BJPsych Open (2023)
9, e27, 1–6. doi: 10.1192/bjo.2023.1

Paper

Early self-reported post-traumatic stress symptoms after trauma exposure and associations with diagnosis of post-traumatic stress disorder at 3 months: latent profile analysis

Chia-Hao Shih*, Adrian Zhou*, Stephen Grider, Hong Xie, Xin Wang† and Jon D. Elhai†

Background

Trauma exposure can cause post-traumatic stress symptoms (PTSS), and persistently experiencing PTSS may lead to the development of post-traumatic stress disorder (PTSD). Research has shown that PTSS that emerged within days of trauma was a robust predictor of PTSD development.

Aims

To investigate patterns of early stress responses to trauma and their associations with development of PTSD.

Method

We recruited 247 civilian trauma survivors from a local hospital emergency department. The PTSD Checklist for DSM-5 (PCL-5) and Acute Stress Disorder Scale (ASDS) were completed within 2 weeks after the traumatic event. Additionally, 3 months post-trauma 146 of these participants completed a PTSD diagnostic interview using the Clinician Administered PTSD Scale for DSM-5.

Results

We first used latent profile analysis on four symptom clusters of the PCL-5 and the dissociation symptom cluster of the ASDS and determined that a four-profile model ('severe symptoms', 'moderate symptoms', 'mild symptoms', 'minimal symptoms') was optimal based on multiple fit indices. Gender was found to be predictive of profile membership. We then found a significant association between subgroup membership and PTSD diagnosis ($\chi^2(3) = 11.85$, $P < 0.01$, Cramer's $V = 0.263$). *Post hoc* analysis revealed that this association was driven by participants in the 'severe symptoms' profile, who had a greater likelihood of developing PTSD.

Conclusions

These findings fill the knowledge gap of identifying possible subgroups of individuals based on their PTSS severity during the early post-trauma period and investigating the relationship between subgroup membership and PTSD development, which have important implications for clinical practice.

Keywords

Acute trauma; civilian trauma survivor; post-traumatic stress symptoms; post-traumatic stress disorder; latent class analysis.

Trauma exposure can result in post-traumatic stress symptoms (PTSS) or full-blown post-traumatic stress disorder (PTSD).[1] Accumulating evidence has revealed that PTSS severity is associated with multifaceted pre-, peri- and post-trauma risk factors, such as history of childhood maltreatment, presence of mild traumatic brain injury at the time of event and subsequent brain alterations in emotion neurocircuitry.[2–5] Notably, early post-traumatic stress responses that emerge within days to weeks post-trauma have been shown to be robust predictors of future development of PTSD.[6,7] These studies employed group-based variable-centred analytic methods to identify predictors of interest. However, modelling heterogeneity in patterns of early post-traumatic stress responses and their associations with PTSD development has rarely been carried out.

To this end, a person-centred model-based statistical approach, such as latent profile analysis (LPA) and latent class analysis (LCA), aims to reveal potential subgroups of individuals by exploring similarities and differences in their responses to a set of observable indicator variables. LPA and LCA assume that people can be grouped into numerous profiles, each of which consists of different configurations of variables of interest. The major difference between LPA and LCA is that LPA applies to continuous variables, whereas LCA applies to categorical variables (see Oberski 2016 for more details[8]). In PTSD research, LPA offers many advantages over traditional variable-centred methods, as it allows for close examination of the heterogeneity in PTSD presentations by accounting for a full range and severity of symptoms with continuous indicators, rather than just binary presence or absence of symptoms. For example, studies have also utilised LPA to investigate dissociative features in PTSD and found additional risk factors and alternative symptoms beyond depersonalisation and derealisation.[9,10] In addition to dissociative PTSD, LPA has been applied to study other subtypes of PTSD, including those with depressive[11] and complex[12] features, which included additional symptoms of affective dysregulation, negative self-concept and interpersonal problems.

LPA/LCA has been widely used to uncover latent PTSD subgroups (e.g. those with dissociative feature) and their associations with other psychological constructs. However, only a limited number of LPA/LCA studies have examined the patterns of early post-traumatic stress responses (responses that emerged within days post-trauma) and their associations with subsequent PTSD development.[13] In particular, current literature suggests a possible dissociative subtype for acute stress disorder (ASD) as well. Unlike dissociative PTSD, however, evidence is mixed regarding a qualitatively distinct ASD subgroup with dissociative features.[14,15] Nonetheless, these findings suggest that the likelihood of PTSD development depends not only on the quantitative differences in

* Joint equal contribution.
† Joint senior authors.

https://doi.org/10.1192/bjo.2023.1 Published online by Cambridge University Press

severity of early post-traumatic stress responses but also qualitative differences in response patterns across groups.

In the current study, we aimed first to use LPA on a sample of civilian trauma survivors based on early PTSS experienced within 2 weeks post-trauma and second to examine how subgroup membership is associated with PTSD diagnosis 3 months post-trauma. Based on findings from previous research on recent trauma survivors and people with PTSD,[13,14,16–18] we hypothesised that three to five latent profiles would be optimal, with profiles differing quantitatively and associated with various levels of likelihood of subsequent PTSD development. We also speculated that there may be profiles differing qualitatively, with the presence of certain characteristics such as dissociation, leading to higher probability of PTSD diagnosis.

Method

Participants and procedure

This study was part of an ongoing longitudinal neuroimaging study described elsewhere (e.g.[5]). In brief, individuals who presented to an emergency department in Ohio, USA, following a traumatic event were contacted by the research personnel in person in the emergency department or by telephone within 48 h of their emergency department visit if they had been discharged. Participants were enrolled for follow-up assessments within 2 weeks of their emergency department visit. Exclusion criteria were: (a) severe injuries (including traumatic brain injury), (b) requiring surgical care, (c) history of severe neuropsychiatric problems, (d) being under the influence of alcohol or substances at the time of the trauma, (e) magnetic resonance imaging (MRI) scan contradictions (e.g. pregnancy or ferrous implants) and (f) could not read/write English.

Participants' PTSS severity was assessed using self-reported questionnaires at baseline (mean 9.05 days post-trauma, s.d. = 6.21 days) using a paper-and-pencil format. Their PTSD diagnosis was assessed by in-person or videoconference interview at follow-up (approximately 3 months after their emergency department visit). Participants received monetary compensation for their participation in the study (US$10 for the consent process, US$20 for baseline assessment and US$50 for the PTSD diagnostic interview). The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human participants/patients were approved by the University of Toledo Institutional Review Board (201575-UT). All participants provided written informed consent.

Measures

First, participants' trauma exposure history was assessed by the Life Events Checklist for DSM-5 (LEC-5),[19] which is a self-report measure assessing 16 potential traumatic events. The LEC-5 is a DSM-5 modification of the original LEC, which has shown appropriate psychometric properties.[20] Next, PTSD symptoms were assessed using the PTSD Checklist for DSM-5 (PCL-5).[21] The PCL-5 is a self-report measure of PTSD symptoms which consists of 20 items that map onto the DSM-5 diagnostic symptom criteria for PTSD. Participants were instructed to rate symptoms in response to their emergency department trauma on a 5-point Likert scale (from 0 'not at all' to 4 'extremely'). The PCL-5 has shown adequate psychometric properties.[22]

Dissociation symptoms were assessed using the dissociation subscale of the Acute Stress Disorder Scale (ASDS).[23] The ASDS is a 19-item self-administered measure for acute stress symptoms and participants respond on a 5-point Likert scale, with higher scores reflecting higher degrees of symptom severity. The ASDS has shown adequate psychometric properties.[23,24] Participants' dissociation symptoms were assessed using the five dissociative symptoms listed in the ASDS (i.e. numbing, reduction in awareness of surroundings, derealisation, depersonalisation and dissociative amnesia).

PTSD diagnosis was evaluated by trained research clinicians and supervised by a licensed clinical psychologist using the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5).[25] The CAPS-5 is a 20-item structured interview that assesses intensity and frequency of PTSD symptoms over the past month. Participants were instructed to rate symptoms based on their emergency department trauma. In the current study, the CAPS-5 scoring algorithm was used to determine PTSD diagnosis approximately 3 months after participants' emergency department visit. The CAPS-5 has shown adequate psychometric properties.[26]

Data analysis

Data preparation and analyses were performed with R 4.1.1 for Windows (R Core Team, 2021) and associated packages. Although whether Likert-type items can be treated as continuous variables is in debate, several studies have shown that a Likert-type variable with five or more categories can be treated as continuous without negative impact on the analysis.[27,28] Before carrying out LPA, missing values (item-level missingness were 0.89% and 0.66% for the PCL-5 and ASDS respectively) were imputed with R's 'mice' package using maximum likelihood procedures on all participants who completed baseline assessment (data were removed for six participants who missed the entire PCL-5 and two participants who missed the ASDS). Additionally, to preserve power and promote model convergence, mean scores from the four symptom clusters of the PCL-5 (i.e. re-experiencing, avoidance, negative alterations in cognition and mood, and hyperarousal) and ASDS dissociation symptoms were calculated and used as indicators. Note that it is standard practice to put the variables on the same scale in LPA/LCA,[29] therefore 1 was subtracted from the ASDS response scale of 1–5 to match the scale of PCL-5 (i.e. 0–4).

LPA was performed using R's 'tidyLPA' package. The optimal number of profiles was determined based on the following indices: the Akaike information criterion (AIC), Bayesian information criterion (BIC), sample-size-adjusted BIC (aBIC), bootstrapped likelihood ratio test (BLRT) and entropy. Lower values of the AIC, BIC and aBIC indicate better fit. The BLRT was used to statistically compare models with adjacent numbers of profiles. A significant *P*-value indicates that a model with k profiles fits better than another with $k - 1$ profiles. Entropy is an indicator of classification accuracy; values range between 0 and 1, with values close to 0 indicating low classification accuracy and values close to 1 indicating high classification accuracy. Among these fit indices, we prioritised BLRT most in determining the optimal number of profiles because it is the most objective measure (i.e. it yields a *P*-value). Several studies have shown that BLRT is the most accurate fit index.[30,31] Once the optimal profile solution was determined, a three-step approach was applied. In the three-step approach, profile membership is used as a predictor of outcome, which accounts for classification uncertainty and posterior probabilities.[32] Specifically, we examined whether age and gender were predictive of profile membership using multinomial logistic regression. We then examined the association between profile membership and PTSD diagnosis 3 months post-trauma. Statistical significance was set at $\alpha = 0.05$, two-sided, for all analyses.

https://doi.org/10.1192/bjo.2023.1 Published online by Cambridge University Press

Table 1 Fit indices for the competing latent profile models

Model	AIC	BIC	aBIC	BLRT p	Entropy
One-profile	3520	3555	3523	–	1
Two-profile	3000	3074	3007	0.01	0.89
Three-profile	2888	3000	2899	0.01	0.84
Four-profile	**2845**	**2996**	**2859**	**0.01**	**0.84**
Five-profile	2836	3026	2854	0.08	0.85
Six-profile	2827	3055	2849	0.08	0.86

AIC, Akaike information criterion; BIC, Bayesian information criterion; aBIC, sample-size-adjusted BIC; BLRT, bootstrapped likelihood ratio test. The optimal model is shown in bold.

Results

After missing data imputation, we had PCL-5 and ASDS data at baseline from 247 participants (mean age 32.96 years, s.d. = 11.14 years). The majority of participants were female ($n = 162$; 65.59%) and had visited the emergency department because of a motor vehicle accident ($n = 147$; 59.51%) or interpersonal violence ($n = 91$; 36.84%).

A series of competing latent profile models was specified (i.e. variances were allowed to vary across subgroups and residual error variances were fixed at 0) and estimated using mean scores of the PTSD and dissociation symptom clusters. One- to six-profile solutions were estimated and converged. Table 1 presents fit indices for the competing latent profile models. In general, AIC, BIC and aBIC values kept decreasing from the one- to the six-profile models, except the BIC value for the five-profile and six-profile models. Additionally, BLRT *P*-values were all significant except for the five-profile and six-profile models, indicating no significant improvement in model fit beyond four profiles. Last, all models showed adequate entropy values. Based on the above-mentioned model fit indices, we selected the four-profile model as optimal.

Individual profiles for the four-profile model are depicted in Fig. 1 and symptom cluster means for each profile are presented in Table 2. Profile 1, labelled 'severe symptoms', accounted for 20% of the sample and individuals belonging to this profile had higher mean scores across all five symptom clusters. Profile 2, labelled 'moderate symptoms', was the largest group, accounting for approximately 40% of the sample. Individuals in this profile had moderate symptoms, with all symptom cluster mean scores lower than those for profile 1. Profile 3, labelled 'mild symptoms', consisted of approximately 30% of the sample with mild symptoms and all symptom cluster mean scores were lower than those for profile 2. Profile 4, labelled 'minimal symptoms', accounted for 10% of the sample and individuals in this profile had the mildest symptoms, with low PTSD symptom mean scores but dissociation cluster mean scores comparable to those for profile 3. Significant differences in average scores of all subscales were found for all profile memberships (Table 2).

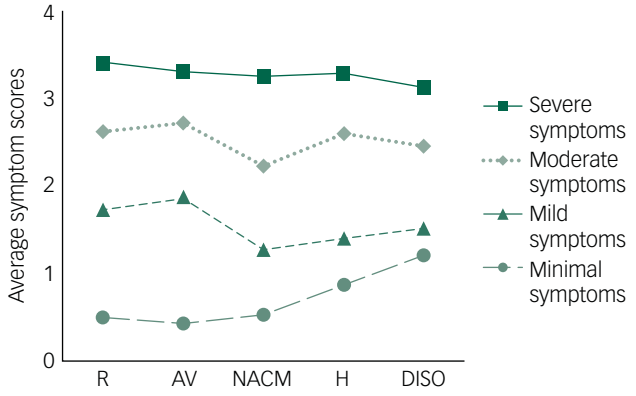

Fig. 1 Individual profiles for the four-profile model. R, re-experiencing; AV, avoidance; NACM, negative alterations in cognitions and mood; H, hyperarousal; DISO, dissociation symptoms.

The associations between demographic variables and profile membership were estimated using multinomial logistic regression. With the 'minimal symptoms' profile serving as a reference group, being male significantly decreased the likelihood of membership in the 'severe symptoms' profile (OR = 0.32, $P < 0.05$) and 'moderate symptoms' profile (OR = 0.26, $P < 0.01$), but not the 'mild symptoms' profile. In addition, age showed no predictive effects for any group comparisons (Table 3).

Among these 247 participants, 146 participants completed a CAPS-5 diagnostic interview approximately 3 months post-trauma. There were no significant differences in age and gender between participants with or without the CAPS-5 diagnostic interview: $t(245) = -0.28$, $P > 0.05$, partial $\eta^2 = 0.0003$ for age, and $\chi^2(1) = 0.96$, $P > 0.05$, $\phi = 0.071$ for gender. In contrast, participants who did not complete a CAPS-5 diagnostic interview showed lower symptom severity at baseline on all five subscales compared with participants who completed a CAPS-5 diagnostic interview 3 months post-trauma: $t(245) = -0.6.71$, $P < 0.01$, partial $\eta^2 = 0.16$ for the re-experiencing subscale; $t(245) = -4.39$, $P < 0.01$, partial $\eta^2 = 0.07$ for the avoidance subscale; $t(245) = -5.80$, $P < 0.01$, partial $\eta^2 = 0.12$ for the negative alterations in cognition and mood subscale; $t(245) = -6.17$, $P < 0.01$, partial $\eta^2 = 0.13$ for the hyperarousal subscale; and $t(245) = -2.79$, $P < 0.01$, partial $\eta^2 = 0.03$ for the dissociation subscale.

A chi-square test showed a significant association between profile membership and PTSD diagnosis ($\chi^2(3) = 11.85$, $P < 0.01$, Cramer's $V = 0.263$). *Post hoc* analysis[33] indicated that this association was driven by higher proportion of participants in the 'severe symptoms' profile developing PTSD 3 months post-trauma ($P < 0.05$, false discovery rate-corrected) (Table 4).

Discussion

The current study aimed to fill the knowledge gap by first investigating potential profiles of individuals who show unique patterns in their post-traumatic stress responses within days post-trauma, and then further examining the association between profile membership and PTSD diagnosis 3 months post-trauma. LPA was performed on PTSS severity of recent trauma survivors, and a four-profile solution was found optimal. Specifically, individuals in the 'severe symptoms' profile 1 showed moderate-to-high symptoms on all five symptom clusters, whereas individuals in the 'minimal symptoms' profile showed none or low symptoms across all four PTSD symptom clusters and slightly elevated dissociation symptoms. Two intermediate profiles were observed. The 'moderate symptoms' profile was the largest group and participants with this profile showed low-to-moderate symptoms on all five symptom clusters. Last, participants in the 'mild symptoms' profile showed milder symptoms on all five symptom clusters relative to the 'moderate symptoms' profile. Gender, but not age, was predictive of profile membership, and male participants were less likely to be in the 'severe symptoms' and 'moderate symptoms' profiles. Furthermore, we revealed an association between profile membership and PTSD diagnosis 3 months post-trauma, whereby participants with worse symptoms during the early post-trauma period had a higher likelihood of developing PTSD.

https://doi.org/10.1192/bjo.2023.1 Published online by Cambridge University Press

Table 2 Unstandardised class means for the four-profile model[a]

	Severe symptoms: *n* = 53 (21.46%), mean (s.d.)	Moderate symptoms: *n* = 99 (40.08%), mean (s.d.)	Mild symptoms: *n* = 69 (27.94%), mean (s.d.)	Minimal symptoms: *n* = 26 (10.53%), mean (s.d.)	*F*	Partial η^2
Re-experiencing	3.39 (0.44)	2.62 (0.70)	1.72 (0.63)	0.50 (0.35)	169.90***	0.68
Avoidance	3.30 (0.63)	2.72 (0.95)	1.87 (0.97)	0.43 (0.43)	80.19***	0.50
NACM	3.25 (0.41)	2.23 (0.62)	1.26 (0.64)	0.52 (0.47)	192.00***	0.70
Hyperarousal	3.28 (0.38)	2.60 (0.52)	1.39 (0.45)	0.87 (0.64)	239.00***	0.75
Dissociation	3.12 (0.49)	2.45 (0.82)	1.51 (0.77)	1.20 (0.84)	63.24***	0.44

NACM, negative alterations in cognition and mood.
a. Re-experiencing, avoidance, NACM and hyperarousal are symptom clusters from the PTSD Checklist for DSM-5 (PCL-5), whereas dissociation is one of the symptom clusters from the Acute Stress Disorder Scale (ASDS).
*** $P < 0.001$.

Table 3 Multinomial logistic regression predicting latent profile membership as a function of age and gender

	Severe versus minimal symptoms			Moderate versus minimal symptoms			Mild versus minimal symptoms		
	B	s.e.	OR	B	s.e.	OR	B	s.e.	OR
Age	−0.004	0.021	0.996	−0.015	0.020	0.985	−0.014	0.020	0.987
Gender	−1.147*	0.497	0.318	−1.337**	0.459	0.263	−0.687	0.467	0.503

B, coefficient; s.e., standard error; OR, odds ratio.
*$P < 0.05$; **$P < 0.01$.

Table 4 Post-traumatic stress disorder (PTSD) diagnosis 3 months post-trauma for each symptom profile (*n* = 146)

	Severe symptoms, *n* (%)	Moderate symptoms, *n* (%)	Mild symptoms, *n* (%)	Minimal symptoms, *n* (%)	
Participants with PTSD	23 (52.3)	24 (36.4)	7 (22.6)	0 (0)	$\chi^2(3) = 11.85$, $P < 0.01$,
Participants without PTSD	21 (47.7)	42 (63.6)	24 (77.4)	5 (100)	Cramer's $V = 0.263$

Dissociative subtypes of PTSD and ASD

Previous studies have utilised LPA/LCA to examine the dissociative PTSD subtype and associated covariates. In general, between three and five profiles differing in levels of PTSD symptom severity and/or quality were identified across different studies, with at least one profile supporting the dissociative PTSD subtype.[34] For example, three-profile models in civilian trauma survivors,[9,10] veterans[35] and victims of childhood abuse[36] have generally consisted of the following three subgroups: (a) high PTSD and high dissociation, (b) high PTSD and low dissociation and (c) low symptomatology. Similarly, a four-profile model of PTSD and dissociation was found in a sample of female sexual assault survivors, with the additional profile consisting of intermediate PTSD symptomatology.[37]

Although studies have supported the existence of the dissociative subtype in people with PTSD,[9,17,18,37] research using LPA/LCA to identify subtypes of early PTSS is still scarce. Current evidence on various types of trauma hints at the existence of a possible dissociative ASD subtype, but results are inconsistent across studies. Hansen and colleagues[15] identified a five-class solution from a sample with mixed trauma types (victims of rape, bank robbery, earthquake and violence) and showed one highly symptomatic class marked primarily by dissociation and avoidance when compared with the four intermediate classes, suggesting a dissociative avoidant ASD subtype. However, Armour & Hansen[14] reported that two out of four groups were found to endorse a high level of dissociation that differed significantly in the degree of intrusion symptoms, which supported an intrusion-predominant subtype in early responding. It is noteworthy that both studies did not assess associations between ASD subgroup membership and the development of PTSD.

Early PTSS and subsequent PTSD diagnosis

To the best of our knowledge, only a handful of studies used person-centred approaches to examine early PTSS and subsequent PTSD diagnosis. Shevlin and colleagues[13] revealed a four-profile model from victims of sexual assault, with one high, one low and two intermediate profiles that were similar in dissociation but opposite in arousal symptoms. Moreover, the authors reported that individuals with a high ASD symptom profile had the highest conditional probability ($P = 0.701$) of PTSD diagnosis, whereas among the two intermediate groups, the one with high arousal symptoms had almost twice the probability of PTSD than the one with low arousal symptoms ($P = 0.493$ *v.* $P = 0.247$). Therefore, Shevlin et al[13] suggested that arousal, rather than dissociation, may be the most important factor in predicting PTSD development. On the other hand, Hansen and colleagues[38] used LCA and identified three classes (high, moderate and low ASD symptom severity) that differ only quantitatively, but not qualitatively. Similarly, Lenferink and colleagues[16] also found a three-class solution optimal in trauma-exposed children, with low, intermediate and high ASD symptoms.

In the current study, we also observed that the four profiles of recent civilian trauma survivors differed only quantitatively, providing no support for the existence of subtypes of early post-traumatic stress responses. Although Hansen et al[38] speculated that the lack of ASD subtypes might be attributed to differences in statistical methods between LCA and LPA, our study showed that even with LPA, the existence of a particular qualitatively distinct profile in early post-traumatic symptoms may not be evident, especially in light of the inconsistent findings from previous early post-trauma studies.[13–15] Nonetheless, the current findings indicated that individuals with highly symptomatic early post-trauma stress response profiles were most vulnerable to development of PTSD, which echoes previous findings.[13,38] Therefore, healthcare providers should monitor these people closely and provide necessary preventive strategies, which would possibly reduce PTSD development in these individuals.

Limitations

A few limitations should be considered while interpreting the findings of the current study. First, the sample size is modest and the

https://doi.org/10.1192/bjo.2023.1 Published online by Cambridge University Press

majority of participants (more than 95%) had experienced either a motor vehicle accident or interpersonal violence. Therefore, future work to replicate the current findings is warranted. Second, although the drop-out rate at 3 months post-trauma was similar to our previous work using a similar design,[4] it may the affect the generalisability of the current findings. Also, participants who completed 3-month follow-up showed higher PTSS severity at baseline. The positive association of higher symptom severity and greater mental disorder comorbidity with retention rate was observed in other longitudinal studies focusing on other mental health issues.[39,40] Third, data obtained at baseline were self-reported measures (although at follow-up we used a clinician-administered measure); it might be necessary to use only clinician-administered measures to confirm that both approaches provide equivalent information and produce similar results. Last, approximately 18% of participants ($n = 26$) who completed the 3-month CAPS-5 diagnostic interview had experienced new trauma(s), in addition to the index trauma that qualified them for the study. Despite our instructions to participants to answer questions based only on the index trauma, potential contamination of PTSD diagnosis ratings may still exist.

Chia-Hao Shih, Department of Emergency Medicine, University of Toledo, Toledo, Ohio, USA; **Adrian Zhou**, Department of Psychiatry, University of Toledo, Toledo, Ohio, USA; **Stephen Grider**, Department of Emergency Medicine, University of Toledo, Toledo, Ohio, USA; **Hong Xie**, Department of Neurosciences, University of Toledo, Toledo, Ohio, USA; **Xin Wang**, Department of Psychiatry, University of Toledo, Toledo, Ohio, USA; **Jon D. Elhai**, Department of Psychiatry, University of Toledo, Toledo, Ohio, USA; and Department of Psychology, University of Toledo, Toledo, Ohio, USA

Correspondence: Chia-Hao Shih. Email: chiahao.shih@utoledo.edu

First received 6 Jun 2022, final revision 21 Nov 2022, accepted 28 Dec 2022

Data availability

The data that support the findings of this study are available from the corresponding author on reasonable request.

Author Contribution

C.-H.S.: conceptualisation, formal analysis, writing original draft; A.Z.: writing original draft; S.G.: investigation, writing – review and editing; H.X.: investigation, writing – review and editing; X.W.: investigation, writing – review and editing, funding acquisition; J.D.E.: conceptualisation, methodology, writing – review and editing.

Funding

This work was supported by the National Institute of Mental Health (NIMH) under grant (R01MH110483).

Declaration of interest

None.

References

1 Shalev A, Liberzon I, Marmar C. Post-traumatic stress disorder. *N Engl J Med* 2017; **376**: 2459–69.

2 Chen J, Christ NM, Shih C-H, Xie H, Grider SR, Lewis C, et al. Dispositional optimism mediates relations between childhood maltreatment and PTSD symptom severity among trauma-exposed adults. *Child Abuse Neglect* 2021; **115**:105023.

3 Shih C-H, Thalla PR, Elhai JD, Mathews J, Brickman KR, Redfern RE, et al. Preliminary study examining the mediational link between mild traumatic brain injury, acute stress, and post-traumatic stress symptoms following trauma. *Eur J Psychotraumatol* 2020; **11**: 1815279.

4 Wang X, Xie H, Cotton AS, Duval ER, Tamburrino MB, Brickman KR, et al. Preliminary study of acute changes in emotion processing in trauma survivors with PTSD symptoms. *PLoS One* 2016; **11**: e0159065.

5 Xie H, Huffman N, Shih C-H, Cotton AS, Buehler M, Brickman KR, et al. Adverse childhood experiences associate with early post-trauma thalamus and thalamic nuclei volumes and PTSD development in adulthood. *Psychiatry Res Neuroimaging* 2022; **319**: 111421.

6 Creamer M, O'Donnell ML, Pattison P. The relationship between acute stress disorder and posttraumatic stress disorder in severely injured trauma survivors. *Behav Res Ther* 2004; **42**: 315–28.

7 Shalev AY, Gevonden M, Ratanatharathorn A, Laska E, van der Mei WF, Qi W, et al. Estimating the risk of PTSD in recent trauma survivors: results of the International Consortium to Predict PTSD (ICPP). *World Psychiatry* 2019; **18**: 77–87.

8 Oberski D. Mixture models: latent profile and latent class analysis. In *Modern Statistical Methods for HCI* (eds J Robertson, M Kaptein): 275–87. Springer, 2016.

9 Durham TA, Byllesby BM, Elhai JD, Wang L et al. Latent profile analysis of PTSD and dissociation, and relations with anger. *Curr Psychol* 2020; **41**: 1595–602.

10 Műllerová J, Hansen M, Contractor AA, Elhai JD, Armour C. Dissociative features in posttraumatic stress disorder: a latent profile analysis. *Psychol Trauma* 2016; **8**: 601–8.

11 Contractor AA, Roley-Roberts ME, Lagdon S, Armour C. Heterogeneity in patterns of DSM-5 posttraumatic stress disorder and depression symptoms: latent profile analyses. *J Affect Disord* 2017; **212**: 17–24.

12 Achterhof R, Huntjens RJC, Meewisse M-L, Kiers HAL. Assessing the application of latent class and latent profile analysis for evaluating the construct validity of complex posttraumatic stress disorder: cautions and limitations. *Eur J Psychotraumatol* 2019; **10**: 1698223.

13 Shevlin M, Hyland P, Elklit A. Different profiles of acute stress disorder differentially predict posttraumatic stress disorder in a large sample of female victims of sexual trauma. *Psychol Assess* 2014; **26**: 1155.

14 Armour C, Hansen M. Assessing DSM-5 latent subtypes of acute stress disorder dissociative or intrusive? *Psychiatry Res* 2015; **225**: 476–83.

15 Hansen M, Armour C, Wang L, Elklit A, Bryant RA. Assessing possible DSM-5 ASD subtypes in a sample of victims meeting caseness for DSM-5 ASD based on self-report following multiple forms of traumatic exposure. *J Anxiety Disord* 2015; **31**: 84–9.

16 Lenferink LIM, Egberts MR, Kullberg M-L, Meentken MG, Zimmermann S, Mertens YL, et al. Latent classes of DSM-5 acute stress disorder symptoms in children after single-incident trauma: findings from an international data archive. *Eur J Psychotraumatol* 2020; **11**: 1717156.

17 Blevins CA, Weathers FW, Witte TK. Dissociation and posttraumatic stress disorder: a latent profile analysis. *J Trauma Stress* 2014; **27**: 388–96.

18 Deen A, Biedermann SV, Lotzin A, Krüger-Gottschalk A, Dyer A, Knaevelsrud C, et al. The dissociative subtype of PTSD in trauma-exposed individuals: a latent class analysis and examination of clinical covariates. *Eur J Psychotraumatol* 2022; **13**: 2031591.

19 Weathers FW, Blake DD, Schnurr PP, Kaloupek DG, Marx BP, Keane TM. *The Life Events Checklist for DSM-5 (LEC-5)*. National Center for PTSD, 2013. Available from: https://www.ptsd.va.gov/professional/assessment/te-measures/life_events_checklist.asp.

20 Gray MJ, Litz BT, Hsu JL, Lombardo TW. Psychometric properties of the life events checklist. *Assessment* 2004; **11**: 330–41.

21 Weathers FW, Litz BT, Keane TM, Palmieri PA, Marx BP, Schnurr PP. *The PTSD Checklist for DSM-5 (PCL-5)*. National Center for PTSD, 2013. Available from: https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp.

22 Bovin MJ, Marx BP, Weathers FW, Gallagher MW, Rodriguez P, Schnurr PP, et al. Psychometric properties of the PTSD checklist for Diagnostic and Statistical Manual of Mental Disorders–Fifth Edition (PCL-5) in veterans. *Psychol Assess* 2016; **28**: 1379–91.

23 Bryant RA, Moulds ML, Guthrie RM. Acute stress disorder scale: a self-report measure of acute stress disorder. *Psychol Assess* 2000; **12**: 61–8.

24 Mac Donald CL, Adam OR, Johnson AM, Nelson EC, Werner NJ, Rivet DJ, et al. Acute post-traumatic stress symptoms and age predict outcome in military blast concussion. *Brain* 2015; **138**: 1314–26.

25 Weathers FW, Blake DD, Schnurr PP, Kaloupek DG, Marx BP, Keane TM. *The Clinician-Administered PTSD Scale for DSM-5 (CAPS-5)*. National Center for PTSD, 2013. Available from: https://www.ptsd.va.gov/professional/assessment/adult-int/caps.asp.

26 Boeschoten MA, Van der Aa N, Bakker A, Ter Heide FJJ, Hoofwijk MC, et al. Development and evaluation of the Dutch clinician-administered PTSD scale for DSM-5 (CAPS-5). *Eur J Psychotraumatol* 2018; **9**: 1546085.

27 Johnson DR, Creech JC. Ordinal measures in multiple indicator models: a simulation study of categorization error. *Am Sociol Rev* 1983: 398–407.

28 Zumbo BD, Zimmerman DW. Is the selection of statistical methods governed by level of measurement? *Can Psychol* 1993; **34**: 390.

29 Sinha P, Calfee CS, Delucchi KL. Practitioner's guide to latent class analysis: methodological considerations and common pitfalls. *Crit Care Med* 2020; **49**: e63–79.

https://doi.org/10.1192/bjo.2023.1 Published online by Cambridge University Press

30 Nylund KL, Asparouhov T, Muthén BO. Deciding on the number of classes in latent class analysis and growth mixture modeling: a Monte Carlo simulation study. *Struct Equ Modeling* 2007; **14**: 535–69.

31 Nylund-Gibson K, Choi AY. Ten frequently asked questions about latent class analysis. *Transl Issues Psychol Sci* 2018; **4**: 440.

32 Asparouhov T, Muthén B. Auxiliary variables in mixture modeling: three-step approaches using M plus. *Struct Equ Modeling* 2014; **21**: 329–41.

33 Shan G, Gerstenberger S. Fisher's exact approach for post hoc analysis of a chi-squared test. *PLoS One* 2017; **12**: e0188709.

34 Hansen M, Ross J, Armour C. Evidence of the dissociative PTSD subtype: a systematic literature review of latent class and profile analytic studies of PTSD. *J Affect Disord* 2017; **213**: 59–69.

35 Wolf EJ, Miller MW, Reardon AF, Ryabchenko KA, Castillo D, Freund R. A latent class analysis of dissociation and posttraumatic stress disorder: evidence for a dissociative subtype. *Arch Gen Psychiatry* 2012; **69**: 698–705.

36 Steuwe C, Lanius RA, Frewen PA. Evidence for a dissociative subtype of PTSD by latent profile and confirmatory factor analyses in a civilian sample. *Depress Anxiety* 2012; **29**: 689–700.

37 Armour C, Elklit A, Lauterbach D, Elhai JD. The DSM-5 dissociative-PTSD subtype: can levels of depression, anxiety, hostility, and sleeping difficulties differentiate between dissociative-PTSD and PTSD in rape and sexual assault victims? *J Anxiety Disord* 2014; **28**: 418–26.

38 Hansen M, Hyland P, Armour C. Does highly symptomatic class membership in the acute phase predict highly symptomatic classification in victims 6 months after traumatic exposure? *J Anxiety Disord* 2016; **40**: 44–51.

39 Claus RE, Kindleberger LR, Dugan MC. Predictors of attrition in a longitudinal study of substance abusers. *J Psychoact Drugs* 2002; **34**: 69–74.

40 Graaf R, Bijl RV, Smit F, Ravelli A, Vollebergh WA. Psychiatric and sociodemographic predictors of attrition in a longitudinal study The Netherlands Mental Health Survey and Incidence Study (NEMESIS). *Am J Epidemiol* 2000; **152**: 1039–47.

https://doi.org/10.1192/bjo.2023.1 Published online by Cambridge University Press