 44.98% of the variance in the data. A second factor relating to more Dysphoric-related symptoms (items C3, C5, C6, C7, D1, D2, D3) explained 43.56% of the variance, and a third factor relating to Hyperarousal symptoms (items B5, D5) explained 11.46% of the variance in the data.

Confirmatory factor analysis. Confirmatory factor analysis of the theoretical models showed none demonstrated excellent fit to the data (i.e., with a CFI/TLI > .95 and RMSEA < .06). Fit statistics for the five theoretical models tested and the data-driven three factor EFA model are presented in

Table 4. Fit statistics for the tested models using CFA

Model	χ^2(df)	CFI	TLI	SRMR	RMSEA	BIC
Sample 1—Community sample affected by earthquake ($n = 392$)						
1. One factor	565.58(119)	.835	.812	.069	.104	20409.17
2. Three factor DSM-IV	467.50(116)	.870	.848	.068	.094	20319.11
3. Emotional Numbing (4 factor)	435.88(113)	.881	.857	.066	.091	20295.51
4. Dysphoria (4 factor)	**407.39(113)**	**.891**	**.869**	**.064**	**.087**	**20267.03**
5. Dysphoric arousal (5 factor)	400.44(109)	.893	.866	.063	.088	20270.77
6. EFA model (3 factor)	**343.41(116)**	**.916**	**.902**	**.059**	**.075**	**20312.39**
Sample 2—Sample affected by SCI ($n = 163$)						
1. One factor	420.66(119)	.693	.649	.084	.125	8789.21
2. Three factor DSM-IV	335.34(116)	.777	.738	.122	.108	8709.67
3. Emotional Numbing (4 factor)	306.16(113)	.804	.764	.116	.102	8686.27
4. Dysphoria (4 factor)	293.58(113)	.816	.779	.114	.099	8673.70
5. Dysphoric arousal (5 factor)	286.40(109)	.820	.775	.114	.100	8674.23
6. EFA model (3 factor)	**158.76(87)**	**.895**	**.873**	**.065**	**.071**	**7832.22**

Note: Numbers in bold = optimal fitting models.

Table 4. In terms of the theoretical models, it appears that Model 4 (four-factor Dysphoria model; BIC of 20267.03) and Model 5 (five-factor Dysphoric Arousal model; BIC of 20270.77) represented the best fit to the data, with acceptable fit values, but the difference between these models appeared minimal (with a BIC difference of 3.74). However, Model 5 resulted in a not positive definite covariance matrix, potentially due to the high covariances between the Numbing and Dysphoric factors (1.018) suggesting Model 4 to be a better fit. Examination of the BIC values showed strong support for Model 4 to be a better fit compared to Model 1 (difference = 142.14), Model 2 (difference = 52.08), and Model 3 (difference = 28.48). Table 5 demonstrates the factor loadings and Cronbach's alphas for each theoretical model. Confirmatory Factor Analysis was also conducted on the factors identified by the EFA, and Table 6 displays the factor loadings and Cronbach's alphas. Comparing the data-driven three-factor model (stemming from the EFA) to the theoretical models, based on the fit indices it would appear the extracted three-factor model better fit the data. However, when considering the BIC values Model 4 appears to better fit the data than the EFA model (difference = 45.36). Fit statistics for all models tested are presented in Table 4.

Sample 2: Nepali people affected by a spinal cord injury

Exploratory factor analysis. The mean PTSD score for the sample was 36.01 ($SD = 13.59$, range = 17–82). Factorability of the data met recommended standards, Bartlett's test of sphericity was significant, χ^2 (136) = 1067.75, $p < .001$, and the Kaiser–Meyer–Olkin measure of sampling adequacy was high (KMO = .85). However, items B1 and B2 were highly correlated ($r = .87$), and to reduce issues arising from multicollinearity these indicators were combined using averaging. Parallel analysis using both EFA and maximum likelihood estimation suggested retaining four factors. Using maximum likelihood estimation and an oblique (oblim) rotation, EFA with four factors showed good fit to the data, χ^2 (62) = 87.23, $p = .019$, CFI = .99, RMSEA = .05 [.02; .07], AIC = -36.77, and BIC = −228.59. However, communalities for a number of items were low; items B4, B5, C2, C3, C4, D1, D2, and D4 were below .3. Item B4 loaded poorly onto all factors (.231).

As item B4 did not load onto any factor, EFA was re-conducted excluding this item. The results of parallel analysis using EFA and maximum likelihood estimation suggested retaining three factors, and led to a better-fitting model, χ^2 (63) = 93.28, $p = .008$, CFI = .98, RMSEA = .05 [.03; .08], AIC = −32.72, and BIC = −227.62. Factor loadings, communalities, and Cronbach's α for each factor are presented in Table 7. However, communalities for a number of items were low; items B5, C4, D2, D4, D5 and the composite B1/B2 were below .3. The retained factors suggest one factor relating to Dysphoria/Arousal (items C3, C4, C5, C6, C7, D1, D2, D3, D5), explaining 50.91% of the variance in the data. A second factor relating to Reexperiencing symptoms (items B1/B2 composite, B3, B5) explained 27.54% of the variance, and a third factor relating to Avoidance/Hyperarousal symptoms (items C1, C2, D4) explained 21.55% of the variance in the data.

Confirmatory factor analysis. The five theoretical models were tested with all items included,[2] and the three-factor data-driven EFA model. As can be seen in Table 4, no model demonstrated excellent fit to the data (i.e., with a CFI/TLI > .95 and RMSEA < .06). In terms of the theoretical models, it appears that Model 4 (four-factor Dysphoria model; BIC of 8673.70) and Model 5 (five-factor Dysphoric Arousal model; BIC of 8674.23) represented the

Table 5. Sample 1 (earthquake)—Standardized factor loadings for each theoretical model from CFA and Cronbach's α for each subscale

		1 factor	α	DSM-IV (3 factor)		α	Emotional Numbing (4 factor)		α	Dysphoria (4 factor)		α	Dysphoric Arousal (5 factor)		α
B1	Recurrent thoughts	.66	.919	.73		.856	.74		.856	.74		.856	.74		.856
B2	Recurrent dreams	.68		.77			.78			.78			.78		
B3	Reliving/flashbacks	.74		.82	R		.82	R		.82	R		.82	R	
B4	Psychological cue reactivity	.70		.69			.69			.69			.69		
B5	Physiological cue reactivity	.74		.73			.73			.73			.73		
C1	Avoidance of thinking/talking	.50		.48		.775	.63	AV	.488	.64	AV	.488	.63	AV	.488
C2	Avoidance of reminders	.38		.36			.51			.50			.51		
C3	Trouble remembering	.69		.71			.72		.791	.71			.71		.791
C4	Loss of interest	.63		.61	AV		.60			.60			.59		
C5	Feeling detached	.51		.56			.59	N		.60			.59	N	
C6	Emotionally numb	.66		.71			.73			.73	D	.869	.73		
C7	Sense of doomed future	.64		.65			.66			.66			.66		
D1	Sleeping difficulties	.66		.66		.779	.66		.779	.67			.67		.714
D2	Irritability/Anger	.56		.61			.61			.64			.65	DA	
D3	Difficulty concentrating	.71		.73	H		.73	H		.76			.75		
D4	Hypervigilance	.53		.52			.52			.56	H	.618	.56	AA	.618
D5	Easily startled	.75		.72			.72			.78			.78		

Note: R = re-experiencing, AV = avoidance, N = numbing, H = hyperarousal, D = dysphoria, DA = dysphoric arousal, AA = anxious arousal.

best fit to the data, with acceptable fit values, but the difference between these models appeared minimal (with a BIC difference of 0.53). However, Model 5 resulted in a not positive definite covariance matrix, potentially due to the high covariances between the Numbing and Dysphoric factors (1.04), as such Model 4 appeared to better fit the data. Examination of the BIC values showed strong support for Model 4 to be a better fit compared to Model 1 (difference = 115.51), Model 2 (difference = 35.97), and Model 3 (difference = 12.57). Table 8 demonstrates the factor loadings and Cronbach's alphas for each model. Confirmatory factor analysis was also conducted on the factors identified by the EFA, and Table 9 displays the factor loadings and Cronbach's alphas. Comparing the data-driven EFA three-factor model to the theoretical models, based on the fit indices and the BIC values it would appear the extracted three-factor model better fit the data. Indeed, the EFA-derived model had a lower BIC than Model 4 (difference = 841.48). Fit statistics for all models tested are presented in Table 4.

Measurement invariance across samples

We fitted the four-factor dysphoria model to the pooled sample data. A MGCFA was conducted, and Table 10 displays the results of the invariance tests. Based on the results of the configural invariance model, this model cannot be rejected suggesting the four-factor dysphoria model was invariant across the two samples. The chi-square difference test demonstrates that the full metric invariance model (factor loadings constrained) led to a significant increase over the configural invariance model. Likewise, the scalar invariance model led to a significant increase over the metric invariance model. As such this suggests the four-factor dysphoria model demonstrates scalar invariance and the means of PTSD can be compared across these two samples.

Measurement invariance across gender

Sample 1: Community sample affected by the 2015 earthquake. We fitted both the theoretically best-fitting model (the four-factor dysphoria model) and the data-driven three-factor EFA model (given both fit the data well) to examine measurement invariance across gender. Table 11 displays the results of the invariance tests.

Based on the results of the configural invariance model, the four-factor dysphoria model cannot be rejected suggesting it was invariant across the two samples. The chi-square difference test demonstrated the full metric invariance model (factor loadings constrained) did not lead to a significant increase over the configural invariance model, $p = .304$. Likewise, the scalar invariance model did not lead to a

Table 6. Sample 1 (earthquake)—Standardized factor loadings from CFA, for the EFA-derived model

		EFA derived 3-factor model	
B1	Recurrent thoughts	.75	M
B2	Recurrent dreams	.78	M
B3	Reliving/flashbacks	.82	M
B4	Psychological cue reactivity	.68	M
C1	Avoidance of thinking/talking	.49	M
C2	Avoidance of reminders	.43	M
C4	Loss of interest	.64	M
D4	Hypervigilance	.56	M
C3	Trouble remembering	.70	D
C5	Feeling detached	.61	D
C6	Emotionally numb	.75	D
C7	Sense of doomed future	.67	D
D1	Sleeping difficulties	.66	D
D2	Irritability/Anger	.65	D
D3	Difficulty concentrating	.77	D
B5	Physiological cue reactivity	.81	H
D5	Easily startled	.81	H

Note: M = mixed symptoms relating to Reexperiencing, Avoidance, and Emotional Symptoms, D = Dysphoria, H = Hyperarousal.

significant increase over the metric invariance model, $p = .271$. As such this suggests the four-factor dysphoria model does not demonstrate scalar invariance and the means of PTSD cannot be compared across gender groups in this sample.

For the three-factor EFA model, based on the results of the configural invariance model, this model cannot be rejected suggesting this data-derived three-factor model was invariant across the two samples. The chi-square difference test demonstrated the full metric invariance model (factor loadings constrained) did not lead to a significant increase over the configural invariance model, $p = .160$. Likewise, the scalar invariance model did not lead to a significant increase over the metric invariance model, $p = .156$. As such this suggests the three-factor EFA model does not demonstrate scalar invariance, and the means of PTSD cannot be compared across gender groups.

Sample 2: Nepali people affected by a spinal cord injury. We fitted both the theoretically best-fitting model (the four-factor dysphoria model), and the data-driven three-factor EFA model considering both fit the data well.

For the theoretically derived four-factor Dysphoria model, MGCFA failed to converge due multicollinearity (items B1 and B2). Therefore, MGCFA was conducted with these items combined. Table 12 displays the results of the invariance tests. Based on the results of the configural invariance model, this model cannot be rejected suggesting the four-factor dysphoria model was invariant across the two samples. The chi-square difference test demonstrated that the full metric invariance model (factor loadings constrained) did not lead to a significant increase over the configural invariance model, $p = .603$. Likewise, the scalar invariance model did not lead to a significant increase

Table 7. Sample 2 (SCI)—Pattern of factor loadings with proposed factor structure labels, with communalities and scale reliability of each factor from EFA

		F1	F2	F3	Com.	α
Factor 1: Dysphoria/Arousal						
C3	Trouble remembering important parts	.555			.311	.817
C4	Loss of interest in things that you used to enjoy	.311			.229	
C5	Feeling distant or cut off from other people	.754			.576	
C6	Feeling emotionally numb or being unable to have loving feelings for those close to you	.535			.342	
C7	Feeling as if your future will somehow be cut short	.588			.430	
D1	Trouble falling or staying asleep	.486			.351	
D2	Feeling irritable or having angry outbursts	.444			.237	
D3	Having difficulty concentrating	.635			.417	
D5	Feeling jumpy or easily startled	.467			.247	
Factor 2: Reexperiencing						
B3	Suddenly acting or feeling as if it were happening again (as if you were reliving it)		.913		.856	.734
B5	Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of it		.350		.295	
B1/B2	Composite indictor of B1 (Repeated, disturbing memories, thoughts, or images) and B2 (Repeated disturbing dreams)		.481		.286	
Factor 3: Avoidance/Hyperarousal						
C1	Avoid thinking about or talking about it or avoid having feelings related to it			.677	.459	.621
C2	Avoid activities or situations because they remind you of it			.557	.321	
D4	Being "super alert" or watchful on guard			.316	.169	

Table 8. Sample 2 (SCI)—Standardized factor loadings for each theoretical model, using CFA, and Cronbach's α for each subscale

		1 factor	α	DSM-IV (3 factor)		α	Emotional Numbing (4 factor)		α	Dysphoria (4 factor)		α	Dysphoric Arousal (5 factor)		α
B1	Recurrent thoughts	.57	.881	.89		.797	.89		.797	.89		.797	.89		.797
B2	Recurrent dreams	.66		.97			.96			.96			.96		
B3	Reliving/flashbacks	.62		.57	R		.57	R		.57	R		.57	R	
B4	Psychological cue reactivity	.55		.26			.27			.27			.27		
B5	Physiological cue reactivity	.69		.45			.45			.45			.46		
C1	Avoidance of thinking/talking	.41		.36		.699	.62	AV	.595	.61	AV	.595	.61	AV	.595
C2	Avoidance of reminders	.42		.41			.69			.70			.70		
C3	Trouble remembering	.46		.51			.52		.701	.51		.799	.52		.701
C4	Loss of interest	.53		.52	AV		.53			.53			.52		
C5	Feeling detached	.58		.66			.69	N		.68			.70	N	
C6	Emotionally numb	.50		.55			.54			.53	D		.54		
C7	Sense of doomed future	.61		.63			.66			.65			.65		
D1	Sleeping difficulties	.59		.58		.724	.58		.724	.60			.58		.586
D2	Irritability/Anger	.57		.60			.60			.57			.55	DA	
D3	Difficulty concentrating	.60		.64	H		.64	H		.64			.60		
D4	Hypervigilance	.50		.52			.52			.63	H	.609	.64	AA	.609
D5	Easily startled	.58		.60			.60			.70			.69		

Note: R = re-experiencing, AV = avoidance, N = numbing, H = hyperarousal, D = dysphoria, DA = dysphoric arousal, AA = anxious arousal.

Table 9. Sample 2 (SCI)—Standardized factor loadings from CFA, for the EFA derived model

		EFA derived 3-factor model	
C3	Trouble remembering	.52	D/A
C4	Loss of interest	.53	
C5	Feeling detached	.67	
C6	Emotionally numb	.53	
C7	Sense of doomed future	.65	
D1	Sleeping difficulties	.60	
D2	Irritability/Anger	.59	
D3	Difficulty concentrating	.63	
D5	Easily startled	.58	
B1/B2	Recurrent thoughts & Recurrent dreams	.63	R
B3	Reliving/flashbacks	.70	
B5	Physiological cue reactivity	.75	
C1	Avoidance of thinking/talking	.57	A/H
C2	Avoidance of reminders	.66	
D4	Hypervigilance	.58	

Note: D/A = Dysphoria and Arousal symptoms, R = Reexperiencing, A/H = Avoidance and Hyperarousal symptoms.

over the metric invariance model, $p = .483$. As such this suggests the four-factor Dysphoria model does not demonstrate scalar invariance and the means of PTSD cannot be compared across gender groups in this sample.

For the three-factor EFA model, based on the results of the configural invariance model, this model cannot be rejected suggesting this data-derived three-factor model was invariant across the two samples. However, the chi-square difference test demonstrated the full metric invariance model (factor loadings constrained) did not lead to a significant increase over the configural invariance model, $p = .607$. Likewise, the scalar invariance model did not lead to a significant increase over the metric invariance model, $p = .580$. As such this suggests the three-factor EFA model does not demonstrate scalar invariance, and the means of PTSD cannot be compared across gender groups.

Discussion

To our knowledge, the present research is the first to examine if PTSD symptoms show a similar latent structure in Nepal to that observed in Western populations. While the aim of the research was not to determine the "best-fitting model," we show that the four-factor Dysphoria model demonstrated the best fit to the data compared to other theoretical derived models, with good fit indices. This model also demonstrated scalar invariance across two samples who experienced qualitatively different traumas, meaning PTSD scores were comparable across samples using this model. One group experienced an earthquake, a somewhat collective trauma which was also experienced by others around them. The other group experienced a life-changing traumatic spinal cord injury—a more individual trauma. These results demonstrate evidence that PTSD symptoms cluster somewhat (but not excellently) around previously hypothesized Western factor structures across two Nepalese samples.

We also explored the underlying factor structure using EFA to shed further light on the how PTSD symptoms might map onto these samples in Nepal. This provided somewhat conflicting results, identifying a three-factor structure in each. In the earthquake sample these factors related to a mixture of re-experiencing /avoidance/emotional symptoms, dysphoria, and hyperarousal. In the SCI sample, factors

Table 10. MGCFA for four-factor Dysphoria model

Model	Chi-square	*df*	Chi-square Difference	AIC	BIC	RMSEA
Four-factor Dysphoria Model						
1. Configural invariance	700.98	226		28985	29467	
2. Full metric invariance	822.18	239	121.20*	29080	29507	0.181
3. Scalar invariance	909.05	252	909.05*	29141	29513	0.149

Note: * denotes $p < .001$.

Table 11. MGCFA for gender, four-factor Dysphoria Model and data-driven EFA model in Sample 1

Model	Chi-square	*df*	Chi-square Difference	AIC	BIC	RMSEA
Four-factor Dysphoria Model						
1. Configural invariance	553.32	226		19786.02	20221.85	
2. Full metric invariance	568.38	239	15.06	19775.08	20161.21	0.09
3. Scalar invariance	583.99	252	15.62	19764.70	20101.13	0.08
EFA Three-factor Model						
1. Configural invariance	513.25	232		19733.95	20146.84	
2. Full metric invariance	532.38	246	19.25	19725.08	20084.44	0.08
3. Scalar invariance	551.62	260	19.25	19716.33	20022.17	0.08

Note: * denotes $p < .001$.

appeared to represent dysphoria/arousal, re-experiencing, and avoidance/hyperarousal symptoms. While the four-factor Dysphoria model still better fit the data from those affected by the earthquake, the data-driven model seemed to better fit the data from those affected by a SCI.

Some previous research has argued that PTSD might be culture specific (Marsella et al., 1996; Patel & Hall, 2021; Summerfield, 2001; Young, 1997), and that within non-Western populations symptoms might be different (Marsella & Christopher, 2004; McCall & Resick, 2003). As previously highlighted, it is important that PTSD is accurately assessed if we are to diagnose and treat PTSD in such populations. The observed results of this research provide some support for the premise that PTSD symptoms are universally experienced, or at the least provides some evidence of this in Nepal. Our results also replicate and contribute to previous literature on factor-analytic work in other non-Western samples, including Malaysia, India, Rwanda, China, and West Africa (Armour, Raudzah Ghazali, et al., 2013; Charak et al., 2014; Fodor et al., 2015; Liu, Wang, Cao, & Zhang, 2014; Vinson & Chang, 2012).

In addition, the four-factor Dysphoria model (Re-experiencing, Avoidance, Dysphoria, Hyperarousal) appears to most accurately represent PTSD's latent structure in both these samples compared to the other theoretical models, and it demonstrated scalar invariance. While it is a limitation of the present research that we did not use a revised DSM-5 PTSD assessment tool (American Psychiatric Association, 2013), considering that the four- and five-factor models tested and the PCL-S closely resembles the DSM-5 PTSD criteria (e.g., Kaysen et al., 2021; LeardMann et al., 2021; Rosellini et al., 2015), our research results would support the use of revised DSM-5 measures to assess PTSD symptomology in this non-Western population.

It is worth noting, however, that EFAs indicated a different underlying factor structure in both samples to that suggested by the four-factor Dysphoria model. While acknowledging that the four-factor Dysphoria model demonstrated good fit to the data, it points to the importance of considering the data—and the context. Interestingly, EFAs indicated the structure was also different across the two samples. This may be due to the nature of the trauma experienced. The earthquake was an experience victims shared with many others in real time, whereas the spinal cord injuries were largely experienced individually. This different pattern of symptoms may reflect this difference in people's sense of shared experience of their trauma. Furthermore, it highlights how trauma symptoms are sensitive to the culture they are situated within—PTSD is a socially situated phenomenon. Indeed, in Nepal suffering and hardship (dukkha) are seen as a normal part of life (Hepburn, 2017). However, we advise caution in interpreting the factor structure identified by EFAs. Due to our sample size we may have lacked statistical power for EFA, and a number of items had low communalities (Costello & Osborne, 2005; Williams et al., 2010).

Given that trauma is gendered, including its incidence and experience (e.g., Muldoon, 2024), it is interesting that neither the four-factor Dysphoria model nor the data-driven models identified from EFA demonstrated scalar invariance. Gender appears to have affected response patterns to the items. This differs from some past research

Table 12. MGCFA for gender, four-factor Dysphoria Model and data-driven EFA model in Sample 2

Model	Chi-square	*df*	Chi-square Difference	AIC	BIC	RMSEA
Four-factor Dysphoria Model						
1. Configural invariance	348.48	196		8264.66	8598.79	
2. Full metric invariance	358.63	208	10.15	8250.81	8547.81	0.09
3. Scalar invariance	370.17	220	11.54	8238.35	8498.23	0.09
EFA Three-factor Model						
1. Configural invariance	307.25	174		7780.8	8077.8	
2. Full metric invariance	317.35	186	10.10	7766.92	8026.79	0.09
3. Scalar invariance	327.76	198	10.41	7753.32	7976.07	0.09

Note: * denotes $p < .001$.

showing the latent structure of PTSD to be similar across males and females (Chung & Breslau, 2008; Tay et al., 2017), but is consistent with other work (Armour et al., 2011; Frankfurt et al., 2016). This may suggest that men and women in Nepal cannot be accurately compared with regards to item-level severity. It also has implications for clinicians, as it suggests the utility of counting symptoms in clusters or using a cut-off score to determine PTSD diagnosis may be poor.

A strength of this research is the employment of two different trauma samples to examine the underlying latent structure of PTSD. The fact that the four-factor Dysphoria model fits and demonstrates scalar invariance across two samples adds confidence to the observed results. Interestingly, in Sample 2 (SCI sample) overall mean PTSD scores were lower and item B4 (psychological cue reactivity) did not load onto its factor (across all models), while this item did load onto its factor in the natural disaster sample. This suggests that this item might be a poor marker of re-experiencing symptoms in SCI patients in Nepal. Of note, however, this factor was found to load well in a sample of SCI patients in China (Liu, Wang, Cao, & Zhang, 2014). As such, further research is needed to explore this before any conclusions can be drawn.

Moreover, conducting research in non-WEIRD (Henrich et al., 2010) contexts is challenging and a key issue for this research was the adaption of the scale for use with those who had limited literacy and numeracy and did not speak English. This presented language issues but also challenges in terms of how people could offer meaningful responses. Despite this, accessing two distinct samples of this size among a difficult-to-reach population is a significant strength of this research.

While we did employ two different samples in an under-studied population to test our hypotheses, we acknowledge the limitations with cross-sectional designs. Longitudinal studies to examine the temporal stability of symptom dimensions would be a welcome next step in non-Western contexts. Further, future research can build on the present findings by using DSM-5 assessment methods to assess PTSD symptoms. Likewise, future research should test the convergent and discriminant validity of PTSD models. Additional research is needed to understand how PTSD relates to such outcomes in a non-Western context like Nepal.

In summary, the present research adds to a growing existing literature demonstrating the validity of assessing PTSD symptoms in non-Western and non-WEIRD samples. Importantly, these findings lend support for the premise that the way PTSD is defined in Western cultures appears to translate somewhat to non-Western cultures and provides preliminary evidence that PTSD symptoms cluster around hypothesized Western factor structures across two Nepalese samples. However, given that no model was an excellent fit to the data, as well as the lack of measurement invariance across gender, it suggests a more holistic approach to assessing, and treating, PTSD symptoms (e.g., taking into account functional status, other DSM markers, and the cultural context—like dukkha). In particular, it has implications for clinicians in determining a PTSD diagnosis, and the results would suggest against the use of clusters or PTSD cut-offs. We also cannot claim that these samples are representative of the experience of trauma across different populations in Nepal, but the results do offer insights into an under-researched and under-represented sample. Further research is needed in this area, and further exploration across other non-Western samples.

Acknowledgements

This research was supported by an Irish Research Council New Foundations Scheme (Sample 1) and the University Grants Commission, Nepal, Funding ID: FRG-75/76-HS-16 (Sample 2). This research is also supported by the European Research Council (ERC) under an Advanced Grant (Grant agreement no. 884927). We wish to acknowledge the BBIS, Pharmacy, and Human Biology students in Kathmandu University for their assistance with data collection (Sample 1) and to our second translator

Kamal Adhikari. We also acknowledge the research team involved in Sample 2 data collection, specifically Jemina Shrestha, Rahul Shrestha, and Misu Manandhar.

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Irish Research Council, University Grants Commission-Nepal (FRG-75/76-HS-16), and the H2020 European Research Council (grant number 884927).

ORCID iD

Siobhán M. Griffin https://orcid.org/0000-0002-3613-2844

Supplemental material

Supplemental material for this article is available online.

Notes

1. This research was not preregistered. Data and materials are found on the OSF: https://osf.io/w6gjq/?view_only=0b9affc586da45998f7f057dbfb7d560.
2. The factor loadings for item B4 (psychological cue reactivity) were low (.26 and .27 across models). We present the analysis and factor loadings with this item excluded in the Supplementary materials in case it is of interest. With this item removed the mean PTSD score for the sample was 34.28 (SD = 12.92, range = 16–77).

References

Adhikari, S. P., Gurung, G., Khadka, B., & Rana, C. (2020). Factors influencing depression in individuals with traumatic spinal cord injury and caregivers' perceived burden in a low-income country: A cross-sectional study. *Spinal Cord*, *58*(10), 1112–1118. https://doi.org/10.1038/s41393-020-0451-5

Agger, I., Vuk, S., & Mimica, J. (1995). *Theory and practice of psychosocial projects under war conditions in Bosnia-Herzegovina and Croatia*. ECHO/ECTF.

American Psychiatric Association (Ed.). (1994). *Diagnostic and statistical manual of mental disorders, 4th ed* (4th ed.). American Psychiatric Publishing, Inc.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5* (5th ed). American Psychiatric Association.

American Psychological Association. (2017). *Clinical practice guideline for the treatment of posttraumatic stress disorder (PTSD) in adults*. American Psychiatric Association.

Armour, C., Carragher, N., & Elhai, J. D. (2013). Assessing the fit of the dysphoric arousal model across two nationally representative epidemiological surveys: The Australian NSMHWB and the United States NESARC. *Journal of Anxiety Disorders*, *27*(1), 109–115. https://doi.org/10.1016/j.janxdis.2012.10.006

Armour, C., Elhai, J. D., Layne, C. M., Shevlin, M., Duraković-Belko, E., Djapo, N., & Pynoos, R. S. (2011). Gender differences in the factor structure of posttraumatic stress disorder symptoms in war-exposed adolescents. *Journal of Anxiety Disorders*, *25*(4), 604–611. https://doi.org/10.1016/j.janxdis.2011.01.010

Armour, C., Műllerová, J., & Elhai, J. D. (2016). A systematic literature review of PTSD's latent structure in the diagnostic and statistical manual of mental disorders: DSM-IV to DSM-5. *Clinical Psychology Review*, *44*, 60–74. https://doi.org/10.1016/j.cpr.2015.12.003

Armour, C., O'Connor, M., Elklit, A., & Elhai, J. D. (2013). Assessing posttraumatic stress disorder's latent structure in elderly bereaved European trauma survivors: Evidence for a five-factor dysphoric and anxious arousal model. *The Journal of Nervous and Mental Disease*, *201*(10), 901–906. https://doi.org/10.1097/NMD.0b013e3182a5befb

Armour, C., Raudzah Ghazali, S., & Elklit, A. (2013). PTSD's latent structure in Malaysian tsunami victims: Assessing the newly proposed Dysphoric Arousal model. *Psychiatry Research*, *206*(1), 26–32. https://doi.org/10.1016/j.psychres.2012.09.012

Arora, S. (2022). Intersectional vulnerability in post-disaster contexts: Lived experiences of Dalit women after the Nepal earthquake, 2015. *Disasters*, *46*(2), 329–347. https://doi.org/10.1111/disa.12471

Asmundson, G. J. G., Stapleton, J. A., & Taylor, S. (2004). Are avoidance and numbing distinct PTSD symptom clusters? *Journal of Traumatic Stress*, *17*(6), 467–475. https://doi.org/10.1007/s10960-004-5795-7

Asmundson, G. J. G., Wright, K. D., McCreary, D. R., & Pedlar, D. (2003). Post-traumatic stress disorder symptoms in United Nations peacekeepers: An examination of factor structure in peacekeepers with and without chronic pain. *Cognitive Behaviour Therapy*, *32*(1), 26–37. https://doi.org/10.1080/16506070310003648

Baschnagel, J. S., O'Connor, R. M., Colder, C. R., & Hawk, L. W., Jr. (2005). Factor structure of posttraumatic stress among western New York undergraduates following the September 11th terrorist attack on the World Trade Center. *Journal of Traumatic Stress*, *18*(6), 677–684. https://doi.org/10.1002/jts.20076

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*(2), 238–246. https://doi.org/10.1037/0033-2909.107.2.238

Boelen, P. A., van den Hout, M. A., & van den Bout, J. (2008). The factor structure of Posttraumatic Stress Disorder symptoms among bereaved individuals: A confirmatory factor analysis study. *Journal of Anxiety Disorders*, *22*(8), 1377–1383. https://doi.org/10.1016/j.janxdis.2008.01.018

Bracken, P. (1998). Hidden agendas: Deconstructing PTSD. In P. Bracken & C. Petty (Eds.), *Rethinking the trauma of war* (pp. 38–59). Free Association Books.

Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Sage Publications.

Brunnet, A. E., Derivois, D., Machado, W. D. L., & Haag Kristensen, C. (2021). The posttraumatic stress disorder factorial structure: Findings from a multicultural sample. *Journal of Aggression, Maltreatment & Trauma*, *30*(10), 1366–1380. https://doi.org/10.1080/10926771.2020.1848952

Carvalho, T., Cunha, M., Pinto-Gouveia, J., & Duarte, J. (2015). Portuguese version of the PTSD checklist-military version (PCL-M)-I: Confirmatory factor analysis and reliability.

Psychiatry Research, *226*(1), 53–60. https://doi.org/10.1016/j.psychres.2014.11.055

Charak, R., Armour, C., Elklit, A., Angmo, D., Elhai, J. D., & Koot, H. M. (2014). Factor structure of PTSD, and relation with gender in trauma survivors from India. *European Journal of Psychotraumatology*, *5*(1), 25547. https://doi.org/10.3402/ejpt.v5.25547

Chung, H., & Breslau, N. (2008). The latent structure of post-traumatic stress disorder: Tests of invariance by gender and trauma type. *Psychological Medicine*, *38*(4), 563–573. https://doi.org/10.1017/S0033291707002589

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research, and Evaluation*, *10*(1), 1. https://doi.org/10.7275/jyj1-4868

Davis, A., Davis, C., & Gibson, J. (2015). *Psychological support in disasters: Facilitating psychological support for catastrophic events*. LawTech Publishing Group.

Dhakal, B. (2018). Statistical trends in literacy rates in Nepal. *IOSR Journal of Applied Chemistry*, *11*(11), 71–77. https://doi.org/10.9790/5736-1111017177

Diamantopoulos, A., & Siguaw, J. A. (2000). Assessment of model fit. In *Introducing LISREL: A guide for the uninitiated* (p. 87). Sage Publications Ltd.

DuHamel, K. N., Ashman, T., Keane, T. M., Vickberg, S. M. J., Scigliano, E., Ostroff, J., Winkel, G., Mundy, E. A., Morasco, B. J., Hurley, K., Burkhalter, J., Chhabra, R., Papadopoulos, E., Moskowitz, C., & Redd, W. (2004). Construct validity of the post-traumatic stress disorder checklist in cancer survivors: Analyses based on two samples. *Psychological Assessment*, *16*(3), 255–266. Scopus. https://doi.org/10.1037/1040-3590.16.3.255

Elhai, J. D., Biehn, T. L., Armour, C., Klopper, J. J., Frueh, B. C., & Palmieri, P. A. (2011). Evidence for a unique PTSD construct represented by PTSD's D1–D3 symptoms. *Journal of Anxiety Disorders*, *25*(3), 340–345. https://doi.org/10.1016/j.janxdis.2010.10.007

Elhai, J. D., Biehn, T. L., Naifeh, J. A., & Christopher Frueh, B. (2011). Posttraumatic stress disorder instrument wording content is associated with differences in factor structure. *Journal of Traumatic Stress*, *24*(2), 208–212. https://doi.org/10.1002/jts.20628

Elhai, J. D., Ford, J. D., Ruggiero, K. J., & Frueh, B. C. (2009). Diagnostic alterations for post-traumatic stress disorder: Examining data from the national comorbidity survey replication and national survey of adolescents. *Psychological Medicine*, *39*(12), 1957–1966. https://doi.org/10.1017/S0033291709005819

Elhai, J. D., Naifeh, J. A., Forbes, D., Ractliffe, K. C., & Tamburrino, M. (2011). Heterogeneity in clinical presentations of posttraumatic stress disorder among medical patients: Testing factor structure variation using factor mixture modeling. *Journal of Traumatic Stress*, *24*(4), 435–443. https://doi.org/10.1002/jts.20653

Elhai, J. D., & Palmieri, P. A. (2011). The factor structure of post-traumatic stress disorder: A literature update, critique of methodology, and agenda for future research. *Journal of Anxiety Disorders*, *25*(6), 849–854. https://doi.org/10.1016/j.janxdis.2011.04.007

Elklit, A., Armour, C., & Shevlin, M. (2010). Testing alternative factor models of PTSD and the robustness of the dysphoria factor. *Journal of Anxiety Disorders*, *24*(1), 147–154. https://doi.org/10.1016/j.janxdis.2009.10.002

Foa, E. B. (1995). *Post-traumatic Diagnostic Scale manual*. National Computer Systems.

Foa, E. B., Cashman, L., Jaycox, L., & Perry, K. (1997). The validation of a self-report measure of posttraumatic stress disorder: The Posttraumatic Diagnostic Scale. *Psychological Assessment*, *9*(4), 445–451. https://doi.org/10.1037/1040-3590.9.4.445

Foa, E. B., Riggs, D. S., Dancu, C. V., & Rothbaum, B. O. (1993). Reliability and validity of a brief instrument for assessing post-traumatic stress disorder. *Journal of Traumatic Stress*, *6*(4), 459–473. https://doi.org/10.1007/BF00974317

Fodor, K. E., Pozen, J., Ntaganira, J., Sezibera, V., & Neugebauer, R. (2015). The factor structure of posttraumatic stress disorder symptoms among Rwandans exposed to the 1994 genocide: A confirmatory factor analytic study using the PCL-C. *Journal of Anxiety Disorders*, *32*, 8–16. https://doi.org/10.1016/j.janxdis.2015.03.001

Forbes, D., Fletcher, S., Lockwood, E., O'Donnell, M., Creamer, M., Bryant, R. A., McFarlane, A., & Silove, D. (2011). Requiring both avoidance and emotional numbing in DSM-V PTSD: Will it help? *Journal of Affective Disorders*, *130*(3), 483–486. https://doi.org/10.1016/j.jad.2010.10.032

Frankfurt, S. B., Anders, S. L., James, L. M., Engdahl, B., & Winskowski, A. M. (2015). Evaluating the dimensionality of PTSD in a sample of OIF/OEF veterans. *Psychological Trauma: Theory, Research, Practice, and Policy*, *7*(5), 430–436. https://doi.org/10.1037/tra0000012

Frankfurt, S. B., Armour, C., Contractor, A. A., & Elhai, J. D. (2016). Do gender and directness of trauma exposure moderate PTSD's latent structure? *Psychiatry Research*, *245*, 365–370. https://doi.org/10.1016/j.psychres.2016.08.049

Gauci, M. A., & MacDonald, D. A. (2012). Confirmatory factor analysis of the posttraumatic stress disorder checklist. *Journal of Aggression, Maltreatment & Trauma*, *21*(3), 321–330. https://doi.org/10.1080/10926771.2012.665429

Hansen, M., Armour, C., & Elklit, A. (2012). Assessing a dysphoric arousal model of acute stress disorder symptoms in a clinical sample of rape and bank robbery victims. *European Journal of Psychotraumatology*, *3*(1), 10.3402/ejpt.v3i0.18201. https://doi.org/10.3402/ejpt.v3i0.18201

Harpaz-Rotem, I., Tsai, J., Pietrzak, R. H., & Hoff, R. (2014). The dimensional structure of posttraumatic stress symptomatology in 323,903 U.S. Veterans. *Journal of Psychiatric Research*, *49*, 31–36. https://doi.org/10.1016/j.jpsychires.2013.10.020

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *The Behavioral and Brain Sciences*, *33*(2–3), 61–83. discussion 83-135. https://doi.org/10.1017/S0140525X0999152X

Hepburn, S. J. (2017). Everyday darkness and catastrophic events: Riding Nepal's buses through peace, war and an earthquake. In G. Hooper & J. J. Lennon (Eds.), *Dark tourism: Practice and interpretation* (pp. 147–159). Routledge.

Ibrahim, H., Catani, C., Ismail, A. A., & Neuner, F. (2019). Dimensional structure and cultural invariance of DSM V post-traumatic stress disorder among Iraqi and Syrian displaced people. *Frontiers in Psychology*, *10*. https://www.frontiersin.org/articles/10.3389/fpsyg.2019.01505 https://doi.org/10.3389/fpsyg.2019.01505

Jorgensen, T. D., Pornprasertmanit, S., Schoemann, A. M., & Rosseel, Y. (2022). *semTools: Useful tools for structural equation modeling* [R package version 0.5-6]. Retrieved from https://CRAN.Rproject. org/package=semTools

Joshi, M., & Pyakurel, S. R. (2015). Individual-level data on the victims of Nepal's civil war, 1996–2006: A new data set. *International Interactions*. *43*(1), 601–609. https://doi.org/10.1080/03050629.2015.987345

Karkee, R., & Lee, A. H. (2016). Epidemiology of road traffic injuries in Nepal, 2001–2013: Systematic review and secondary data analysis. *BMJ Open*, *6*(4), e010757. https://doi.org/10.1136/bmjopen-2015-010757

Kaysen, D., Rhew, I. C., Bittinger, J., Bedard-Gilligan, M., Garberson, L. A., Hodge, K. A., Nguyen, A. J., Logan, D. E., Dworkin, E. R., & Lindgren, K. P. (2021). Prevalence and factor structure of PTSD in DSM-5 versus DSM-IV in a national sample of sexual minority women. *Journal of Interpersonal Violence*, *36*(21–22), NP12388–NP12410. https://doi.org/10.1177/0886260519892960

King, D. W., Leskin, G. A., King, L. A., & Weathers, F. W. (1998). Confirmatory factor analysis of the clinician-administered PTSD scale: Evidence for the dimensionality of posttraumatic stress disorder. *Psychological Assessment*, *10*(2), 90–96. https://doi.org/10.1037/1040-3590.10.2.90

Kirshblum, S. C., Burns, S. P., Biering-Sorensen, F., Donovan, W., Graves, D. E., Jha, A., Johansen, M., Jones, L., Krassioukov, A., Mulcahey, M. J., Schmidt-Read, M., & Waring, W. (2011). International standards for neurological classification of spinal cord injury (revised 2011). *The Journal of Spinal Cord Medicine*, *34*(6), 535–546. https://doi.org/10.1179/204577211X13207446293695

Kleinman, A. M. (1977). Depression, somatization and the "new cross-cultural psychiatry". *Social Science & Medicine (1967)*, *11*(1), 3–9. https://doi.org/10.1016/0037-7856(77)90138-X

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed.). Guilford Press.

Kohrt, B. A., & Hruschka, D. J. (2010). Nepali concepts of psychological trauma: The role of idioms of distress, ethnopsychology and ethnophysiology in alleviating suffering and preventing stigma. *Culture, Medicine, and Psychiatry*, *34*(2), 322–352. https://doi.org/10.1007/s11013-010-9170-2

LeardMann, C. A., McMaster, H. S., Warner, S., Esquivel, A. P., Porter, B., Powell, T. M., Tu, X. M., Lee, W. W., Rull, R. P., & Hoge, C. W. (2021). Comparison of posttraumatic stress disorder checklist instruments from diagnostic and statistical manual of mental disorders, fourth edition vs fifth edition in a large cohort of US military service members and veterans. *JAMA Network Open*, *4*(4), e218072. https://doi.org/10.1001/jamanetworkopen.2021.8072

Liu, P., Wang, L., Cao, C., Wang, R., Zhang, J., Zhang, B., Wu, Q., Zhang, H., Zhao, Z., Fan, G., & Elhai, J. D. (2014). The underlying dimensions of DSM-5 posttraumatic stress disorder symptoms in an epidemiological sample of Chinese earthquake survivors. *Journal of Anxiety Disorders*, *28*(4), 345–351. https://doi.org/10.1016/j.janxdis.2014.03.008

Liu, S., Wang, L., Cao, C., & Zhang, J. (2014). The factor structure of posttraumatic stress disorder symptoms in patients with traumatic spinal cord injuries. *Archives of Psychiatric Nursing*, *28*(5), 301–304. https://doi.org/10.1016/j.apnu.2014.05.008

Maestas, K. L., Benge, J. F., Pastorek, N. J., LeMaire, A., & Darrow, R. (2011). Factor structure of posttraumatic stress disorder symptoms in OEF/OIF veterans presenting to a polytrauma clinic. *Rehabilitation Psychology*, *56*(4), 366–373. https://doi.org/10.1037/a0025447

Marsella, A. J., & Christopher, M. A. (2004). Ethnocultural considerations in disasters: An overview of research, issues, and directions. *Psychiatric Clinics of North America*, *27*(3), 521–539. https://doi.org/10.1016/j.psc.2004.03.011

Marsella, A. J., Friedman, M. J., Gemty, E. T., & Scurlield, R. M. (1996). Ethnocultural aspects of PTSD: Some closing thoughts. In A. J. Marsella, M. J. Friedman, E. T. Gemty, & R. M. Scurlield (Eds.), *Ethnocultural aspects of posttraumatic stress disorder: Issues, research, and clinical applications* (pp. 529–538). American Psychological Association.

Marshall, G. N. (2004). Posttraumatic stress disorder symptom checklist: Factor structure and English–Spanish measurement invariance. *Journal of Traumatic Stress*, *17*(3), 223–230. https://doi.org/10.1023/B:JOTS.0000029265.56982.86

McCall, G. J., & Resick, P. A. (2003). A pilot study of PTSD symptoms among Kalahari bushmen. *Journal of Traumatic Stress*, *16*(5), 445–450. https://doi.org/10.1023/A:1025702326392

McWilliams, L. A., Cox, B. J., & Asmundson, G. J. G. (2005). Symptom structure of posttraumatic stress disorder in a nationally representative sample. *Journal of Anxiety Disorders*, *19*(6), 626–641. https://doi.org/10.1016/j.janxdis.2004.06.003

Michalopoulos, L. M., Unick, G. J., Haroz, E. E., Bass, J., Murray, L. K., & Bolton, P. A. (2015). Exploring the fit of western PTSD models across three non-western low- and middle-income countries. *Traumatology*, *21*(2), 55–63. https://doi.org/10.1037/trm0000020

Mollica, R. F., Caspi-Yavin, Y., Bollini, P., Truong, T., Tor, S., & Lavelle, J. (1992). The Harvard Trauma Questionnaire. Validating a cross-cultural instrument for measuring torture, trauma, and posttraumatic stress disorder in Indochinese refugees. *The Journal of Nervous and Mental Disease*, *180*(2), 111–116. https://doi.org/10.1097/00005053-199202000-00008

Mordeno, I. G. (2012). An examination of PTSD factor structure in Filipino trauma survivors: A comparison of ten models across three regional groups. *Philippine Journal of Psychology*, *45*(2), 173–205. https://ejournals.ph/article.php?id=1198

Mordeno, I. G., Nalipay, M. J. N., Untalan, J. H. C., & Decatoria, J. B. (2014). Examining posttraumatic stress disorder's latent structure between treatment-seeking and non-treatment-seeking Filipinos. *Asian Journal of Psychiatry*, *11*, 28–34. https://doi.org/10.1016/j.ajp.2014.05.003

Moshagen, M., & Bader, M. (2023a). semPower: General power analysis for structural equation models. *Behavior Research Methods*, *56*, 2901–2922. https://doi.org/10.3758/s13428-023-02254-7

Moshagen, M., & Bader, M. (2023b). *semPower: Power Analyses for SEM* [R package version 2.1.0]. https://CRAN.R-project.org/package=semPower

Moshier, S. J., Lee, D. J., Bovin, M. J., Gauthier, G., Zax, A., Rosen, R. C., Keane, T. M., & Marx, B. P. (2019). An empirical crosswalk for the PTSD checklist: Translating DSM-IV to DSM-5 using a veteran sample. *Journal of Traumatic Stress*, *32*(5), 799–805. https://doi.org/10.1002/jts.22438

Muldoon, O. T. (2024). *The social psychology of trauma: Connecting the personal and the political*. Cambridge University Press. https://doi.org/10.1017/9781009306997

Muldoon, O. T., Haslam, S. A., Haslam, C., Cruwys, T., Kearns, M., & Jetten, J. (2019). The social psychology of responses to trauma: Social identity pathways associated with divergent traumatic responses. *European Review of Social Psychology*, *30*(1), 311–348. https://doi.org/10.1080/10463283.2020.1711628

NPHC. (2011). *National population and housing census* 2011.

Panday, S., Rushton, S., Karki, J., Balen, J., & Barnes, A. (2021). The role of social capital in disaster resilience in remote communities after the 2015 Nepal earthquake. *International Journal of Disaster Risk Reduction*, *55*, 102112. https://doi.org/10.1016/j.ijdrr.2021.102112

Parajuli, B., Acharya, K., & Shrestha, D. (2020). Epidemiology of traumatic spinal cord injury in Nepal: A systematic review. *Asian Journal of Medical Sciences*, *11*(6), 6. https://doi.org/10.3126/ajms.v11i6.30151

Patel, A. R., & Hall, B. J. (2021). Beyond the DSM-5 diagnoses: A cross-cultural approach to assessing trauma reactions. *FOCUS*, *19*(2), 197–203. https://doi.org/10.1176/appi.focus.20200049

Pathak, P., & Schündeln, M. (2022). Social hierarchies and the allocation of development aid: Evidence from the 2015 earthquake in Nepal. *Journal of Public Economics*, *209*, 104607. https://doi.org/10.1016/j.jpubeco.2022.104607

Pietrzak, R. H., Tsai, J., Harpaz-Rotem, I., Whealin, J. M., & Southwick, S. M. (2012). Support for a novel five-factor model of posttraumatic stress symptoms in three independent samples of Iraq/Afghanistan veterans: A confirmatory factor analytic study. *Journal of Psychiatric Research*, *46*(3), 317–322. https://doi.org/10.1016/j.jpsychires.2011.11.013

Raftery, A. E. (1995). Bayesian Model selection in social research. *Sociological Methodology*, *25*, 111–163. https://doi.org/10.2307/271063

R Core Team. (2021). *R: A language and environment for statistical computing* [Manual]. https://www.R-project.org/

Rosellini, A. J., Stein, M. B., Colpe, L. J., Heeringa, S. G., Petukhova, M. V., Sampson, N. A., Schoenbaum, M., Ursano, R. J., & Kessler, R. C. (2015). Approximating a DSM-5 diagnosis of PTSD using DSM-IV criteria. *Depression and Anxiety*, *32*(7), 493–501. https://doi.org/10.1002/da.22364

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*(2), 1–36. https://doi.org/10.18637/jss.v048.i02

Schwarz, G. (1978). Estimating the dimension of a model. *The Annals of Statistics*, *6*(2), 461–464. https://doi.org/10.1214/aos/1176344136

Simms, L. J., Watson, D., & Doebbeling, B. N. (2002). Confirmatory factor analyses of posttraumatic stress symptoms in deployed and nondeployed veterans of the Gulf War. *Journal of Abnormal Psychology*, *111*(4), 637–647. https://doi.org/10.1037//0021-843x.111.4.637

Sinha, P., Mehta, R. S., Parajuli, P., Chaudhary, P., & Kushwaha, R. P. (2022). Burden of care among primary caregivers of spinal cord injury patients attending a tertiary care center in eastern Nepal. *Discover Social Science and Health*, *2*(1), 12. https://doi.org/10.1007/s44155-022-00016-y

Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation approach. *Multivariate Behavioral Research*, *25*(2), 173–180. https://doi.org/10.1207/s15327906mbr2502_4

Stein, D. J., Rothbaum, B. O., Baldwin, D. S., Szumski, A., Pedersen, R., & Davidson, J. R. T. (2013). A factor analysis of posttraumatic stress disorder symptoms using data pooled from two venlafaxine extended-release clinical trials. *Brain and Behavior*, *3*(6), 738–746. https://doi.org/10.1002/brb3.183

Steiner, M. D., & Grieder, S. (2020). EFAtools: An R package with fast and flexible implementations of exploratory factor analysis tools. *Journal of Open Source Software*, *5*(53), 2521. https://doi.org/10.21105/joss.02521

Summerfield, D. (2001). The invention of post-traumatic stress disorder and the social usefulness of a psychiatric category. *BMJ : British Medical Journal*, *322*(7278), 95–98. https://doi.org/10.1136/bmj.322.7278.95

Tay, A. K., Jayasuriya, R., Jayasuriya, D., & Silove, D. (2017). Assessing the factorial structure and measurement invariance of PTSD by gender and ethnic groups in Sri Lanka: An analysis of the modified Harvard Trauma Questionnaire (HTQ). *Journal of Anxiety Disorders*, *47*(co1, 8710131), 45–53. Ovid MEDLINE(R) <2017>. https://doi.org/10.1016/j.janxdis.2017.02.001

Tewari, S., Khan, S., Hopkins, N., Srinivasan, N., & Reicher, S. (2012). Participation in mass gatherings can benefit well-being: Longitudinal and control data from a north Indian Hindu pilgrimage event. *PloS One*, *7*(10), e47291. https://doi.org/10.1371/journal.pone.0047291

United National Office on Drugs and Crime (UNODC). (2009). *Global report on trafficking in person: Nepal country profile*. http://www.unodc.org/documents/human-trafficking/Global_Report_on_TIP.pdf

Vinson, G. A., & Chang, Z. (2012). PTSD Symptom structure among West African war trauma survivors living in African refugee camps: A factor-analytic investigation. *Journal of Traumatic Stress*, *25*(2), 226–231. https://doi.org/10.1002/jts.21681

Wang, L., Zhang, J., Shi, Z., Zhou, M., Li, Z., Zhang, K., Liu, Z., & Elhai, J. D. (2011). Comparing alternative factor models of PTSD symptoms across earthquake victims and violent riot witnesses in China: Evidence for a five-factor model proposed by Elhai et al. (2011). *Journal of Anxiety Disorders*, *25*(6), 771–776. https://doi.org/10.1016/j.janxdis.2011.03.011

Weathers, F. W., Litz, B. T., Herman, D. S., Huska, J. A., & Keane, T. M. (1993). The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility. Paper Presented at the 9th Annual Conference of the ISTSS, San Antonio, TX.

Williams, B., Onsman, A., & Brown, T. (2010). Exploratory factor analysis: A five-step guide for novices. *Australasian Journal of Paramedicine*, *8*, 1–13. https://doi.org/10.33151/ajp.8.3.93

Willott, A., Dhakal, R., Groves, C., Mytton, J., & Ellis, M. (2021). The demographics and traumatic causes of spinal cord injury in Nepal: An observational study. *Trauma*, *23*(4), 330–337. https://doi.org/10.1177/1460408620941342

World Bank. (2016). *Literacy rate, adult total (% of people ages 15 and above)—Nepal*.

Yeomans, P. D., & Forman, E. M. (2009). Cultural factors in traumatic stress. In S. Eshun & R. A. R. Gurung (Eds.), *Culture and mental health: Sociocultural influences, theory, and practice* (pp. 221–244). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781444305807.ch11

Young, A. (1997). *The harmony of illusions: Inventing post-traumatic stress disorder*. Princeton University Press.

Yufik, T., & Simms, L. J. (2010). A meta-analytic investigation of the structure of posttraumatic stress disorder symptoms. *Journal of Abnormal Psychology*, *119*(4), 764–776. https://doi.org/10.1037/a0020981