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CLINICAL RESEARCH ARTICLE

Testing the ICD-11 proposal for complex PTSD in trauma-exposed adults: factor structure and symptom profiles

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ABSTRACT

Background: The proposed ICD-11 criteria for trauma-related disorders define posttraumatic stress disorder (PTSD) and complex posttraumatic stress disorder (cPTSD) as separate disorders. Results of previous studies support the validity of this concept. However, due to limitations of existing studies (e.g. homogeneity of the samples), the present study aimed to test the construct validity and factor structure of cPTSD and its distinction from PTSD using a heterogeneous trauma-exposed sample.

Method: Confirmatory factor analyses (CFAs) were conducted to explore the factor structure of the proposed ICD-11 cPTSD diagnosis in a sample of 341 trauma-exposed adults (n = 191 female, M = 37.42 years, SD = 12.04). In a next step, latent profile analyses (LPAs) were employed to evaluate predominant symptom profiles of cPTSD symptoms.

Results: The results of the CFA showed that a six-factor structure (i.e. symptoms of intrusion, avoidance, hyperarousal and symptoms of affective dysregulation, negative self-concept, and interpersonal problems) fits the data best. According to LPA, a four-class solution optimally characterizes the data. Class 1 represents moderate PTSD and low symptoms in the specific cPTSD clusters (PTSD group, 30.4%). Class 2 showed low symptom severity in all six clusters (low symptoms group, 24.1%). Classes 3 and 4 both exhibited cPTSD symptoms but differed with respect to the symptom severity (Class 3: cPTSD, 34.9% and Class 4: severe cPTSD, 10.6%).

Conclusions: The findings replicate previous studies supporting the proposed factor structure of cPTSD in ICD-11. Additionally, the results support the validity and usefulness of conceptualizing PTSD and cPTSD as discrete mental disorders.

Prueba de la propuesta de la CIE-11 para el trastorno de estrés postraumático complejo en adultos expuestos a trauma: estructura de factores y perfiles de síntomas

Antecedentes: Los criterios propuestos por la CIE-11 para los trastornos relacionados con trauma, define el trastorno de estrés postraumático (TEPT) y el trastorno de estrés postraumático complejo (TEPTc) como dos trastornos separados. Los resultados de estudios previos apoyan la validez de este concepto. Sin embargo, debido a las limitaciones de los estudios existentes (ej. Homogeneidad de las muestras), el presente estudio tuvo como objetivo probar la validez de constructo y la estructura factorial del TEPTc y su distinción del TEPT utilizando una muestra heterogénea expuesta a trauma.

Metodo: Se realizaron análisis de factores confirmatorios (AFCs) para explorar la estructura de los factores del diagnóstico propuesto de TEPTc por la CIE-11 en una muestra de 341 adultos expuestos al trauma (n = 191 mujeres, M = 37.42 años, SD = 12.04). En un siguiente paso, se emplearon análisis de perfil latente (APL) para evaluar los perfiles de síntomas predominantes de los síntomas de TEPTc.

Resultados: Los resultados de la AFC mostraron que una estructura de seis factores (es decir, síntomas de intrusión, evitación, hiperalerta y síntomas de desregulación afectiva, autoconcepto negativo y problemas interpersonales) se ajusta mejor a los datos. Según los APL, una solución de cuatro clases caracteriza de manera óptima los datos. La clase 1 representa un trastorno de estrés postraumático moderado y síntomas bajos en los grupos de específicos de TEPTc (grupo de trastorno de estrés postraumático, 30.4%). La clase 2 mostró una baja gravedad de los síntomas en los seis conglomerados (grupo de síntomas bajos, 24.1%). Las clases 3 y 4 mostraron síntomas de TEPTc, pero difirieron con respecto a la gravedad de los síntomas (clase 3: TEPTc, 34.9% y clase 4: TEPTc grave, 10.6%). Conclusiones: Los hallazgos replican estudios previos que respaldan la estructura de factores propuesta

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Trastorno de Estrés Postraumático complejo; AFC; APL; Perfil de síntomas; estructura factorial; adultos; CIE-11

关键词
复杂创伤后应激障碍; CFA; LPA; 症状剖面; 因子结构; 成人; ICD-11

HIGHLIGHTS

- The current study investigated the factor structure and the symptom profile of complex PTSD in treatment-seeking adult trauma survivors.
- The current study investigated the factor structure and the symptom profile of complex PTSD in treatment-seeking adult trauma survivors.
- A confirmatory factor analysis showed that a six-factor structure with correlating symptom clusters best fits the data.
- A latent class analysis showed that PTSD and cPTSD have distinct symptom profiles. A four-class solution best fits the data: low symptoms class, PTSD class, cPTDS class, and severe cPTSD class.

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del TEPTc en la CIE-11. Además, los resultados respaldan la validez y la utilidad de conceptualizar el TEPT y el TEPTc como trastornos mentales distintos.

评估ICD-11（草案）中创伤暴露成人的复杂PTSD：因子结构和症状剖面

背景：ICD-11（草案）的创伤相关疾病标准中，将创伤后应激障碍（PTSD）和复杂创伤后应激障碍（cPTSD）定义为不同的疾病。前人研究结果支持这一提议。然而，由于现有研究具有局限性（例如样本的同质性），本研究旨在测试cPTSD的结构效度和因子结构及其在异质创伤暴露样本中与PTSD的区别。
方法：在341名有创伤经历的成年人样本中（*n* = 191名女性，M = 37.42岁，SD = 12.04）使用验证性因子分析（CFAs）考察ICD-11 （草案）中cPTSD诊断的因子结构。之后，使用潜剖面分析（LPAs）来评估cPTSD症状的主要症状剖面。
结果：CFA的结果显示六因素结构（即：闯入，回避，高唤起和情感失调症状，消极的自我概念和人际关系问题）最拟合数据。根据LPA，四分类方案可以最佳概括数据。 1类代表中度PTSD和特定cPTSD症状簇中的低症状（PTSD组，30.4%）。第2类显示所有六症状簇严重程度较低（低症状组，24.1%）。第3类和第4类均表现出cPTSD症状，但在症状严重程度方面存在差异（第3类：cPTSD，34.9%；和第4类：严重cPTSD，10.6%）。
结论：该研究结果重复了先前支持ICD-11中cPTSD因子结构的研究。此外，该结果支持PTSD和cPTSD是有区别的精神障碍概念，这种区分具有有效性和有用性。

1. Introduction

The concept of complex posttraumatic stress disorder (cPTSD) is based on seminal work by Judith Herman (1992), who suggested that the definition of posttraumatic stress disorder (PTSD) is not appropriate to characterize the complex symptomatology experienced by survivors of prolonged and repeated traumatic events, often experienced early in life. In line with this idea, the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) introduced the concept of Disorders of Extreme Stress Not Otherwise Specified (DESNOS; American Psychiatric Association [APA], 2000), although not as an official diagnosis. The current DSM-5, however, moved further away from cPTSD as a distinct disorder (American Psychiatric Association, 2013), mainly due to the lack of a consistent definition and therefore a lack of valid and reliable assessments (Resick et al., 2012) in combination with this edition's very strict criteria for including additional diagnoses (Friedman, 2013).

However, in the forthcoming revision of the International Classification of Diseases and Related Health Problems (ICD-11, World Health Organization, 1992), cPTSD will be proposed as a sibling disorder of PTSD in the group of 'Disorders specifically associated with stress' (Maercker et al., 2013). The concept of a sibling disorder is based on the fact that PTSD and cPTSD are both traumatic stress disorders, which show a related but distinct set of symptoms. PTSD is a fear-related disorder in which the core symptoms are associated with trauma-related stimuli (Cloitre, Garvert, Weiss, Carlson, & Bryant, 2014). The specific symptom picture of cPTSD (besides the core PTSD clusters) refers to more complex disturbances in self-organization which are not necessarily linked to trauma-related triggers, and it occurs across different settings and more complex traumatic events (Brewin et al., 2017; Cloitre, Garvert, Brewin, Bryant, & Maercker, 2013). Thus, the preliminary definition of cPTSD comprises the three core clusters of PTSD (i.e. intrusion, avoidance, hyperarousal), which are directly linked to trauma-related stimuli, and three additional clusters (i.e. difficulties in affect regulation, problems with self-concept, disturbances in interpersonal functioning; Maercker et al., 2013).

Recent research has validated the proposed ICD-11 definition of cPTSD by (a) examining the factor structure and (b) examining distinctive symptom profiles in different trauma-exposed cohorts. The existing literature currently differs in terms of the number of identified factors. Models have been investigated which support two factors (i.e. a PTSD and a specific cPTSD factor called 'disturbances in self-organization', DSO; e.g. Hyland et al., 2016; Nickerson et al., 2016), four factors (i.e. a PTSD and three specific cPTSD factors called 'affect regulation', 'interpersonal problems' and 'negative self-concept', e.g. Cloitre et al., 2014; Knefel & Lueger-Schuster, 2013) and also a six-factor structure (i.e. three PTSD clusters called 're-experiencing', 'avoidance' and 'hyperarousal' and three specific cPTSD clusters; Hyland et al., 2016; Karatzias et al., 2016). In a recent overview by Brewin et al. (2017), three possible factor structures were summarized: (1) a factor structure with six symptom clusters (correlated but non-hierarchical), (2) a structure with a single higher-order factor supported by six symptom clusters, and (3) a two-factor higher-order model (PTSD and DSO).

In addition to the factor structure described above, a number of studies have employed latent class/profile modelling to test the construct validity of PTSD and cPTSD as separate diagnoses as proposed for ICD-11. The majority of research studies found evidence for different classes of symptom profiles related to PTSD and cPTSD (e.g. Karatzias et al., 2017;

Knefel, Garvert, Cloitre, & Lueger-Schuster, 2015; Perkonigg et al., 2016). In most studies, three different classes emerged, distinguishing (1) individuals with clinically relevant PTSD symptoms only (i.e. high levels in the three PTSD core clusters, low levels in the three additional cPTSD clusters), (2) individuals with clinically relevant cPTSD symptoms (i.e. high levels in all six clusters), and (3) individuals with a generally low symptom severity level in all six clusters (e.g. Cloitre et al., 2013; Elklit, Hyland, & Shevlin, 2014). Other studies found support for two- or four-class solutions (Karatzias et al., 2017; Knefel et al., 2015).

A frequent criticism levelled against the cPTSD diagnosis is its potential overlap with borderline personality disorder (BPD) (e.g. Resick et al., 2012). One study therefore included BPD symptoms in a latent class analysis (Cloitre et al., 2014) and identified four classes, namely PTSD, cPTSD, low symptom level, and BPD. This suggests that the proposed ICD-11 criteria for cPTSD are sufficiently different from BPD.

Although most latent class analyses conducted so far have supported the ICD-11 concept, there are also some divergent findings. For example, Wolf et al. (2015) showed in two different samples (community sample and veterans) that groups only differed with regard to their level of symptom severity (i.e. low, moderate, and high levels on all PTSD and cPTSD symptoms, respectively), and not in terms of the type of psychopathology (i.e. distinct symptom patterns for PTSD and cPTSD), as it is proposed in ICD-11. In addition, a serious limitation of past research in this area is that most studies were conducted on rather homogenous samples, many of which comprised only women (Cloitre et al., 2013, 2014) and/or only one type of traumatic event (Elklit et al., 2014: assault and loss of child; Knefel & Lueger-Schuster, 2013: institutional abuse; Perkonigg et al., 2016: interpersonal violence; Murphy, Elklit, Dokkedahl, & Shevlin, 2016: child soldiers; for a review, see Brewin et al., 2017). The purpose of the current study was therefore to replicate and extend earlier research on the factor structure and on the construct validity of cPTSD as proposed for the ICD-11, using a heterogeneous sample with regard to demographic characteristics and trauma type.

The specific aim of the current study was twofold. First, we applied confirmatory factor analysis (CFA) to explore the factor structure of the symptom criteria proposed for PTSD and cPTSD in ICD-11 (Brewin et al., 2017). We hypothesized that cPTSD consists of six factors: three PTSD factors (intrusion, avoidance, hyperarousal) and three specific factors for cPTSD (affect dysregulation, negative self-perception, interpersonal problems). Second, we wished to evaluate distinct symptom profiles of cPTSD in the sample of trauma-exposed adults. To this end, a latent profile analysis was performed. Taking the existing literature into consideration, we hypothesized that the manifestation of (complex) PTSD symptoms is best represented by three classes: low symptoms class, PTSD class, cPTSD class.

2. Method

2.1. Sample

The data for this study were obtained as part of a multicenter study conducted in five clinical treatment centres in Germany. A total of $N = 341$ trauma-exposed participants were included (Münster $n = 83$, Berlin $n = 100$, Hamburg $n = 74$, Dresden $n = 58$, Mannheim $n = 26$; for details, see Krüger-Gottschalk et al., 2017). Participants were either treatment-seeking or were recruited via newspaper announcements. All participants were given the opportunity to receive treatment following their participation in the study. Eligible participants who were at least 18 years old and had experienced at least one traumatic event according to DSM-5 were informed about the purpose and procedures of the study and gave written informed consent. Data were collected between March 2014 and December 2015. The study was approved by the Research Ethics Committee of the University of Muenster.

Participants ($n = 191$, 56% female) were aged between 18 and 76 years ($M = 37.42$, $SD = 12.04$). Twenty-nine percent ($n = 100$) were unmarried with a partner, 26% ($n = 89$) were single (without a partner), 28% ($n = 97$) were married, 4% ($n = 14$) were married but separated, 10% ($n = 33$) were divorced, and 1% ($n = 4$) were widowed. PTSD ($n = 194$, 57%) was the most frequent primary ICD-10 diagnosis, followed by adjustment disorder ($n = 16$, 5%), while 50 participants (15%) had no diagnosis. The sample was very heterogeneous with regard to the types of traumatic events experienced (Table 1).

2.2. Measures

Table 1. Trauma-associated sample characteristics.

	Number (%)
Index trauma (according to LEC)	
Directly experienced	270 (81)
Own life was in danger	145 (44)
Experienced a similar event > 1	201 (62)
Type of trauma* (according to LEC)	
Natural disaster	49 (15)
Fire explosion	53 (16)
Transportation accident	143 (42)
Serious accident	62 (19)
Physical assault	185 (55)
Assault with weapon	105 (31)
Sexual assault	142 (42)
Other unwanted sexual experience	133 (39)
Combat	74 (22)
Life-threatening illness	62 (18)
Severe human suffering	82 (24)

LEC = Life Events Checklist; *type of trauma directly experienced

Table 2. Overview of items used to assess PTSD and cPTSD criteria and factor loadings of confirmatory factor analysis.

Symptom[a]	Corresponding item	Standardized factor loadings[b] (CFA)	Squared standardized factor loadings[b] (R^2)
Intrusion			
	PCL-2 'Nightmares'	.83	.69
	PCL-3 'Flashbacks'	.79	.63
Avoidance			
	PCL-6 'Avoidance of thoughts'	.79	.62
	PCL-7 'Avoidance of reminders'	.86	.75
Hyperarousal			
	PCL-17 'Hypervigilance'	.84	.71
	PLC-18 'Exaggerated state'	.88	.77
Affect dysregulation			
	PCL-15 'Irritable/angry'	.54	.29
	PCL-16 'Recklessness'	.49	.24
	SCL-34 'Feelings easily hurt'	.72	.52
Negative self-perception			
	PCL-9 'Negative beliefs'	.82	.66
	BDI 8 'Self-criticalness'	.72	.52
	SCL-41 'Feeling inferior to others'	.81	.65
	SCL-89 'Feelings of guilt'	.77	.59
Interpersonal problems			
	SCL-18 'Feeling that most people cannot be trusted'	.71	.51
	SCL-68 'Ideas/beliefs that others do not share'	.52	.27
	SCL-69 'Feeling self-conscious with others'	.75	.56

[a]according to Maercker et al. (2013); [b]standardized factor loadings and factor loadings of the confirmatory factor analysis (result section)
PCL = PTSD Checklist, SCL = Symptom Checklist, BDI = Beck Depression Inventory, CFA = Confirmatory Factor Analysis

Assessment instruments of the multicenter study included a battery of self-report measures and a clinical interview. For the current analysis, items were selected from self-report questionnaires that best represented the criteria for cPTSD according to the proposed ICD-11 (Maercker et al., 2013). PTSD was operationalized by the six proposed ICD-11 items (two items/cluster). The specific cPTSD clusters were operationalized using the narrative definition of Maercker et al. (2013): affect dysregulation (three items), negative self-perception (four items), interpersonal problems (three items). Items representing this narrative description of cPTSD were taken from the following three measures:

Posttraumatic Stress Disorder Checklist (PCL-5, Weathers et al., 2013; German version: Krüger-Gottschalk et al., 2017), a 20-item self-report questionnaire assessing PTSD symptoms according to the DSM-5 (American Psychiatric Association, 2013). Items are scored on a 5-point Likert scale (0 = 'not at all' to 4 = 'extremely'). In our study, the PCL-5 showed good internal consistency (Cronbach's α = 0.95). For the PTSD and cPTSD clusters of the ICD-11, six and three items, respectively, were used (see Table 2).

Symptom Checklist-90-R (SCL-90-R, Derogatis, 1983; German version: Frank, 1995), a self-report questionnaire that screens for nine different mental disorders (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism). The 90 items are rated on a 5-point scale (0 = ´not at all` to 4 = ´extremely`). In our study, the SCL-90-R showed good internal consistency (Cronbach's α = 0.95). For the cPTSD clusters, six items were used (Table 2).

Beck Depression Inventory-II (BDI-II, Beck, Steer, & Brown, 1996; German version: Hautzinger, Keller, & Kühner, 2006), a self-report instrument to assess the severity of depressive symptoms. The 21 items are rated on a 4-point scale (0 = 'not at all' to 3 = 'extremely'). In our study, the BDI-II showed good internal consistencies (Cronbach's α = 0.98). One item was used to operationalize the negative self-perception criterion of cPTSD (Table 2).

2.3. Statistics

First, we followed a variable-centred approach by using a CFA to focus on grouping items and testing the best-fitting factor structure of cPTSD as defined in the proposed ICD-11 criteria. As no established measure of the proposed ICD-11 cPTSD criteria existed at the time of planning this study, we selected questionnaire items from different instruments that best represented each proposed symptom cluster as described by Maercker et al. (2013; see Table 2). We tested four different structure models with regard to the three proposed possible models by Brewin et al. (2017), and additionally a four-factor model initially found by Cloitre et al. (2013): (1) a one-factor model, i.e. all items are on one factor; (2) a two-factor model, i.e. a PTSD factor and a specific cPTSD factor; (3) a four-factor model, i.e. a PTSD factor and three specific cPTSD factors; and (4) a six-factor model, i.e. three PTSD factors and three specific cPTSD factors. We assumed a six-factor structure of cPTSD consisting of the three PTSD clusters (intrusion, avoidance,

Table 3. Fit indices for alternative models of the cPTSD structure.

	AIC	adj BIC	CFI/TLI	RSMEA	90% CI	SRMR
One-factor model	13,836.35	13,859.79	0.85/0.83	0.10	0.09–0.11	0.06
Two-factor model	13,682.91	13,706.89	0.92/0.91	0.07	0.06–0.08	0.05
Four-factor model	13,676.69	13,703.06	0.93/0.91	0.07	0.06–0.082	0.05
Six-factor model	**13,586.05**	**13,616.82**	**0.97/0.96**	**0.05**	**0.04 – 0.06**	**0.04**

AIC = Akaike's Information Criterion; adj BIC = adjusted Bayesian information criterion; CFI = comparative fit index; TLI = Tucker-Lewis index; RSMEA = root mean square error of approximation; CI = confidence interval; SRMR = standardized root mean residual.
Bold type indicates the best-fitting model.
One-factor model, all items are on one *g*-factor; two-factor model, PTSD factor and specific cPTSD factor; four-factor model, PTSD factor and three specific cPTSD factors; six-factor model, three PTSD factors and three specific cPTSD factors.

hyperarousal) and three additional cPTSD clusters (affect dysregulation, negative self-perception, interpersonal problems). As the normality assumptions of maximum likelihood parameter estimation were slightly violated, i.e. the skewness of some items was above 1 but less than 2 (values of kurtosis were less than 7), we used the MLR estimator. To assess model fit, we used indices suggested by Schermelleh-Engel, Moosbrugger, and Müller (2003): the comparative fit index (CFI ≥ 0.97 represents good model fit) and Tucker-Lewis index (TLI ≥ 0.97 represents good model fit), the root mean square error of approximation (RMSEA < 0.05 represents good model fit) as well as its 90% confidence interval (CI around the estimated RMSEA), and standardized root mean residual (good model fit if SRMS < 0.05) and Akaike's Information Criterion (lowest AIC value = best fit). We did not use the χ^2 statistic because this fit index has to be shown to easily become significant with large sample sizes (Van de Schoot, Lugtig, & Hox, 2012). The CFA was conducted with Mplus 7 (Muthén & Muthén, 1998–2012).

Second, we followed a person-centred approach by using latent profile analyses (LPA) to model symptom profiles of cPTSD. LPA attempts to identify subgroups of individuals which are unknown a priori and share a symptom profile which is similar within a class but which is distinct from the other profiles. Items of the best-fitting model of the CFA were standardized and means of the x-factor structure of cPTSD (according to the CFA) were used for the LPA. When using LPA, the specification of the variance-covariance matrix can influence the number of latent classes. Therefore, the model-building process must compare different models of variance-covariance specifications in order to find the best-fitting model (Masyn, 2013). First, the most restrictive form of an LPA was fitted, assuming class-invariant variance and zero covariances between the indicators (a: unvarying, diagonal). We started by estimating a one-profile model and successively increased the number of profiles. The same procedure was repeated for models assuming less restrictive variance-covariance structures, that is, (b) a model with covariances fixed at zero between indicators within classes, and differing variances across classes (varying, diagonal), (c) a model with covarying indicators within classes, and variances and covariances forced to be equal across classes (unvarying, unrestricted); and (d) the least restricted structure, where indicators can covary within classes, and variances and covariances across classes can be different (varying unrestricted; Masyn, 2013).

Each model was estimated using 500 random starts and 50 optimizations. The best-fitting model of each structure (a–d) was identified by using the following statistical criteria: (1) Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC), (2) the entropy (highest value indicates the best-fitting model), and (3) the bootstrap likelihood ratio test (BLRT) indicating that the estimated model with *g* classes fits the data better than a model with *g-1* classes when the *p*-value is significant. In addition, the interpretability and theoretical soundness of the profiles were considered as well as the class count. In a second step, the approximate correct model probability (cmP) was calculated to compare the best-fitting models for each structure (a–d) (the highest value indicated the best model). This index allows a comparison of different models and therefore a decision on the correct model relative to the other models (Masyn, 2013).

3. Results

3.1. Confirmatory factor analysis

Goodness-of-fit indices of the CFA model for cPTSD result in a model with six factors: three PTSD factors (intrusion, avoidance, hyperarousal) and three specific cPTSD factors (affect regulation, self-concept, interpersonal relationships; Table 3). The six-factor model shows the best approximate fit (RSMEA) and comparative fit (CFI/TLI) as well as the lowest AIC and adjusted BIC with regard to the other models. These results support the appropriateness of the six-factor model compared to the two- and four-factor models.

Latent correlations between the six cPTSD factors are shown in Table 4, indicating the highest correlations within the three specific cPTSD factors

Table 4. Latent factor correlations (standardized coefficients).

	1	2	3	4	5	6
1. Intrusion	-					
2. Avoidance	**.72**	-				
3. Hyperarousal	**.80**	**.74**	-			
4. Affect regulation	.72	.74	.87	-		
5. Self-concept	.72	.66	.71	**.94**	-	
6. Interpersonal relations	.70	.65	.75	**.93**	**.95**	-

Bold type refers to correlations within PTSD clusters (1–3) and within specific cPTSD clusters (4–6), respectively

(.93–.94). The three PTSD factors also show moderate to high correlations (.72–.80).

Standardized factor loadings of single items with regard to the appropriate factor (i.e. six factors of cPTSD) are shown in Table 2, indicating substantial correlations between the observed variables (i.e. items) and the assigned factor (range: 0.49–0.88). Correlations were very high for all items of the three PTSD factors (range: .79–.88) as well as for the self-concept factor (range: .72–.82). Indicators for the factors of 'affect regulation' as well as 'interpersonal relationships' seem to be more heterogeneous (range: .49–.72 and range: .52–.75, respectively). All factors explain a moderate to high proportion of the variance in the indicators (range: 24–77%; Table 2).

3.2. Latent profile analysis

With regard to the within-class variance-covariance model structures, we examined the model fit indices (i.e. BIC, AIC, likelihood value) for the four mentioned variance-covariance structures: (a) unvarying, diagonal, (b) varying, diagonal, (c) unvarying, unrestricted, and (d) varying, unrestricted (Table 5).

The best-fitting model within each of the model structures is highlighted in bold in Table 5. For the unvarying, diagonal model (a), the five-class solution fitted best as it had the lowest AIC and BIC. With regard to the varying, diagonal model (b), the five-class solution of the varying, diagonal structure was not considered due to a problematic variance of the hyperarousal cluster in one of the five classes (M = .69), showing a zero variance (Estimate < 0.001), and due to the distribution of the sample size across the five classes (i.e. one class consists of only eight persons). Due to the problematic parameter in the five-class solution (i.e. zero variance), the four-class solution was preferred, showing the lowest values for BIC and AIC. For the unvarying, unrestricted model (c), the four-class solution best fitted the data due to the lowest BIC and the highest entropy compared to the two- and three-class solution. With regard to the varying, unrestricted model (d), the three- to five-class solutions were not trustworthy because the log-likelihood value was not replicated even after increasing the starts; therefore, these solutions are not considered.

The best-fitting overall model was the four-class solution of the varying diagonal model (b; Table 5, framed). Looking at the fit indices, the AIC and the BIC were lower than those of the other three bold-typed models (Table 5). Moreover, the correct model probability (cmP), which shows the correct model relative to other models, favoured this four-class solution (model a, five-class solution: cmP < .01; model b, four-class solution: cmP > .99; model c, four-class solution: cmP < .01; model d, two-class solution: cmP < .01).

The overall best-fitting four-class solution (of model b, see Figure 1) comprised a first group with low symptoms in all six clusters (low symptoms group, n = 84; 24.1%), a second group with moderate PTSD symptoms and lower symptoms in the specific cPTSD clusters (PTSD group, n = 106; 30.4%), a third group also with comparatively moderate PTSD symptoms and moderate to high

Table 5. Model fit indices for latent profiles of cPTSD symptoms.

Model	No. of classes	AIC	BIC	SSA-BIC	Entropy	BLRT p value
(a) Unvarying, diagonal	2	4439.802	4513.049	4452.774	.88	< .001
	3	4291.497	4391.729	4309.248	.82	< .001
	4	4232.446	4359.663	4254.976	.80	< .001
	5	**4191.381**	**4345.583**	**4218.690**	**.82**	**< .001**
(b) Varying, diagonal	2	4272.60	4368.97	4289.67	.95	< .001
	3	4065.30	4211.80	4091.25	.85	< .001
	4	**3987.78**	**4184.39**	**4022.60**	**.86**	**< .001**
	5[a]	3922.41	4169.16	3966.13	.88	< .001
(c) Unvarying, unrestricted	2	4236.29	4367.36	4259.50	.84	< .001
	3	4194.62	4352.68	4222.61	.85	< .001
	4	**4152.29**	**4337.36**	**4185.06**	**.85**	**< .001**
	5	5129.05	4341.08	4166.60	.82	< .001
(d) Varying, unrestricted	**2**	**4033.19**	**4245.21**	**4070.73**	**.93**	**< .001**
	3	-	-	-	-	-
	4	-	-	-	-	-
	5	-	-	-	-	-

AIC = Akaike Information Criterion; BIC = Bayesian information criterion; SSA-BIC = sample-size adjusted BIC; BLRT = bootstrap likelihood ratio test; bold type = best-fitting models within each of the four model structures; framed = overall best-fitting model.
[a] five-class solution is not taken into consideration due to a zero variance.

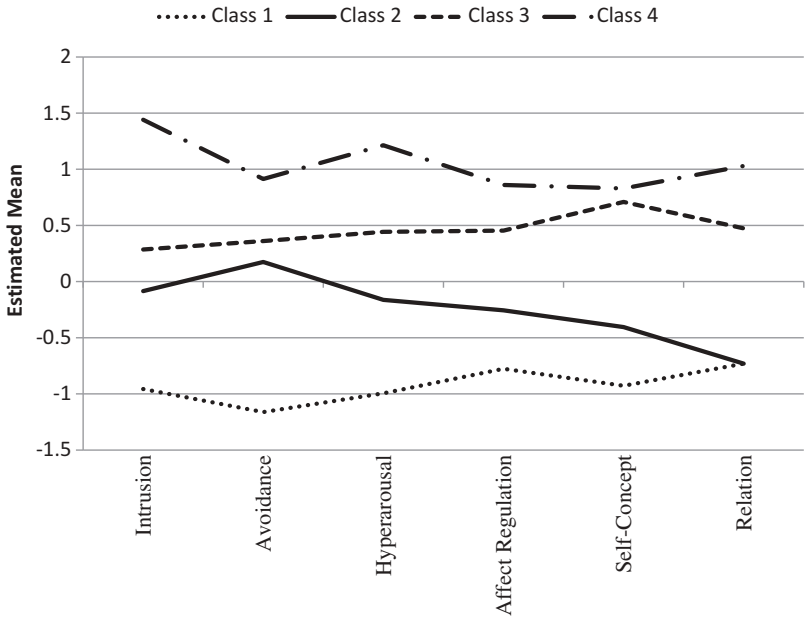

Figure 1. Estimated means of (complex) PTSD symptom clusters for each of the four latent classes.

symptoms in the specific cPTSD clusters (cPTSD group, n = 122, 34.9%), and a fourth group with high symptoms in all symptom clusters (severe cPTSD, n = 37; 10.6%).

The average latent class probabilities for the most likely latent class membership by the four-class solution were very high (low symptoms group: 0.95; PTSD group: 0.89; cPTSD group: 0.94; severe cPTSD: 0.89). These results imply discrimination between the four classes.

3.3. Specific characteristics of the four classes

Table 6 shows sociodemographic and trauma-related variables as well as univariate comparisons with regard to the four classes. The mean age did not differ significantly between classes (range between 37.62 and 38.20 years, $\chi^2(192) = 217.21$, n.s.). Gender did significantly differ between classes, $\chi^2(192) = 27.34$, $p < .001$: all classes comprised a greater proportion of women, except for the low symptoms class (36% female). With regard to trauma characteristics, the results revealed a significantly higher percentage of seriously injured individuals in the severe cPTSD class (Class 4) compared to the other three classes. With regard to the number of traumatic events, individuals of both cPTSD classes (Classes 3 and 4) were significantly more likely to report traumatic events more than once during their lifetime compared to the low symptoms class (Class 1) and the PTSD class (Class 2).

4. Discussion

This study evaluated the factor structure and the symptom profiles of cPTSD in a heterogeneous sample of trauma survivors. The confirmatory factor analysis revealed that a six-factor structure showed the most adequate model fit. The information criteria (AIC and BIC) were lower compared to the models with fewer factors, and the fit indices (RMSEA, CFI, TLI) were appropriate. These six factors support the symptom clusters proposed in the definition of cPTSD in the ICD-11, i.e. symptoms of intrusion, avoidance, hyperarousal (PTSD core clusters) and symptoms of affective dysregulation, negative self-concept, interpersonal problems (specific cPTSD clusters). Fit indices of comparative models, which assume a solution with one, two, and three factors, respectively, did not fit the data sufficiently (Table 3). In addition, substantial correlations between the observed variables (i.e. items) and

Table 6. Results of class membership for a four-class solution.

Class	1 Low symptoms	2 PTSD	3 cPTSD	4 Severe cPTSD	Pairwise comparison
Age *M* (*SD*)	38.20 (11.24)	36.52 (13.09)	38.08 (12.52)	37.62 (10.37)	
Sex, female, *n*	30 (36%)	60 (57%)	87 (71%)	21 (57%)	
Trauma characteristics:					
Self-experienced, *n*	61 (73%)	76 (72%)	104 (85%)	29 (78%)	all n.s.
Seriously injured, *n*	11 (13%)	19 (18%)	29 (24%)	19 (27%)	2 < 4, 1 < 3, 1 < 4, 3 < 4
More than once, *n*	32 (38%)	62 (59%)	80 (66%)	27 (73%)	1 < 2, 1 < 3, 1 < 4

PTSD = Posttraumatic Stress Disorder, cPTSD = complex Posttraumatic Stress Disorder, *M* = Mean, *SD* = Standard Deviation, *n* = sample size, Pairwise comparisons: < or > Significant differences between two classes, $p < .05$; all other comparisons are not significant

the assigned three PTSD factors indicate homogeneity of the items and reliable indicators. For the specific cPTSD factors, 'affect regulation' as well as 'interpersonal relationships' seem to be more heterogeneous than the PTSD factors. Here, the items 'feelings easily hurt' (affect regulation) as well as 'feeling that most people cannot be trusted' and 'feeling very self-conscious with others' (interpersonal problems) seem to be reliable indicators for the two factors due to their high standardized factor loadings. With regard to the existing literature, a six-factor structure was also supported by the fit indices in the studies by Karatzias et al. (2016) and Hyland et al. (2016), who both decided to support an equal-fitting two-factor model. In addition, a six-factor structure with correlating symptom clusters was proposed by Brewin et al. (2017). In sum, the current study adds further empirical support to this proposal and speaks for the validity of a six-factor solution, in line with the proposed ICD-11 model. Importantly, our study extends previous findings from studies in homogeneous samples, by using a heterogeneous sample comprising mixed groups of trauma survivors.

The analysis of the symptom profiles found that a four-class solution optimally characterized the data. Class 1 represents a group with low symptoms in all six clusters (low symptoms group, 24.1%). Class 2 represents moderate PTSD symptoms and low symptoms in the specific cPTSD clusters (PTSD group, 30.4%). Classes 3 and 4 both exhibited cPTSD symptoms but differed with respect to the severity of the six symptom clusters, with Class 3 showing moderate PTSD symptoms and moderate to high symptoms within the specific cPTSD clusters (cPTSD group, 34.9%), and Class 4 showing high symptoms in all six symptom clusters (severe cPTSD, 10.6%). Therefore, three classes could be identified, which differ with respect to symptom presentation (i.e. low symptoms, PTSD, cPTSD). This finding is consistent with the existing literature, which found low symptoms as well as distinct classes of PTSD and cPTSD (e.g. Karatzias et al., 2017; Murphy et al., 2016).

All four classes differ with regard to their level of symptom severity. A study by Wolf et al. (2015) claimed that the differences between the classes are only based on differences in symptom severity (i.e. low, moderate, severe disturbance) and are not a result of distinct disorders (i.e. PTSD vs. cPTSD). Their findings showed an almost parallel pattern with regard to the levels of symptom severity across the six clusters of all four classes, indicating only a difference in level of disturbance. The four classes of our study, however, showed a divergent pattern, which differed regarding the specific cPTSD symptom clusters (affect regulation, self-concept, interpersonal relationships, see Figure 1). Here, the PTSD class (Class 2) showed a lower symptom severity within the specific cPTSD clusters, which corresponds to the theoretical concept of PTSD as a fear- and trauma-related disorder with prominent symptoms of re-experiencing, avoidance and hyperarousal. For the cPTSD classes (Classes 3 and 4), in line with its theoretical background as a sibling disorder of PTSD, all six clusters were prominent, particularly the additional symptoms not related to the trauma but with more complex disturbances in self-organization (in our study, especially the clusters 'self-concept' and 'interpersonal relationships'). These divergent patterns of the classes underpin the qualitative distinction between PTSD and cPTSD.

Contrary to recent research (e.g. Knefel et al., 2015; Perkonigg et al., 2016), we did not find a subsample of individuals who only suffered from specific cPTSD symptoms (i.e. with an absence of PTSD symptoms). A possible explanation might lie in the different cohorts examined in the studies: Knefel et al. (2015) as well as Perkonigg et al. (2016) examined individuals who had experienced interpersonal trauma in early stages of their lives. According to the literature, interpersonal childhood traumatization leads to both interpersonal and emotion regulation problems (e.g. Cloitre, Stovall-McClogh, & Han, 2005; Dvir, Ford, Hill, & Frazier, 2014), which are factors of cPTSD. Therefore, it could be assumed that for the subsample of individuals with interpersonal childhood traumatization, severe disturbances in self-organization (DSO) have a strong clinical importance and should be taken into consideration for treatment. Nevertheless, as the sample in the present study was very heterogeneous, consisting of adults who had experienced diverse types of traumatic experiences (i.e. interpersonal and accidental) in different stages of their lives (i.e. childhood and adulthood), they might not solely show DSO symptoms.

In addition to the hypothesized three classes, we found a fourth class, representing cPTSD with severe disturbances, in each of the six symptom clusters. Previous studies examining the symptom profiles of PTSD only (e.g. Böttche, Pietrzak, Kuwert, & Knaevelsrud, 2015, Pietrzak et al., 2014) consistently reported different levels of disturbance, i.e. PTSD symptom profiles differed in terms of symptom severity (low, medium, high), thus showing a similarity to the classes of this study. In the present study, we were also able to identify a low-symptom cPTSD class (Class 1), a cPTSD class with moderate to high symptom severity (Class 3), and a severe cPTSD class (Class 4).

With regard to sociodemographic characteristics of the four classes, PTSD and cPTSD appear to be more frequent among females. Compared to the low symptoms group (group 1), the other three groups (PTSD, cPTSD, severe cPTSD) all comprise a greater

proportion of women. This finding is in line with previous research showing that PTSD, as well as cPTSD as a sibling disorder of PTSD, are more common in females than in males (Hyland et al., 2017; Knefel et al., 2015).

When looking at specific trauma-related characteristics within these classes (Table 6), it appears that individuals with severe cPTSD were more often seriously injured during their indicated index trauma. However, this finding only constitutes a first assumption with respect to different symptom profiles of cPTSD.

Taken as a whole, these results mainly support and extend the existing literature by defining cPTSD based on the current narrative of ICD-11 cPTSD (Maercker et al., 2013) and by using a heterogeneous sample with diverse traumatic events. A sample with a greater diversity of traumatic events allows the concept of cPTSD to be generalized to a representative population, while the specificity of traumatic events in previous studies limited the validity of the findings (e.g. Knefel & Lueger-Schuster, 2013; Perkonigg et al., 2016).

Despite these strengths, several limitations should be taken into consideration when interpreting the results and to offer future research directions. First, we did not use a validated instrument to examine cPTSD. To date, no official definition of cPTSD has been published. Therefore, we tried to be as precise as possible in terms of reproducing the current definition of ICD-11 cPTSD by representing each narrative statement with a suitable item. This method has been used by various researchers to provide evidence for the distinct existence of cPTSD. With the upcoming release of the ICD-11 and an official definition, reliable and valid measurements will solve this problem. The ICD Trauma Questionnaire (Cloitre, Roberts, Bisson, & Brewin, 2015) is a first attempt at such an instrument. The divergent results with regard to the factor structure might be a consequence of the different types of measurement (i.e. newly developed questionnaire vs. single items). A second limitation is related to the sample: participants were treatment-seeking individuals attending clinical treatment centres and were therefore not randomly sampled. However, recruitment took place in five different centres located throughout Germany, which might have helped to produce a diverse sample. Third, we used a self-report questionnaire in a cross-sectional design. Although an interview was used for the diagnosis of PTSD, no conclusions could be drawn for cPTSD due to the lack of a valid definition. With regard to the cross-sectional design, we could not preclude temporal changes in the symptom profile. Therefore, future research should on the one hand strengthen the validity of the diagnosis by using diagnostic interviews, and on the other hand report longitudinal effects. Fourth, we used a one-step approach in the context of covariates (i.e. the effect of class membership on sociodemographic and trauma-specific variables) instead of a three-step approach for predicting class membership (Vermunt, 2010). Nevertheless, due to the high entropy of the LPA model, the classification error of class membership is less biased (Van de Schoot, Sijbrandij, Winder, Depaoli, & Vermund, 2017) and a one-step approach seemed to be adequate for the univariate comparisons. Future research should also use the three-step approach to focus on predictors of class membership.

To conclude, our findings strengthen previous data by (1) identifying the specific cPTSD clusters as distinct factors, (2) supporting the forthcoming ICD-11 definition, and (3) identifying distinct classes of PTSD and cPTSD, indicating cPTSD to be a discrete mental disorder. This differentiation of PTSD and cPTSD is crucial for both theoretical and clinical reasons. In terms of the recognition of cPTSD as a distinct disorder and an explicit definition in the forthcoming ICD-11, future research will be able to focus on the development and maintenance of cPTSD as well as potential predictors. In terms of clinical implications, reliable and valid diagnoses are essential for treatment outcome, because symptoms of PTSD and cPTSD may require different treatment approaches due to the centrality of trauma- and fear-related symptoms in PTSD vs. the more complex disturbances in self-regulation and interpersonal functioning in cPTSD. In addition to the already existing effective treatment approaches (e.g. exposure, cognitive reconstruction; Watts et al., 2013), treatment for cPTSD may need to address the non-fear-related symptoms of affective dysregulation, negative self-concept, and interpersonal problems.

Disclosure statement

No potential conflict of interest was reported by the authors.

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