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BASIC RESEARCH ARTICLE

Posttraumatic stress and depression symptom classes in parents of trauma-exposed children: a transdiagnostic perspective using pooled individual participant data

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ABSTRACT

Background: In the aftermath of child trauma, post-traumatic stress (PTS) and depression symptoms often co-occur among trauma exposed children and their parents. Studies have used latent class analysis (LCA) to examine PTS and depression symptoms and identify homogeneous subgroups among trauma exposed children. However, little is known about subgroups or classes of PTS and depression reactions of parents of traumatised children.
Objectives: (1) Determine PTS and depression symptom classes at 2–9 months post-trauma, and (2) to examine sociodemographic covariates among parents of trauma exposed children.
Methods: Using harmonised individual participant data ($n = 702$) from eight studies (Australia, UK, US) included in the Prospective studies of Acute Child Trauma and Recovery Data Archive (PACT/R), we modelled these phenomena at the symptom level using LCA.
Results: Our LCA yielded three solutions: 'high internalizing symptom' class (11%); 'low PTS-high depression' class (17%); and 'low internalizing symptom' class (72%). Parents of children in the 'low PTS-high depression' class were more likely to have children of older age and be part of an ethnic minority, compared to the 'low internalizing symptoms' class. Mothers were more likely to be in the 'high internalizing symptom' class compared to the 'low internalizing symptoms' class.
Conclusions: These findings reveal a qualitative structure and relationship between depression and PTS symptoms that highlights the importance of assessing and targeting a broad range of internalising symptoms in post-trauma psychological treatment.

Clases de síntomas de depresión y estrés postraumático en padres de niños expuestos a traumas: Una perspectiva transdiagnóstica utilizando datos agrupados de participantes individuales

Antecedentes: Después de un trauma en la infancia, el estrés postraumático (EPT) y los síntomas de depresión a menudo coexisten entre los niños expuestos al trauma y sus padres. Los estudios han utilizado el análisis de clases latentes (ACL) para examinar el síndrome de estrés postraumático y los síntomas de depresión, e identificar subgrupos homogéneos entre los niños expuestos a traumas. Sin embargo, se sabe poco sobre los subgrupos o clases de EPT y las reacciones de depresión de los padres de niños traumatizados.
Objetivos: (1) determinar las clases de síntomas de depresión y EPT entre 2 y 9 meses después del trauma, y (2) examinar las covariables sociodemográficas entre los padres de niños expuestos al trauma.
Métodos: Utilizando datos armonizados de participantes individuales ($n = 702$) de ocho estudios (Australia, Reino Unido, EE. UU.) incluidos en los estudios prospectivos del archivo de datos de recuperación y trauma infantil agudo (PACT/R), modelamos estos fenómenos a nivel de síntomas utilizando ACL.
Resultados: Nuestro ACL arrojó tres soluciones: clase de 'síntoma de alta internalización' (11%); clase 'bajo EPT-depresión alta' (17%); y clase de 'síntoma de internalización baja' (72%). Los padres de niños en la clase de 'bajo EPT-alta depresión' tenían más probabilidades de tener hijos de mayor edad y ser parte de una minoría étnica, en comparación con la clase de 'bajos síntomas de internalización'. Las madres tenían más probabilidades de estar en la clase de 'síntomas de internalización altos' en comparación con la clase de 'síntomas de internalización bajos'.

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Posttraumatic stress (PTS); depression symptoms; acute child trauma; parental outcomes; latent class analysis (LCA); hierarchical taxonomy of psychopathology (HiTOP); social determinants of mental health (SDMH)

PALABRAS CLAVE
Estrés Postraumático (EPT); síntomas de depresión; trauma infantil agudo; resultados de los padres; análisis de clases latentes (ACL); taxonomía jerárquica de psicopatología (HiTOP); determinantes sociales de la salud mental (SDMH)

HIGHLIGHTS

- Using harmonised individual participant data from eight studies included in the Prospective studies of Acute Child Trauma and Recovery (PACT/R) Data Archive we identified three distinct classes of parental internalising reactions using Latent Class Analysis.
- Mothers, family ethnic minority status, and children of older age were associated with distinct classes of problematic symptoms.
- The findings from the present study highlight the need for assessing and targeting a broad range of internalising symptoms after trauma, and that mothers, parents of older

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Conclusiones: Estos hallazgos revelan una estructura cualitativa y una relación entre la depresión y los síntomas del EPT que resalta la importancia de evaluar y abordar una amplia gama de síntomas internalizantes en el tratamiento psicológico postraumático.

children and families with ethnic minority status might be at risk for elevated symptoms.

1. Introduction

In the aftermath of a traumatic event, symptoms of depression and posttraumatic stress (PTS) frequently co-occur (Afzali et al., 2017; Hurlocker et al., 2018). Parents and/or caregivers of children who experience a traumatic event may develop elevated levels of PTS symptoms, significant posttraumatic stress disorder (PTSD), depression symptoms independently (Kassam-adams et al., 2015; Wilcoxon et al., 2021) or with these disorders co-occurring (Eli et al., 2020). Whether or not a parent meets full diagnostic criteria, PTS and depression symptoms might have significant implications for the parent/caregiver and their child's mental health (Morris et al., 2012). Literature on the adjustment of trauma-exposed children highlights the critical impact of parents in helping the child cope with traumatic events and their consequences (Scheeringa & Zeanah, 2001). In the wake of their child's traumatic experience, parents may experience feelings of distress, shame, guilt, and depression (Holt et al., 2014). Combined depression and PTS symptoms may have even greater impact on a parent's ability to support child emotional and behavioural regulation following a traumatic event (Chemtob et al., 2010).

A recent meta-analysis of parental PTSD following a child's single-event trauma found similar rates of PTSD (18%) and depression (17%) among parents, with parental depression as a significant PTSD correlate (Wilcoxon et al., 2021). Research has examined the co-occurrence of PTS and depression symptoms in parents of trauma-exposed children in the context of emergency medical care (Kassam-adams et al., 2015); pediatric burn injury (Kent et al., 2000); terrorist attacks (Chemtob et al., 2010); as well as children and parents seeking intervention following their child's traumatic event (Salloum et al., 2015). These studies have found that parental depression symptoms and PTS frequently co-occur.

The comorbidity between PTSD and depression can be explained in several ways. PTSD may play a causal role in depression, or depression may play a causal role in further potential traumatic experiences, contributing to the risk of PTSD (Stander et al., 2014). Alternatively, the high co-morbidity of PTSD and depression may be explained by their shared symptoms (i.e. anhedonia, concentration difficulties, sleep disturbance), their shared risk factors (i.e. childhood maltreatment, high negative affect and low extraversion), or their shared biological factors (i.e. structural and functional neuroimaging, hypothalamic pituitary adrenal axis, epigenetics, gene expression) (Flory & Yehuda, 2015). Emerging research indicates the presence of an underlying internalising symptomatic pattern characterised by anxiety and sadness (Watson et al., 2022), represented by dysphoria symptoms within current PTSD criteria (Contractor et al., 2014; Elhai et al., 2015). Some researchers have questioned whether PTSD and depression are part of the same posttraumatic stress disorder spectrum or whether they are distinct disorders (Stander et al., 2014), and whether the distinctions within current classification systems are optimal to inform individualised prevention strategies and interventions (Contractor et al., 2017).

The Hierarchical Taxonomy of Psychopathology (HiTOP) model addresses limitations of traditional taxonomies of psychiatric disorders, with the aim of improving the measurement, description, and organisation of psychopathology (Conway et al., 2019; Kotov et al., 2017; Watson et al., 2022). Potential limitations of traditional taxonomies of psychiatric disorders include subjective boundaries on the continuum of psychopathology and normality (i.e. considering all mental disorders as categories); disorder co-occurrence/co-morbidity and heterogeneity in diagnosis; limited reliability of traditional diagnoses; and patients not meeting the cut-off for diagnoses despite displaying symptomology that requires care (Kotov et al., 2017). Using HiTOP, a client's presenting symptomology is not viewed through a specific diagnostic category or disorder classification. Instead, the clinician conceptualises symptoms in a hierarchical structure as they relate to one-another with potential overlaps (Watson et al., 2022). As a research framework, the HiTOP model has been evaluated using psychometric approaches, and through latent variable modelling, such as latent class analysis (LCA). Using LCA, dimensions of the HiTOP model can be understood via latent classes of symptom models (Conway et al., 2019).

LCA is a person-centered method useful in studies with heterogenous participant symptom classes. LCA identifies qualitatively diverse subgroups within participant populations who share heterogenous characteristics (Petersen et al., 2019). Given the frequency with which PTS and depressive symptoms co-occur following a traumatic event, applying LCA makes it possible to identify subclasses of symptom-classes across the two disorders and allows comparison of latent classes by shape/type (qualitative differences) and symptom level (quantitative differences) (Contractor et al., 2017).

Adult studies using LCA/Latent Profile Analysis (LPA) to examine co-occurring patterns of PTS and depression following a traumatic event have focused on victim-survivors of war (Contractor et al., 2015), refugees (Lenferink et al., 2022), sexual assault (Au et al., 2013), and natural disasters (Zhen et al., 2020). Several LCA/LPA studies reported three or four classes based on different levels of symptom severity (Eli et al., 2020; Hruska et al., 2014; Zhou et al., 2018). Other studies found classes differing in severity and type, meaning that the severity of PTS and depression symptoms was not consistently reflective of one another; Cao et al. (2015) found four-non-parallel profiles among earthquake survivors of low symptoms, predominantly depression, predominantly PTSD, and combined PTSD-depression subgroups; Contractor et al. (2017) results of LPA indicated a three-class solution containing a high PTSD and depression severity class among university students: lower PTSD/higher depression class, and higher PTSD/lower depression class.

To date, only two studies have examined symptom classes of PTS and depression in parents and caregivers following a traumatic event, in which parents have lost their only child (Eli et al., 2020; Zhou et al., 2018). Eli et al. (2020) demonstrated three distinct profile groups of individuals with low, moderate, and high levels of both depression and PTS symptom presentation. Zhou et al. (2018) had similar findings with three latent subgroups identified: (1) 'resilient' subgroup (low levels of physical and psychological outcomes, even post-traumatic growth), (2) 'coping' subgroup (moderate levels of physical impairments, negative psychological outcomes and high levels of post-traumatic growth), and (3) 'dysfunctional' subgroup (high levels of physical impairments, negative psychological outcomes and low levels of post-traumatic growth).

Several sociodemographic factors have been significantly associated with PTS of parents with trauma-exposed children, including gender (higher PTSD incidence in mothers versus fathers (Morris et al., 2012; Wilcoxon et al., 2021); Black or minority ethnicity (Wilcoxon et al., 2021); younger age (Elkins et al., 2022); and low income (Elkins et al., 2022; Wilcoxon et al., 2021). This literature is consistent with the broader framework of social determinants of mental health (SDMH), i.e. that groups with greater exposure and vulnerability to unfavourable social, economic, and environmental circumstances over the life-course, based on gender, race and/or ethnicity, are at higher risk of mental disorders and ill-health (World Health Organization and Calouste Gulbenkian Foundation, 2014).

Past research examining parents after traumatic experiences of children has been limited by small sample sizes making it difficult to apply analytical techniques like LCA (Chemtob et al., 2010; Salloum et al., 2015). The current study is pooling and reusing participant-level data from eight studies, providing a larger sample of this vulnerable group, and allowing the use of LCA and consideration of sociodemographic covariates, that would not otherwise be possible (Kassam-Adams & Olff, 2020). Better understanding of parent internalising symptoms after child trauma is critical to inform individualised interventions.

1.1. Study aims and research questions

Using an LCA approach we focus on two aims:

1. To determine classes of internalising symptoms (using PTS and depression items) of parents following their child's traumatic event; We hypothesised that LCA modelling would result in three or four classes for PTS and depression symptoms, with a large proportion of parents in a low or moderate symptom class, and a smaller number in the high symptom class. We did not have specific hypotheses about classes with type/qualitative differences between PTS and depression symptoms due to the paucity of studies investigating LCA/LPA in parents following traumatic events.
2. To examine potential sociodemographic covariates of these classes, including child age and gender; parent/caregiver ethnic minority status; and parent gender. Children in younger age, female caregivers, and being a member of an ethnic minority group were hypothesised to predict belonging to the high PTS/depression group.

2. Method

2.1. Pact/R data archive

Data for this study were obtained from the Prospective Studies of Acute Child Trauma and Recovery (PACT/R) data archive, an international data repository of prospective studies of child traumatic stress (Kassam-Adams et al., 2020), part of the Child Trauma Data Archives (www.childtraumadata.org). The Archive includes de-identified, anonymized data from studies conducted with appropriate ethics approval. The Institutional Review Board (IRB) of The Children's Hospital of Philadelphia determined that the operation of the archive does not constitute human subjects research because all data are de-identified. These projects are associated with the Global Collaboration on Traumatic Stress (Olff et al., 2020) FAIR Data Theme, which supports a growing collection of integrative individual patient data (IPD) projects (https://www.global-psychotrauma.net/fair).

For the current analyses, eight of the 30 studies in the PACT/R archive met our inclusion criteria: Data from at least one assessment of parent/

Table 1. Overview of eight studies and characteristic used in harmonised dataset from the PACT/R Data Archive*.

	PACT/R dataset number	Type(s) of acute trauma exposure (index event)	Age range (years)	Country	Year(s)[a]	*N* in dataset	Number of assessments	Assessment timing[b] <24 hr	1 day–1 mo	1–3 mo	3–6 mo	6–12 mo	≥12 mo
1.	1005	Injury (Kassam-adams et al., 2015)	8–17	US	2003	159	2	X			X		
2.	1007	Injury (Kassam-Adams et al., 2011)	8–17	US	2007–2008	100	3		X	X		X	
3.	1010	Injury (Le Brocque et al., 2010)	7–16	AUS	2000–2002	137	4		X	X		X	X
4.	1012	Injury (Kenardy et al., 2008)	7–15	AUS	2003–2004	66	3		X	X		X	
5.	1014	Injury (Cox et al., 2010)	7–16	AUS	2007	11	3		X	X		X	
6.	1019	Injury (Ostrowski et al., 2007)	8–18	US	2003–2004	39	3	X		X		X	
7.	1022	Injury/Medical/ Violence/RTA (Nixon et al., 2010)	7–17	AUS	2004–2006	76	3		X		X	X	
8.	1038	Injury/RTA/Violence/ Medical Halligan (Hiller et al., 2018)	6–13	UK	2014–2015	114	3		X		X	X	
		Total for combined 8 datasets	**6–18**		**2000–2015**	**702**	**2–4**						

Note. [a]Calendar year(s) in which index trauma occurred.
[b]Time categories are mutually exclusive, i.e. '1–3 mo' denotes at least 1 month but less than 3 months. RTA: Road traffic accident; Medical: Acute medical event other than injury; US: United States; AUS: Australia; UK: United Kingdom.
*Table adapted from Kassam-Adams et al. (2020).

caregiver PTS and depression symptoms conducted two to nine months (60–269 days) after their child's traumatic event. These eight studies provide individual participant data representing 702 parents/caregivers from studies conducted in the USA, UK, and Australia. Table 1 includes additional study characteristics.

2.2. Procedure

2.2.1. Data harmonization

The Child Trauma Data Archives project provides variables harmonised across samples from different countries, for several sociodemographic factors relevant to our analyses: child ethnic minority status, coded

Table 2. Overview of eight studies and constructs used in harmonised dataset from the PACT/R data archive.

	Symptom Construct	*N*	PTS Assessment CAPS	IES	IESR	PCL	PDS	Depression Assessment CESD	DASS
PTS items	Intrusive	702	X	X	X	X	X		
	Bad dreams	499	X	X	X	X	X		
	Flashbacks	702	X		X	X	X		
	Emotional cue reactivity	702	X	X	X	X	X		
	Physical reactions to reminders	499	X		X	X	X		
	Avoidance of thoughts	701	X	X	X	X	X		
	Avoidance of reminders	702	X	X	X	X	X		
	Trauma-related amnesia	488	X			X	X		
	Negative beliefs*	0							
	Distorted cognitions*	0							
	Negative emotions*	0							
	Feeling detatched	487	X			X	X		
	Lack of positive emotions	702	X	X	X	X	X		
	Irritable / angry	499	X		X	X	X		
	Reckless*	0							
	Overly alert	498	X		X	X	X		
	Easily startled	499	X		X	X	X		
	Depersonalization*	0	X						
	Derealization*	0	X	X	X				
	Foreshortened future	488	X			X	X		
Cross-diagnostic items	Diminished interest	702	X			X	X	X	X
	Difficulty concentrating	498	X		X	X	X	X	
	Sleep problems	702	X	X	X	X	X	X	
Depression items	Depressed mood	702						X	X
	Hopless	702						X	X
	Weight loss	297						X	
	Psychomotor agitation or retardation	702						X	X
	Fatigue	298						X	
	Worthlessness	702						X	X
	Suicidality*	0							

Note. *Denotes items not used in LCA.

based on reported child race/ethnicity, and whether child is a minority in their country of residence. Ethnic minorities included those who reported their race as 'Black / African American' (US), 'Black' (UK), 'African' (AUS), 'Asian' (US, UK, AUS), 'Chinese' (UK), 'American Indian / Alaska Native' (US), 'Native Hawaiian or Other Pacific Islander' (US), 'Indigenous Australian' (AUS), 'New Zealand Maori' (AUS), 'Pacific Islander' (AUS) 'Middle Eastern' (AUS), 'Multi-Racial' (US), 'Mixed' (UK), or 'Other' (UK). We used this variable as an indicator of family ethnic minority status.

In order to examine parent internalising symptoms, we integrated five measures of PTS and two measures of depression used in the eight original datasets combined in these analyses. Table 2 includes an overview of the symptoms assessed across the PTS and depression measures. In the data used for this study, parents were asked to complete the questions related to their own PTS symptoms with respect to their child's traumatic event. Item-level harmonisation for internalising symptoms occurred in a multi-step process. Item content concordance was based on harmonisation algorithms developed by the Child Trauma Data Archive for adult (parent/caregiver) mental health symptoms. The harmonisation algorithms was also applied in a previous research which used pooled data from PACT/R Archive (Lenferink et al., 2020), and is also supported by a recent study expanding on the harmonisation process of social, emotional and behavioural constructs (McDaniel et al., 2023). The harmonisation algorithms includes: (a) symptom criteria across DSM-IV, DSM-5, ICD-10 and ICD-11 diagnoses for PTS and depression were aligned based on concordance of content, for example DSM-IV and DSM-5 Major Depressive Disorder symptom A1 'depressed mood most of the day, nearly every day' and ICD-10 and ICD-11 Recurrent Depressive Disorder symptom 'depressed mood' were aligned to create the harmonised symptom 'depressed mood'; (b) item-level content from PTS and depression measures was mapped to corresponding symptom criteria, for example, the item 'I felt sad and depressed' from the Depression and Anxiety Stress Scales, and the item 'I felt depressed' from the Center for Epidemiological Studies Depression Scale both correspond to the harmonised symptom 'depressed mood;' and (c) concordance and item-mapping were reviewed and approved by an expert panel, comprised of members of the Child Trauma Data Archives Expert Advisory Group (https://childtraumadata.org/child-trauma-data-archives-team). A table outlining the concordance of measure items across diagnostic constructs can be found on the Child Trauma Data Archives website (https://childtraumadata.org/use-data/harmonization).

For the current study, item-level variables were dichotomised based on each measure's standard scoring rules for symptom presence. Where standard scoring rules were not available, items were dichotomised based on expert consensus. Dichotomised item-level variables were then combined to create common cross-measure harmonised variables for presence or absence of each symptom criterion for PTSD or depression in the DSM or ICD systems noted above. Not all studies in this dataset were able to contribute to every harmonised symptom item since not all had used measures assessing every symptom criterion. Most included studies were conducted using measures based on DSM-IV PTSD diagnostic criteria, which do not include 4 PTS items associated with DSM-5 (negative beliefs, distorted cognitions about the event, negative emotions, and reckless behaviour). Neither of the depression measures used in these studies included an item for suicidality, thus this construct was excluded from analysis.

Three symptoms appear with nearly identical content across PTSD and depression disorder criteria: sleep problems, difficulty concentrating, and diminished interest. In our creation of dichotomous harmonised items for these overlapping symptoms, we were using items from measures assessing either disorder. For example, difficulty concentrating may have been deemed present based on a participant's positive response to 'I had trouble concentrating' (on the Impact of Events Scale, a PTS measure), or to 'I had trouble keeping my mind on what I was doing' (on the Center for Epidemiological Studies Depression Scale). Overall, 23 internalising symptoms including 14 PTS items, 6 depression items, and 3 cross-diagnostic items were assessed and included in these analyses.

2.2.2. Covariates of class membership

Correlates of class membership included in the analysis were child age in years, dichotomous variables for parent/caregiver gender, child gender, and family ethnic minority status. Additionally, we performed a sensitivity analysis to assess the impact of individual studies on the classification outcomes. Each study was treated as an independent predictor to evaluate its association with the identified classes.

2.3. Data analysis

We conducted LCA using Mplus 8.8 (Muthén & Muthén, 2012) to identify distinct classes of internalising symptoms, using 23 harmonised and dichotomised depression and PTS symptoms. LCA facilitates the extraction of distinct, meaningful subgroups based on the unobserved heterogeneity within a population and the similarity of their response classes (Petersen et al., 2019).

The appropriate number of latent classes underlying the data is determined by running successive models, beginning with a one-class solution, and

then comparing changes in various fit statistics. Each model was tested for fit using four separate measures (Nylund et al., 2007): the Bayesian Information Criteria (BIC), adjusted Bayesian Information Criteria (SABIC), the Lo–Mendell–Rubin adjusted likelihood ratio test (LMR), and the parametric bootstrap likelihood ratio test (BLRT). The BIC and SABIC are interpreted as the lowest value being considered the best fit. The LMR and the BLRT provide comparisons between models; significant values indicate the model is an improved fit over the model with fewer classes, e.g. whether a 4-class model fits significantly better than a 3-class model. Entropy was not used as a fit measure; however, lower entropy values may indicate that the model does not illustrate groups with uniquely separate characteristics. The meaningfulness of the patterns of internalising symptoms (PTS and depression symptoms) was also considered in the selection of the final class structure. Missing data on the PTS and Depression symptoms were accounted for with the Mplus missing data default option (Muthén & Muthén, 2012), i.e. full information maximum likelihood (FIML).

After identifying classes of internalising symptoms using LCA, we examined the degree to which sociodemographic factors were associated with parent's/caregiver's likelihood of class membership using the manual three-step method implemented in Mplus (Asparouhov & Muthén, 2014a). Step 1: We computed an LCA using the latent class indicators as noted above. Step 2: The most likely class membership was established for each observation, using the class-specific endorsement probabilities obtained during the first step. Step 3: Auxiliary variables (i.e. the covariate variables) were included; the class memberships were fixed according to the previous step and used in multinomial logistic regression as dependent variables. All covariates (i.e. child age, gender, child ethnic minority status, and parent gender) were included in each model. Missing data on the covariates was handled by utilising full information maximum likelihood methods when running the multinomial logistic regression (Mplus syntax ESTIMATOR = ML, INTEGRATION = montecarlo), allowing for a more complete inclusion of information from each of the 702 participants despite incomplete responses.

Table 3. Sample demographic characteristics.

Variable	*M* (*SD*), range
Age of child (years)	11.19 (2.64) 6–19
Age of Parent/caregiver (years)	40 (6.30) 25–67
	N (%)
Sex	
Boys	455 (64.8%)
Girls	247 (35.2%)
Country of residence	
USA	298 (42.5%)
UK	114 (16.2%)
Australia	290 (41.3%)
Ethnic minority in country of residence	
No	505 (71.9%)
Yes	165 (23.5%)
Missing	21 (4.6%)
Relationship of parent/caregiver to child (gender)	
Mother	602 (85.8%)
Father	82 (11.7%)
Other (non-parent) guardian	8 (1.1%)
Missing	10 (1.3%)
Parent completed secondary education	
No	63 (9%)
Yes	362 (51.6)
Missing	277 (39.5%)
Trauma type	
Unintentional injury (fall, sports, animal bite, etc.)	547 (77.9%)
Acute medical event (non injury)	9 (1.3%)
Road traffic accident requiring medical attention	132 (18.8%)
Missing	14 (2%)

3. Results

3.1. Descriptive data

The final sample included data from 702 parents/caregivers of children following potentially traumatic event TME from eight research studies conducted in three countries (US, UK, and Australia). Table 3 presents demographic data for the final sample. All studies enrolled participants after potentially traumatic event that would have met Criterion A for PTSD (for the child and the parent) under DSM-IV or DSM-5. The most common type of index event was unintentional injury (77.9%; e.g. fall and sports), followed by injuries from road traffic accidents (RTA; 18.8%; e.g. motor vehicle occupant, pedestrian, and motorcyclist), and other acute medical events (1.3%; e.g. acute anaphylaxis), with 2% missing.

3.2. Latent class analysis

Table 4 presents the principle LCA model fit indices. According to the LMR the two-profile and three-profile solution had an optimal fit to the data and had meaningful profile sizes. All entropy values were acceptable, with the two- five- and six-profile models having the highest values. However, in the five-and six-profile solution, the sample sizes of some of the profiles were small (<6.5%), the LMR value was non-significant, and the BIC increased. Additionally, although the four- five- and six-profile models had decreasing AIC values suggesting solutions with more profiles, LMR indicated that improvement compared to the three- four- and five- profile models (respectively) was not statistically significant. Between the two- and three-profile models, the three-profile solution was selected as the best fitting model as it had the lower BIC and AIC. Figure 1 show plots of the probability of endorsing each symptom by latent class assignment. The first class, labelled 'high internalizing symptoms' ($n = 76$, 11%), was characterised by the endorsement of the following symptoms: intrusive thoughts, emotional cue reactivity, physical distress at trauma reminders, avoiding thoughts and feelings

Table 4. LCA model fit summary.

			Fit Indices						Class 1		Class 2		Class 3		Class 4		Class 5		Class 6	
Model	Log Likelihood	Free Param-eters	AIC	BIC	SABIC	Entropy	LMR Adjusted *p*-value	BLRT *p*-value	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
1	4371.08	23	8788.16	8892.90	8819.87															
2	3537.20	47	7168.40	7382.43	7233.20	0.93	0.00	.00	522	74.4%	180	25.6%								
3	**3364.50**	**71**	**6871.01**	**7194.33**	**6968.89**	**0.92**	**0.00**	**.00**	**76**	**10.8%**	**118**	**16.8%**	**508**	**72.4%**						
4	3273.87	95	6737.75	7170.37	6868.73	0.91	0.31	.00	48	6.8%	64	9.1%	103	14.7%	487	69%				
5	3207.49	119	6652.99	7194.91	6817.06	0.93	0.06	.00	45	6.4%	78	11.2%	51	7.3%	52	7%	486	69.2%		
6	−3164.86	143	6615.72	7266.93	6812.87	0.93	0.30	.00	19	2.7%	486	69.2%	49	6.9%	32	5%	73	10.4%	46	70%

Note: AIC: Akaike Information Criterion; BIC: Bayesian Information Criterion; SABIC: Sample-Size Adjusted Bayesian Information Criterion; LMR: Lo-Mendell-Rubin Adjusted Likelihood Ratio Test; BLRT: Bootstrap likelihood ratio difference test.

about trauma, irritability, hypervigilance, heightened startle response, concentration problems, diminished interest, sleeping problems, depressed mood, fatigue, and agitation. The second class, labelled 'low PTS-high depression' ($n = 118$, 17%), was characterised by the endorsement of concentration problems, diminished interest, depressed mood, hopelessness, and worthlessness symptoms. The third and final class, labelled 'low internalizing symptoms' ($n = 508$, 72%) was characterised by low endorsement of all symptoms.

3.3. Covariates of class membership

Table 5 presents the comparisons between classes in terms of demographic variables. Covariates of class membership (child's age, parent and child gender, and child ethnic minority status) were examined via the three-step approach, as described above (Asparouhov & Muthén, 2014b).

Parents of older children were more likely to be in the 'low PTS-high depression' class compared to the 'low internalizing symptom' class and compared to the 'high internalizing symptom' class. Parents in ethnic minority families were more likely to be in the 'low PTS-high depression' class compared to the 'low internalizing symptom' class. Female parents and caregivers were more likely to be included in the 'high internalizing symptom' class in comparison to the 'Low internalizing symptom' class. No other covariates were found to be associated with the 'high internalizing symptom' class. Child gender was not associated with any of the classes. The sensitivity analysis revealed that class membership was not significantly influenced by any specific study (study 1 [OR = −.17; $p = .77$]; study 2 and study 6 (merged due to low N) [OR = 2.50; $p = .89$]; study 3 and study 5 (merged due to low N) [OR = 1.54; $p = .46$]; study 4 [OR = 3.39; $p = .16$]; study 7 [OR = 1.197; $p = .79$]; study 8 [OR = 2.19; $p = .28$]). This suggests that the classifications are robust and not dependent on the results or characteristics of any single study included in our analysis. See Table 1 for additional study characteristics.

4. Discussion

The aim of this study was to examine heterogeneity in internalising symptom classes among parents/caregivers following a traumatic event for their child. We took a cross-diagnostic perspective, considering symptoms within both PTS and depression as currently defined by common diagnostic systems. Our results suggest three distinct classes of internalising symptoms among parents, with nearly three quarters endorsing 'low internalizing symptoms' class; about one fifth endorsing 'low PTS-high depression

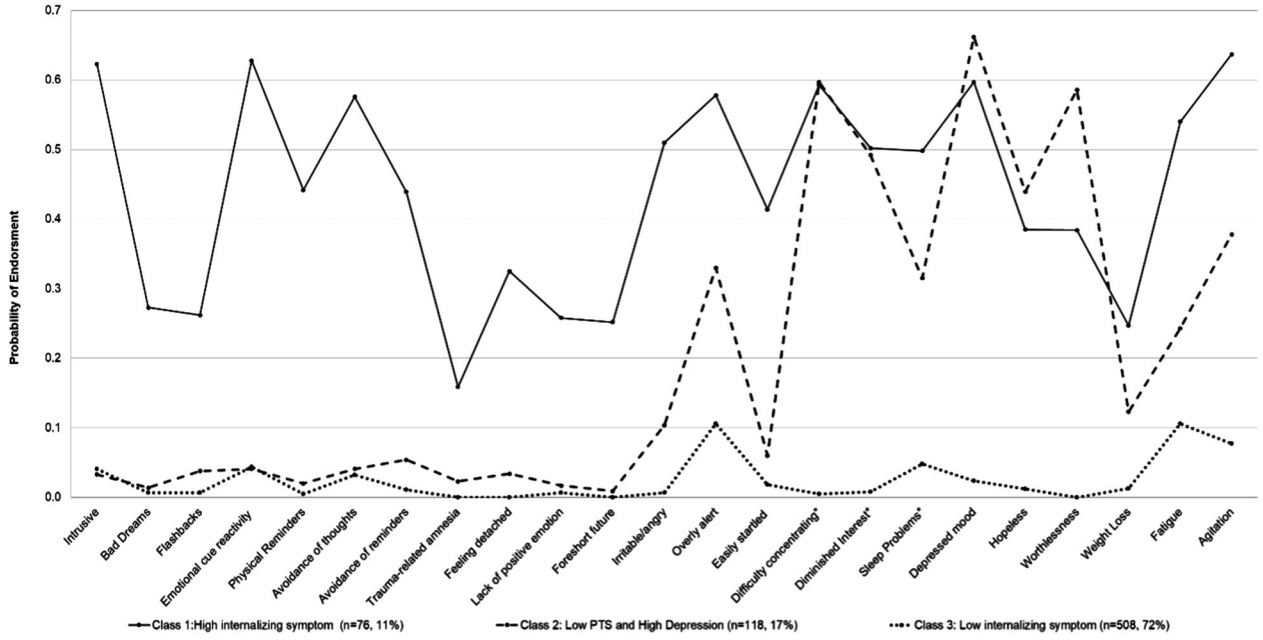

Figure 1. Estimated probabilities of class membership for the three-class model.
Note: *PTS-depression overlap symptoms.

symptoms' class, and about one tenth reporting 'high internalizing symptoms' class. These classes indicate that individual heterogeneity exists in the internalising reactions of parents following the traumatic event of their child, with classes differing both by shape/type (qualitative differences) and by symptom level (quantitative differences).

Most of the parents in our study (72%) fell into the 'low internalizing symptom' class, defined by generally low levels of internalising symptoms across all 23 symptoms. These findings contribute to a growing body of literature indicating that similar to adults experiencing a traumatic event themselves, the majority of parents are resilient, reporting low symptoms following a child's traumatic exposure (Le Brocque et al., 2010; Murphy et al., 2020).

The second class (17%) was differentiated by relatively high levels of depression symptoms – including three items specific to traditional depression criteria (hopeless, worthlessness, and depressed mood), two items that overlap between depression and PTS criteria (diminished interest and concentration), and low levels across all other PTS symptoms. Prior studies examining the structure of depression symptoms have found two latent constructs often labelled as somatic (sleep difficulties, appetite changes, fatigue, concentration difficulties, agitation) and non-somatic/ affective (e.g. depressed mood, feelings of worthlessness, and thoughts of death) factors (Tsai et al., 2014). Our second class was characterised by moderate levels of 'somatic' symptoms, and high levels of 'non-somatic/affective' symptoms. Previous studies using DSM-5 diagnostic criteria have shown strong relationships with depression non-somatic/affective factors (Afzali et al., 2017; Hurlocker et al., 2018), suggesting that part of the co-morbidity may be related to PTS and depression shared negative affect symptoms (Flory & Yehuda, 2015). Our results showing only two PTS items related to depression non-somatic/ affective symptoms, are inconsistent with these previous findings, but as suggested in previous research (Hurlocker et al., 2018), the criterion sets used, and models of PTSD included in these analyses may be responsible for the discrepant finding. Our harmonised data were pooled from studies based on DSM-IV PTSD diagnostic criteria (i.e. without DSM-5's Negative Alterations in Cognition and Mood symptoms), which may account for our finding of a class

Table 5. Predictors of class membership.

	High Internalising Symptom vs. Low Internalising Symptom					Low PTS and High Depression vs. Low Internalising Symptom					Low PTS and High Depression vs. High Internalizing Symptom				
			95% CI					95% CI					95% CI		
	AOR	S.E.	Lower	Upper	*p*	AOR	S.E	Lower	Upper	*p*	AOR	S.E	Lower	Upper	*p*
Child age	1.01	.04	.92	1.1	.67	**1.21****	.05	1.11	1.31	.00	**1.19****	.06	1.064	1.324	.00
Child gender	1.15	.29	.57	1.73	.57	.89	.20	.49	1.29	.61	.77	.24	.301	1.247	.41
Child ethnic minority	1.44	.41	.63	2.26	.19	**2.21****	.50	1.22	3.21	.00	1.52	.5	.537	2.519	.19
Parent gender	**5.74****	4.17	−2.59	14.07	.01	1.39	.46	.46	2.31	.32	0.24	.18	−0.126	.608	.06

Note: AOR = Adjusted OR; 95% CI = 95% confidence interval. **Statistically significant difference between classes at $p < .005$.

characterised mainly by depression non-somatic/affective symptoms.

The third class (11%) was differentiated by relatively high levels of three depression symptoms (agitation, fatigue, depressed mood), eight PTS items (e.g. intrusive symptoms, avoiding thoughts and feelings), and all three depression-PTS overlap symptoms (difficulty concentrating, diminished interest, sleep problems). This class had low-moderate levels of 'non-somatic/affective' depression symptoms, but high levels of most 'somatic' depression symptoms, suggesting PTS and somatic depression symptoms are highly related. Others have found that PTSD hyperarousal symptoms (e.g. hypervigilance and startle response) directly overlap with somatic depression (i.e. difficulty concentrating and sleeping) (Contractor et al., 2014; Hurlocker et al., 2018). These symptoms also overlap with anxiety-related disorders, suggesting that a transdiagnostic factor, such as anxiety sensitivity, may be accounting for the association (Raines et al., 2017), and should be further examined in future studies.

Our results are also consistent with prior studies in indicating an optimal fitting 3-class solution (Armour et al., 2015; Eli et al., 2020). In some prior studies classes have been found to be different mainly in terms of severity *rather than* type (Armour et al., 2015; Au et al., 2013; Hruska et al., 2014). Other studies found classes differing in severity *and* type (Cao et al., 2015; Contractor et al., 2017; Lenferink et al., 2022), consistent with our study findings. Methodological differences can explain most of the discrepant findings, mainly since when combining data from different studies using different measures, some specificity of information from item-level is lost. To enable harmonisation, the degree of granularity of PTS and depression severity is reduced due to dichotomising symptoms as present/absent in the harmonisation process, thus mild parental symptoms might have been dichotomised as 'absent'. Additionally, and as described earlier in the discussion, the data we integrated came mainly from PTS measures based on DSM-IV PTSD diagnostic criteria, without Negative Alterations in Cognition and Mood symptoms. Additional methodological differences suggested in previous studies may include differing measures and data collection procedures which may explain some of the different results in this field (Contractor et al., 2017).

These results and those of three prior adult studies suggest there is a qualitative difference in the classes of internalising symptoms following potential traumatic exposure, where a predominant depression subgroup is likely to emerge (Cao et al., 2015; Contractor et al., 2017; Lenferink et al., 2022). A key implication of these findings is that researchers and practitioners who focus exclusively on PTS and do not consider depression when assessing post-trauma psychological adjustment may get an incomplete picture of distress in this group (Lenferink et al. (2022). Our cross-diagnostic approach was informed by the HiTOP model, which emphasises the importance of understanding the structure of disorders within the internalising dimension (Watson et al., 2022). Understanding the qualitative structure and relationship between depression and PTS symptoms could help make diagnostic assessments more useful, both in research and in the clinic.

Covariates of class membership identified in this study echo SDMH research, in that ethnic minority status and gender were associated with parent mental health outcomes. Our data showed that mothers were more likely to be in the 'high internalizing symptom' class, with a greater endorsement of both PTS and depressive symptoms, in comparison to the 'low internalizing symptoms' class. These results support existing literature on PTSD and gender, with women being at higher risk of developing PTSD compared to men (Olff, 2017). Studies focusing on parents identified higher PTSD incidence among mothers versus fathers (Morris et al., 2012; Wilcoxon et al., 2021). In Western societies, mothers traditionally raise children and care for the family (Thyen et al., 1999); studies suggest that this may led to them feeling more of a responsibility to help their children cope, hence experiencing more suffering than fathers (Pleck, 2010). Our findings are consistent with existing literature on gender differences in depression (Ferrari et al., 2013), with major depression prevalence generally reported to be twice as widespread in women than men (Salk et al., 2017).

Parents in families with ethnic minority status were more likely to be in the 'low PTS-high depression' class, in comparison to the 'low internalizing symptoms' class. This fits with a large body of research showing that racial discrimination and marginalisation is implicated in higher psychological distress (Bailey, 2019). It is not as clear why ethnic minority status was not associated with being in the 'high internalizing symptom' class, as previous research would suggest, i.e. Black or minority ethnicity has been significantly associated with PTS in parents of trauma-exposed children (Wilcoxon et al., 2021). Parents with older children were more likely to be in the 'low PTS-high depression' class. It may be that a regression from normative age-related development or milestones observed in older children who had gained more independence, accompanied by parents' uncertainty about their child's unpredictable behaviour, emotions, or the possibility of further harm (Yehene et al., 2021), might add an emotional burden of uncertainty for parents of older trauma-exposed. Little research has examined sociodemographic correlates of depressive symptoms in parents after child acute trauma; more work exploring associations among parent gender, marginalized/ethnic minority status

and parental PTS and depressive symptoms should be a high priority.

4.1. Limitations

An important strength of using the PACT/R Data Archive is the ability to include larger samples for analysis. However, combining cross-study data using different measures loses some specificity of information and granularity regarding PTS and depression symptoms severity. Furthermore, as stated in the 'Procedures' section, most of the included studies used DSM-IV criteria for diagnosing PTSD, which lacks the four additional symptoms in DSM-5 under Criterion D: Concerning negative alterations in thoughts and feelings. As a result, these four new symptoms were excluded from the analysis due to insufficient data, limiting our ability to map symptoms in accordance with DSM-5 diagnostic criteria across studies. Cross-study variation in assessment of demographic variables limited the socio-demographic covariate variables available for analysis and may have left out other important covariates of symptom classes. Parental history of prior traumatic experiences or psychiatric illness may be a risk factor for parental distress after child trauma but was not assessed in all the original studies and could not be included in this study. Our cross-sectional analyses did not allow us to examine whether these internalising classes are associated with parental distress over time. Although our use of the three-step approach latent class determination is aligned with current best practices, this approach has been critiqued for possibly underestimating the relationships between covariates and class membership as it has the potential to introduce a large amount of classification error in the second step (Vermunt, 2010). While alternative models have been proposed (Asparouhov & Muthén, 2014a; Ferguson et al., 2020), they are limited in their capacity to missing data. Consequently, the results of our multinomial logistic regression should be interpreted conservatively and replicated in a more robust dataset with minimal to no missing data. The studies included in the analyses were all conducted in western and industrialised countries, limiting the generalizability of the results globally due to cultural differences in expression of PTS and depression symptoms, including language and terminology used to describe symptoms. Finally, the present analyses primarily included parents of children who experienced accidental injury (77.9%) further limiting the generalizability of the findings. Further researcher is needed to test the findings in other geographical population groups and other types of traumatic events.

5. Conclusion

Following their child's traumatic event, parental internalising reactions have individual heterogeneity. We found three distinct classes of individuals – a large group with low internalising symptoms, and smaller groups with low PTS but high depression, or high internalising symptoms, providing evidence for heterogeneity in the co-occurrence of internalising symptoms. An implication of these findings is that clinicians should not only focus on PTS when assessing post-trauma psychological adjustment, but also pay attention to a broader range of internalising symptoms. Future research should investigate and develop interventions designed to be transdiagnostic (i.e. target multiple disorders) which could allow clinicians to focus on a single integrated protocol to treat internalising disorders (García-Escalera et al., 2016). Our finding that gender and family ethnic minority status were associated with distinct classes of problematic symptoms also has important clinical implications – highlighting the need to incorporate considerations of gender and marginalisation and discriminations in clinical practice and policy. Per the SDMH framework (in which groups exposed to unfavourable social, economic, and environmental circumstances based on their gender, race and/or ethnicity, are at higher risk of mental disorders and ill-health overall), it is important to engage in treatment of individuals with interventions *designed* to be intersectional – to recognise the social, economic, and environmental issues, and embed intersectionality in the clinical treatment and support of individuals.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability statement

The datasets used for this study are publicly available, and without individually identifiable information. The

harmonised dataset created for this study is available by request through the Child Trauma Data Archives project: www.childtraumadata.org.

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