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BASIC RESEARCH ARTICLE

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Confirmatory factor analysis of the Clinician-Administered PTSD Scale (CAPS-5) based on DSM-5 vs. ICD-11 criteria

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ABSTRACT

Introduction: Many studies have investigated the latent structure of the DSM-5 criteria for posttraumatic stress disorder (PTSD). However, most research on this topic was based on self-report data. We aimed to investigate the latent structure of PTSD based on a clinical interview, the Clinician-Administered PTSD Scale (CAPS-5).

Method: A clinical sample of 345 participants took part in this multi-centre study. Participants were assessed with the CAPS-5 and the Posttraumatic Stress Disorder Checklist (PCL-5). We evaluated eight competing models of DSM-5 PTSD symptoms and three competing models of ICD-11 PTSD symptoms.

Results: The internal consistency of the CAPS-5 was replicated. In CFAs, the Anhedonia model emerged as the best fitting model within all tested DSM-5 models. However, when compared with the Anhedonia model, the non-nested ICD-11 model as a less complex three-factor solution showed better model fit indices.

Discussion: We discuss the findings in the context of earlier empirical findings as well as theoretical models of PTSD.

Análisis Factorial Confirmatorio de la escala de TEPT Administrada por el Clínico (CAPS-5) basado en criterios DSM-5 vs CIE-11

Introducción: Muchos estudios han investigado la estructura latente de los criterios DSM-5 para el trastorno de estrés postraumático (TEPT). Sin embargo, la mayoría de la investigación en este tema estuvo basada en datos de auto-reporte. Nuestro objetivo fue investigar la estructura latente del TEPT basado en una entrevista clínica, la Escala de TEPT administrada por el Clínico (CAPS-5 por su sigla en inglés).

Método: En este estudio multicéntrico participó una muestra clínica de 345 personas. Los participantes fueron evaluados con la CAPS-5 y la Lista de Chequeo de Trastorno de Estrés Postraumático (PCL-5, por su sigla en inglés). Evaluamos ocho modelos competitivos de síntomas de TEPT del DSM-5 y tres modelos competitivos de síntomas de TEPT de la CIE-11.

Resultados: La consistencia interna de la CAPS-5 fue replicada. En los AFC el modelo de anhedonia emergió como el de mejor ajuste entre todos los modelos del DSM-5 evaluados. Sin embargo, cuando se comparó con el modelo de anhedonia, el modelo no anidado de CIE-11 como una solución menos compleja de tres factores mostró mejores índices de ajuste de modelo.

Discusión: Discutimos los hallazgos en el contexto de los resultados empíricos previos y de los modelos teóricos del TEPT.

基于 DSM-5 与 ICD-11 标准的临床用 PTSD 量表 (CAPS-5) 的验证性因素分析

简介: 许多研究调查了 DSM-5 创伤后应激障碍 (PTSD) 标准的潜在结构。然而, 关于这个主题的大多数研究都是基于自我报告的数据。我们旨在基于临床访谈, 即临床用 PTSD 量表 (CAPS-5) 来考查PTSD 的潜在结构。

方法: 一个345 名参与者的临床样本参与了这项多中心研究。使用 CAPS-5 和创伤后应激障碍检查表 (PCL-5) 评估了参与者。我们评估了 DSM-5 PTSD 症状的八个竞争模型和 ICD-11 PTSD 症状的三个竞争模型。

结果: CAPS-5 的内部一致性得到了重复。在 CFA 中, 快感缺失模型成为所有测试 DSM-5 模型中拟合最佳的模型。然而, 与快感缺失模型相比, 非嵌套 ICD-11 模型作为更不复杂的三因素解决方案显示出更好的模型拟合指数。

讨论: 我们在早期实证研究结果和 PTSD 理论模型背景下讨论这些研究结果。

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TEPT; estructura latente; CAPS-5; DSM-5; CIE-11

关键词

PTSD; 潜在结构; CAPS-5; DSM-5; ICD-11

HIGHLIGHTS

- We investigated the latent structure of PTSD based on a clinical interview (CAPS-5).
- The Anhedonia model emerged as the best fitting model within all tested DSM-5 models.
- However, the less complex non-nested ICD-11 model showed better model fit indices.

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1. Introduction

The DSM-5 and ICD-11 revision processes initiated extensive research on the symptom structure of posttraumatic stress disorder (PTSD), resulting in a renewed debate about the conceptual basis of the PTSD diagnosis. The DSM-5 and ICD-11 workgroups followed different principles in their revisions, which resulted in different diagnostic criteria for PTSD. The ICD-11 revision mainly followed the aims that mental disorders should have a high clinical utility, the diagnostic criteria should focus on a limited set of core symptoms, and that diagnoses are applicable internationally (Keeley et al., 2016). As a result, the new ICD-11 PTSD diagnosis includes six criteria. The ICD-11 workgroup newly included the syndrome complex PTSD (CPTSD) as a further diagnosis which encompasses the six PTSD symptoms and six additional new symptoms (https://icd.who.int/browse11/l-m/en). The main principles for the DSM-5 revision were feasibility for clinical practice, changes being based on research evidence, when possible maintaining continuity with previous DSM editions, and changes from DSM-IV to DSM-5 being free of a priori constraints (American Psychiatric Association, 2013). The DSM-5 workgroup modified the diagnostic criteria by adding new symptom criteria and rephrasing existing ones in comparison to the earlier DSM-IV definition (American Psychiatric Association, 2013) so that the DSM-5 PTSD diagnosis now includes 20 symptom criteria.

A large number of confirmatory factor analyses (CFA) on PTSD have been conducted since the reformulation of the DSM-5 PTSD criteria to better understand the structure of PTSD and to investigate the structural validity of the PTSD criteria (for an overview see e.g. Armour, Müllerova, & Elhai, 2016; Redican et al., 2021). Seven different models have resulted from the CFAs conducted based on the 20 DSM-5 PTSD symptoms (see also Table 1). Since the four-factor DSM-5 model (re-experiencing, avoidance, negative alterations in cognition and mood, hyperarousal) has shown rather poor model fit in most of the CFA studies (Blevins, Weathers, Davis, Witte, & Domino, 2015; Bovin et al., 2016; Wortmann et al., 2016), six alternative and more complex CFA models have been investigated. All models include the two factors re-experiencing and avoidance as proposed by the DSM-5 model, but differ with regard to the remaining factors, as detailed below (for an overview see Table 1).

The four-factor Dysphoria Model (Simms, Watson, & Doebbelling, 2002) narrowed the arousal factor down to now three symptoms (criteria E2-E4) and broadened a factor that represents dysphoria up to ten symptoms (criteria D1-E2 and E5-E6). The five-factor Dysphoric Arousal Model (Elhai et al., 2011) defined symptoms D1-D7 as negative alteration in cognitions and mood and separated dysphoric arousal (criteria E1-E2 & E5-E6) and anxious arousal symptoms (criteria E3-E4). Liu, Wang, Cao, Qing, and Armour (2016) developed a six-factor Anhedonia model by further differentiating between negative affect (D1-D4), anhedonia (D5-D7), dysphoria arousal (E1-E2 & E5-E6) and anxious arousal (E3-E4), whereas Tsai et al. (2015) suggested a six-factor Externalizing Behaviour Model as superior with the factors numbing (D1-D7), externalizing behaviour (E1-E2), anxious arousal (E3-E4) and dysphoric arousal (E5-E6). Zelazny and Simms (2015) proposed a third six-factor model called Alternate Dysphoria Model with the factors dysphoria (D1-D4 & E5-E6), anhedonia (D5-D7), externalizing behaviour (E1-E2) and anxious arousal (E3-E4). Recent studies found the best support for the seven factor Hybrid Model with the factors negative affect (D1-D4), anhedonia (D5-D7), externalizing behaviour (E1-E2), anxious arousal (E3-E4) and dysphoric arousal (E5-E6) (Armour et al., 2015; Cao, Wang, Cao, Zhang, & Elhai, 2017; Contractor, Caldas, Dolan, Lagdon, & Armour, 2018; Murphy et al., 2018). However, some studies could not replicate the hybrid model due to methodological problems (Konecky, Meyer, Kimbrel, & Morissette, 2016; Krüger-Gottschalk et al., 2017).

The growing complexity of these models has been critically discussed in the empirical literature. Rasmussen, Verkuilen, Jayawickreme, Wu, and McCluskey (2018)concluded that (1) high factor correlations are the norm in complex models and (2) a lot of effort has been put into modelling the two rather unspecific PTSD factors 'negative affect and cognitive modification' and 'hyperarousal' instead of putting more effort in understanding the unique PTSD factors 're-experiencing' and 'avoidance'. In contrast to the suggested complex models, Forbes et al. (2015) and Hunt, Chesney, Jorgensen, Schumann, and deRoon-Cassini (2018) have presented a rather radical approach. They conducted CFA models based on the Clinician Administered PTSD scale (CAPS-5) and suggested two-factor models instead of a multidimensional model. Forbes et al. (2015) reported high intercorrelations between the factors intrusion and avoidance as well as between cognition/ mood and arousal/ reactivity and suggested a two-factor-model with the two factors intrusion/ avoidance and cognitions/ mood/ arousal/ reactivity. Hunt et al. (2018) assessed PTSD with the Clinician-Administered PTSD Scale (Weathers et al., 2018) and found that a 2-factor model outperformed the 7-factor hybrid model. The authors interpreted these findings as a representation of the two distinct phenomena (1) posttraumatic stress disorder, and (2) general posttraumatic dysphoria.

Table 1. Symptom mapping of DSM-5 plus common alternative DSM-5 PTSD models and ICD-11 plus alternative ICD-11 PTSD models.

PTSD Symptom	M1: DSM-5 Numbing Model 2013 (4-factor)	M2: DSM-5 Dysphoria Model (4-factor)	M3: DSM-5 Dysphoric Arousal Model (5-factor)	M4: DSM-5 Anhedonia Model (6-factor)	M5: DSM-5 Externalizing Behaviours Model (6-factor)	M6: DSM-5 Alternate Dysphoria Model (6-factor)	M7: DSM-5 7F-Hybrid Model (7-factor)	M8: DSM-5 Dysphoria Model without item 8 (6-factor)	M9: ICD-11 One Factor Model (1-factor)	M10: ICD-11 two factor Model (2-factor)	M11: ICD-11 (3-factor)
B1: uncontrollable memories	R	R	R	R	R	R	R	R			
B2: recurrent dreams of trauma	R	R	R	R	R	R	R	R	PTSD*	R*	R
B3: flashbacks	R	R	R	R	R	R	R	R	PTSD*	R*	R
B4: psychological cue reactivity	R	R	R	R	R	R	R	R			
B5: physiological cue reactivity	R	R	R	R	R	R	R	R			
C1: avoidance of thoughts of trauma	AV	AV	AV	AV	AV	AV	AV	AV	PTSD*	R*	AV
C2: avoidance of reminders of trauma	AV	AV	AV	AV	AV	AV	AV	AV	PTSD*	R*	AV
D1: memory impairment	NAMC	D*	NAMC	NA	N	D*	NA				
D2: negative beliefs	NAMC	D*	NAMC	NA	N	D*	NA	D			
D3: blamed self or others	NAMC	D*	NAMC	NA	N	D*	NA	D			
D4: persistent negative emotional state	NAMC	D*	NAMC	NA	N	D*	NA	D			
D5: diminished interest in activities	NAMC	D*	NAMC	AN	N	AN	AN	AN			
D6: feelings of detachment from others	NAMC	D*	NAMC	AN	N	AN	AN	AN			
D7: inability to experience pos. emotions	NAMC	D*	NAMC	AN	N	AN	AN	AN			
E1: irritability or anger	A	D*	DA*	DA	EB	EB	EB	EB			
E2: reckless or self-destructive behaviour	A	A	DA*	DA	EB	EB	EB	EB			
E3: hypervigilance	A	A	AA	AA	AA	AA	AA	AA	PTSD*	A	A
E4: exaggerated startle response	A	A	AA	AA	AA	AA	AA	AA	PTSD*	A	A
E5: difficulty concentrating	A	D*	DA*	DA	DA	D*	DA	D			
E6: sleeping difficulties	A	D*	DA*	DA	DA	D*	DA	D			

A = alterations in arousal and reactivity. AA = anxious arousal. An = anhedonia, AV = avoidance. D = dysphoria. DA = dysphoric arousal. EB = externalizing behaviours. N = numbing. NA = negative affect. NACM = negative alterations in cognitions and mood. R = re-experiencing. M1 = modell 1.*Items belong to the same factor.

Lee et al. (2019) examined the construct validity of the various PTSD models in two ways: (1) they compared the structural validity of the described PTSD models considering the method factor (self-report vs. clinician rating), and (2) they tested the external validity with external correlates like depression, anxiety, and aggressive driving. For the structural validity, they found the best model fit for the hybrid model, however the fit statistics between the models varied only marginally. The external validity testing revealed mixed results that raise concerns with regard to the utility of parsing the DSM-5 factors.

The PTSD conceptualization of the ICD-11 differs from the DSM-5 conceptualization in the way that the ICD-11 workgroup introduced the CPTSD diagnosis next to PTSD, as mentioned above. The aim of the ICD-11 modification was twofold: first, the conceptualization of stress-associated disorders should be simplified, and second, basic (PTSD) and complex forms (CPTSD) should be distinguished (Maercker et al., 2013). To simplify the conceptualization, the ICD-11 workgroup focused on three core criteria of PTSD, namely re-experiencing, avoidance and hyperarousal, assessed with six items. The more complex form is introduced as CPTSD and includes the three criteria affective dysregulation, negative self-concept and disturbances in relationships, next to the three PTSD criteria.

The structural validity of the six ICD-11 criteria has been tested in various studies recently (for an overview see also Brewin et al., 2017; Hansen, Hyland, Armour, Shevlin, & Elklit, 2015; Hyland, Brewin, & Maercker, 2017; Redican et al., 2021). Hansen et al. (2015) tested the ICD-11 model against the DSM-5 model, the Dysphoric Arousal Model and the Anhedonia model in five different samples with self-reports using the Harvard Trauma Questionnaire. They found the best model fit for the ICD-11 model. Hyland et al. (2017) also supported the factorial validity of the ICD-11 criteria. Using the specific measurement for the ICD-11 criteria, the International Trauma Questionnaire (Cloitre et al., 2018), numerous studies revealed support for the construct validity of the ICD-11 model (Ben-Ezra et al., 2018; Ho et al., 2020; Karatzias et al., 2016; Vallières et al., 2018).

Most of the research on CFA models has been conducted via self report assessments and only few studies have used clinical interviews like the Clinician-Administered PTSD-Scale, CAPS-5 (Weathers et al., 2018) to test the structural validity of PTSD. Weathers et al. (2018) reported the best model fit for the hybrid model. A further study on the CAPS-5 (Muller-Engelmann et al., 2018) reported on the one hand the best model fit for the hybrid model and on the other hand methodological problems for this model. The models with the best fit without methodological problems were the externalizing behaviour model and the DSM-5 model. Recent studies (Boeschoten et al., 2018; Gilmour & Romaniuk, 2020) found support for the six-factor anhedonia model. For the ICD-11 criteria, only one study to date (Bondjers et al., 2019) has conducted a CFA based on interview data. The authors found support for a two-factor second order model that supported the ICD-11 conceptualization of the two distinct disorders PTSD and CPTSD.

Taken together, there is emerging empirical support for the seven-factor hybrid model with regard to the DSM-5 conceptualization. With regard to the ICD-11 conceptualization, a three-factor model appears to represent the structural validity well. Compared to the extensive literature based on self-report data, only a small amount of studies investigated the structural validity based on clinical interviews.

1.1. The aim of this study

The present study is part of larger project for the assessment of PTSD in a German sample (Krüger-Gottschalk et al., 2017). The present study aimed at investigating the factor structure of PTSD based on the CAPS-5 interview (Schnyder, 2013) with regard to the current DSM-5 based models and the ICD-11 model.

2. Methods

2.1. Procedure and participants

Recruitment took place in five different PTSD treatment centres (n = 320) and via newspaper (n = 32). Participants were fully informed about the study before providing written informed consent. For the present study, we included all participants with a full dataset. Finally, the sample comprised N = 345 participants. The assessments were conducted by either registered clinicians or trained psychologists (with at least a bachelor degree), and included an interview to assess PTSD symptoms as well as various questionnaires. Interviewers took part in CAPS-5 training workshop and were supervised throughout the study. The CAPS-5 workshop was conducted by the first and second author, supervision for the CAPS interviews was conducted by the senior clinical psychologist in each treatment centre. The institutional research ethics committee of the University of Münster approved the study.

The full description of the procedure can be seen elsewhere in detail (Krüger-Gottschalk et al., 2017).

2.2. Measures

Traumatic events were assessed with the German version of the *Life Events Checklist for DSM*-5 (Weathers et al., 2013). To determine the diagnostic criteria for PTSD

following DSM-5 and the severity score, the German version of the *Clinician Administered PTSD Scale for DSM-5* (CAPS-5) (Schnyder, 2013) was administered.

The CAPS-5 is a structured clinical interview that assesses the presence vs. absence of the PTSD DSM-5-criteria and provides a symptom severity score (Weathers et al., 2018). Additionally, the CAPS-5 assesses the presence or absence of the dissociative subtype. Furthermore, global ratings of impairment and distress are included as well as the rating of the response validity. Clinicians assessed the frequency, and rated the intensity of each symptom over the past month, then combined frequency and intensity to the severity score on a 5-point-scale ranging from *0 = absent* to *4 = extreme/ incapacitating*. According to the CAPS-5 scoring rules, a symptom with a severity rating of two or higher is considered as present. Based on this scoring rule, the DSM-5 algorithm was used to establish if the PTSD diagnosis was fulfilled or not. Excellent psychometric properties of the CAPS-5 have been reported (Muller-Engelmann et al., 2018) with αs = .65 – .93 and high interrater reliability with ICCs = .81–89.

As a self-report measure, the German version of the *PTSD Checklist for DSM-5* (Krüger-Gottschalk et al., 2017) was used. This questionnaire consists of 20 items that are rated on a 5-point-scale ranging from *0 = not at all* to *4 = extremely*. The items correspond to the PTSD criteria following DSM-5. The internal consistency for the German version of the PCL-5 was reported with α = .95 for the total scale, test-retest-reliability was reported with r_{tt} = .91 (Krüger-Gottschalk et al., 2017).

The *Beck Depression Inventory- II* (Kühner, Bürger, Keller, & Hautzinger, 2007), a 21 item questionnaire with α ≥ .84 and r_{tt} = .75, was used to assess depressive symptoms over the past two weeks. The *Brief Symptom Inventory* (Derogatis & Melisaratos, 1983), a 53-item questionnaire was used to assess for comorbid depressive and general psychopathological symptoms.Internal consistencies for the nine subscales ranged from α = .71 – .85, test-retest-reliability ranged between r_{tt} = .68 – .91.

3. Data analysis

Statistical and demographic data calculations were conducted using R version 4.1 (R Core Team, 2013) with the mvn package version 5.9 for multivariate normality tests (Korkmaz, Goksuluk, & Zararsiz, 2014) and the package Lavaan (Rosseel, 2012) for structural equation modelling with Yuan-Bentler corrections for non-normality data. The present sample size of *N*= 345 can be rated as good in accordance with the recommendation by Comrey and Lee (2013) All CFAs were conducted using the maximum likelihood (ML) procedure.The error covariances were fixed to zero and the variance of a latent variable (reference variable) was fixed to one to assign a metric. The χ2-values and selected fit indices were corrected according to Satorra and Bentler (2010). The model fit was evaluated with common descriptive fit indices (Bentler, 2006) and by reviewing the significance level of the χ2-value. An adequate fit is represented by SRMR-values <.11, RMSEA-values between .06 and .08, and CFI and TLI values ≥.90 (Hu & Bentler, 1999).

Nested models were compared with the chi-square difference test, indicator values were calculated using the MPLUS-Difference test (Muthen & Muthen, 2012) for Satorra-Bentler corrected data (Satorra & Bentler, 2010), non-nested models were compared using the the Akaike Information Criterion (AIC) (Akaike, 1987) and the Bayesian Information Criterion (BIC) (Schwarz, 1978). Lower AIC values indicate a better model fit (Konecky et al., 2016). BIC values with a difference of 10 points represent a better fit for the model with lower BIC values (Kass & Raftery, 1995).

4. Results

4.1. Descriptives

The mean age of the sample was 37.28 years (*SD* = 12.00, range = 18–68), 56.60% were female (gender and age data missing for one participant). According to the CAPS-5, 61.6% of participants met full DSM-5 criteria for PTSD. The prevalence rate according to the PCL-5 cut-off of 33 was 65.17% and 44.05% of the participants met full ICD-11 criteria for PTSD. The following CAPS-5 items were used to calculate the ICD-11 prevalence: nightmares (B2), flashbacks (B3), cognitive avoidance (C1), behavioural avoidance (C2), hypervigilance (E3), startle response (E4). The most frequent traumatic events according to the Life Events Checklist (LEC; Weathers et al., 2013) were physical assault (55.30%), sexual assault (42.60%), traffic accident (42.60%), other unwanted or uncomfortable sexual experience (39.90%), assault with a weapon (32.10%), severe human suffering (25.60%), combat or exposure to a war-zone (22.60%). Any other very stressful event or experience was experienced by 47.90%. The remaining traumatic events assessed by the LEC-5 were reported by 18.70% (life-threatening illness or injury) to 5.90% (captivity for example, being kidnapped, abducted, held hostage, prisoner of war) of the participants. Most of the participants were employed (41.30% full-time and 10.30% part-time), 22.50% were unemployed and 12.50% were retired.

Study participants reported a PTSD symptom severity score of *M*= 29.10 (*SD* = 16.42) assessed with the CAPS-5. The self-reported PTSD symptom severity assessed with PCL-5 resulted in *M* = 39.37 (*SD* = 20.22).

4.2. Reliability of the CAPS-5

Internal consistency for the total score and for all subscales were high (total scale: α = .93; subscales:

α = .85 for re-experiencing, α = .77 for avoidance, α = .83 for negative alterations in cognitions and mood and α = .75 for alterations in arousal and reactivity). Inter-item correlations as another measure for internal consistency ranged from r = .09 to r = .71, which can be regarded as acceptable (Clark & Watson, 2019) (re-experiencing items: .40 – .71, avoidance items: .63, negative alterations in cognitions and mood items: .18 – .65, and alterations in arousal and reactivity items: .13 – .55). The item 'impaired memory (D1)' showed no significant correlation with the two items 'recurrent dreams of trauma (B2)' (r = .03) and 'irritability or anger (E1)' (r = .10). All other inter-item correlations were statistically significant.

Correlation between the CAPS-5 severity score and the self-rating PCL-5 was high with r = .74. The correlation between the CAPS-5 severity score and depressive symptoms measured with the self-report BDI-II was also high with r = .72. Additionally, a high correlation between the CAPS-5 and general psychopathology, assessed through the BSI, with r = .73 was found.

4.3. Confirmatory factor analyses of the CAPS-5

4.3.1. Results of χ^2-Testing and of descriptive fit indices for the DSM-5 models

The result of CFAs of the current DSM-5 model of PTSD according to Table 2 show a Bollen-Stine as well as a Satorra-Bentler corrected significant p-value in χ2-tests. Judging from the recommended descriptive fit indices, the DSM-5 model (M1) stays within the limits proposed by Hu and Bentler (1999) (SRMR <.11, RMSEA <.08, and CFI >.90). All alternative DSM-5 models (M2–M8) also showed significant p-values on their χ^2-test (Table 2). On the fit indices, all models showed SRMR-values below .11, a CFI (SB) of ≥.90 and stayed below the recommended threshold of .08 on the RMSEA. Looking at the three non-nested alternative six-factor models (M4 – M6), Table 2 shows that the DSM-5 six-factor Anhedonia model (M4) has the lowest AIC/BIC ratio. It is a marked improvement over the six-factor Externalizing Behaviours model (M4 vs. M5) (ΔBIC = 48.997) and over the six-factor Alternate Dysphoria model (Zelazny & Simms, 2015) (M4 vs. M6) (ΔBIC = 18.615). The largest fit indices improvements over the current DSM-5 model is attained by seven-factor Hybrid Model (M1 vs. M7; ΔSRMR = .0084; ΔRMSEA = .0013; ΔCFI (SB) = .030).

The outcome of the SB-corrected χ^2-difference test (Table 3) shows that only the six-factor Externalizing Behaviours model (M5) is not a significant improvement over the current DSM-5 four-factor numbing model (M1). All other models are superior to the structure of the first model. Comparing the models with the best fit indices shows the seven-factor hybrid model (M7) to be superior to all of the others. The experimental modified model (M8) also shows highly significant superior model fit and thus beats all other models with less than six factors and most of the fit indices of the seven-factor hybrid model (M7).

The standardized factor loadings (Table 4) of the selected DSM-5 alternative models were between .34 ('small') and .87 ('strong') but in general >.70 (Evans, 1996). The two noticeable exceptions with low factor loadings in both DSM-5 alternative models are the items 'memory impairment' which only loads with .34 on the 'negative effect'-factor in both models and the item 'reckless or self-destructive behavior' which loads with .34 on 'dysphoric arousal' in DSM-5 Anhedonia model (M4) and .42 on 'externalizing Behaviors' in seven-factor hybrid model (M7).

4.3.2. Results of χ^2-Testing and of descriptive fit indices for the ICD-11 models

Results of CFAs testing the ICD-11 models showed that the ICD-11 three-factor model fit better than all other ICD-11 alternative models (one-factor ICD-11 ΔSRMR = .0082; ΔRMSEA = .027; ΔCFI (SB) = .055; two factor ICD-11 model ΔSRMR = .0154; ΔRM SEA = .068; ΔCFI (SB) = .026) as well as the best fitting DSM-5 alternative model (M8 vs. M11; ΔSRMR = .0288; ΔRMSEA = .031; ΔCFI (SB) = .067). Similarly, the ICD-11 three-factor model was significantly superior to all other ICD-11 alternative models (see Table 5). The ICD-11 model (M11) shows high loadings throughout, with values of .61 ('moderate') to .81 ('strong').

Taken together, within the models based on the DSM-5 symptoms, the Hybrid Model and the Anhedonia model both emerged as well-fitting models. Due to the best trade-off between model fit and model complexity (Van de Schoot, Lugtig, & Hox, 2012), we chose the Anhedonia model as the best fitting model based on the comparatively lower BIC value. Given the fact that the item 'impaired memory' (item D1) shows very low factor loading, we also tested a model based on the DSM-5 items excluding item D1 (model M8). This model exceeds the model fit indices of all DSM-5 based models.

However, the more parsimonious ICD-11 three-factor model also revealed excellent model fit indices. Model fit indices for non-nested models indicate a better model fit for the ICD-11 model than the more complex models.

5. Discussion

The present study aimed to critically investigate the factor structure of the German CAPS-5 interview in a heterogeneous treatment-seeking traumatized sample with 61.6% of the sample fulfiling the PTSD diagnoses following DSM-5. In addition, we aimed at comparing the latent structure of the CAPS-5 with the already published latent structure of the PCL-5 (Krüger-

Table 2. Confirmatory factor analysis fit indices for PTSD models of CAPS-5 data.

Model	Uncorrected χ^2 (df)	Satorra-Bentler (SB) corr. χ^2(cF χ^2)	SRMR	RMSEA (CI90)	CFI	SB corr. TLI	SB corr. NFI	SB corr. CFI	AIC	BIC	CAIC
(M1) DSM-5 Numbing Model 2013[1]	407.973 (164)*	365.441 (1.116)**	.0482	.066 (.058 – .074)	.926	.921	.869	.931	499.974	676.777	722.777
(M2) DSM-5 Four Factor Dyshoria Model[1]	389.668 (164)*	348.573 (1.118)**	.0476	.063 (.055 – .071)	.932	.927	.875	.937	481.668	658.471	704.471
(M3) DSM-5 Five Factor Dysphoria Arousal Model	378.170 (160)*	337.620 (1.120)**	.0460	.063 (.055 – .071)	.934	.928	.879	.939	478.170	670.347	720.347
(M4) DSM-5 Six Factor Anhedonia Model[2]	311.486 (155)*	278.324 (1.119)**	.0428	.054 (.045 – .063)	.953	.948	.900	.958	421.486	**632.881**	**687.881**
(M5) DSM-5 Six Factor Externalizing Behaviours Model[2]	360.483 (155)*	322.475 (1.118)**	.0437	.062 (.054 – .070)	.938	.930	.885	.943	470.483	681.878	736.878
(M6) DSM-5 Six Factor Alternate Dysphoria Model[2]	330.101 (155)*	294.938 (1.119)**	.0424	.057 (.049 – .066)	.947	.941	.894	.952	440.101	651.496	706.496
(M7) DSM-5 Seven Factor Hybrid Model	294.280 (149)*	263.322 (1.118)**	**.0398**	**.053 (.044 – .062)**	**.956**	**.950**	**.906**	**.961**	**416.281**	650.737	711.737
(M8) DSM-5vExperimental Modified M6 With 19 Items3	277.709 (137)**	248.503 (1.118)**	.0393	.054 (.045 – .063)	.956	.952	.909	.961	383.709	587.417	640.417
(M9) ICD-11 One Factor Model	48.660 (9)*	41.209 (1.181)**	.0460	.113 (.083 – .145)	.940	.904	.916	.943	72.660	118.783	130.783
(M10) ICD-11 Two Factor Model	28.384 (8)*	23.843 (1.190)**	.0378	.086 (.053 – .121)	.969	.947	.950	.972	54.384	104.350	118.783
(M11) ICD-11 Model	8.587 (6)p = .332	7.250 (1.184)p = .298	**.0194**	**.035 (.001 – .084)**	**.996**	**.994**	**.985**	**.998**	**38.587**	**96.240**	**111.240**

N = 345. *p < .001 (Bollen-Stine-corrected p-value with 1000 bootstraps). **p < .001 (Satorra-Bentler corrected p-value). cF χ^2 = correction Factor. df = degrees of freedom. SRMR = Standardized Root Mean Square Residual. RMSEA = root-mean-squared error of approximation. CFI = comparative fit index. TLI = Tucker Lewis NNFI index. NFI = normed fit indices. AIC = Akaike Information Criterion. BIC = Bayesian Information. CAIC = Corrected Akaikes Information Criteria. Non-nested models are indicated by similar superscripts. The lowest information criterion value of origin symptom based DSM-5 models and the best fit indices are presented in boldface. [3]DSM-5 Item 8 (memory impairment) removed.

Table 3. Adjustes Satorra-Bentler scaling correction χ^2 – difference test for DSM-5 comparing nested models.

Models	Delta (SB) χ^2	Delta *df*	*p*
model 3 vs. model 1	67.74	4	<.001***
model 3 vs. model 2	52.76	4	<.001***
model 4 vs. model 1	36.47	9	<.001***
model 4 vs. model 2	14.49	9	.106
model 4 vs. model 3	17.89	5	<.01 **
model 5 vs. model 1	08.13	9	.521
model 5 vs. model 2	79.83	9	<.001***
model 5 vs. model 3	56.13	5	<.001***
model 6 vs. model 1	64.40	9	<.001***
model 6 vs. model 2	53.18	9	<.001***
model 6 vs. model 3	84.07	5	<.001***
model 7 vs. model 1	103.49	15	<.001***
model 7 vs. model 2	85.25	15	<.001***
model 7 vs. model 3	73.00	11	<.001***
model 7 vs. model 4	14.91	6	<.05 *
model 7 vs. model 5	59.15	6	<.001***
model 7 vs. model 6	31.16	6	<.001***

* = significance level, (M1) DSM-5 Numbing Model 2013 (4-factor), (M2) DSM-5 Dysphoria model (4-factor), (M3) DSM-5 Dysphoria Arousal Model (5-factor), (M4) DSM-5 Anhedonia Model (6-factor), (M5) DSM-5 Externalizing Behaviours Model (6-factor), (M6) DSM-5 Alternate Dyshoria Model (6-factor), (M7) DSM-5 Seven Factor Hybrid Model (7-factor).

Gottschalk et al., 2017). In secondary analyses, we tested the reliability, convergent and discriminant validity of the CAPS-5 in our sample and could replicate the respective findings reported by Muller-Engelmann et al. (2018). Discriminant validity was tested with the BDI-II and the BSI. Results showed that the correlation between the CAPS-5 and the PCL-5 was not higher than the one between CAPS and BDI-II or BSI. This is possibly due to a high overlap between depressive symptoms as assessed with the BDI-II and the BSI and dysphoric symptoms within PTSD as assessed with the CAPS-5, as well as the high comorbidity between the disorders. The constructs may be too close to serve as variables for establishing discriminant validity.With respect to the factor structure, the DSM-5 model and the alternative models based on DSM-5 symptoms that had been suggested in the literature were compared. Additionally, we examined the factor structure based on the ICD-11 structure. Given the low factor loading of the item 'impaired memories', we examined a 6-factor model excluding this item from the CFA. Excluding this item is in line with recent network analyses (Armour, Fried, Deserno, Tsai, & Pietrzak, 2017; Cero & Kilpatrick, 2020; Cramer, Leertouwer, Lanius, & Frewen, 2020; Spiller et al., 2017) that reported very low centrality for trauma-related amnesia.

When looking at the often reported models based on the DSM-5 symptoms, we found the Anhedonia model as the best fitting model given the best trade-off between complexity and fit indices. However, since the D1 item memory impairment shows a low factor loading (cf. also Boeschoten et al., 2018; Muller-Engelmann et al., 2018) and low centrality in network analyses (Armour et al., 2017; Cramer et al., 2020; Spiller et al., 2017), we excluded this item from our CFA analyses and found that this model had the best fit indices compared to all other tested DSM-5 models.

Taken together, the DSM-5 items measured with the CAPS-5 were best represented by the Anhedonia model. This result is in line with recent publications (e.g. Boeschoten et al., 2018). By excluding the item 'impaired memory' this result changed and the six-factor Dysphoria model revealed the best fit indices.

Given the debate on the DSM-5 vs. ICD-11 approach of PTSD, we also tested the ICD-11 models based on the six PTSD criteria of the ICD-11. In accordance with Hansen et al. (2017), the ICD-11 three-factor model achieved the best model fit indices compared to all tested models. In line with this result, Hunt et al. (2018) reported strong model fit indices for the three-factor-ICD-11 model based on the six ICD-11 criteria. Based on the 20 DSM-5 items, Hunt and colleagues found the best support for a two-factor solution that represents the two factors posttraumatic stress and general posttraumatic dysphoria. The factor posttraumatic stress included re-experiencing, avoidance and hyperarousal. Given the fact that in the CFA literature on PTSD the three factors re-experiencing, avoidance, hyperarousal are consistent throughout all tested models, these factors are assumably central for the concept of PTSD. However, dysphoric symptoms are also an important feature of PTSD patients (Silverstein, Petri, Kramer, & Weathers, 2020), which has been shown in recent network analyses (Cero & Kilpatrick, 2020) where the most central PTSD symptoms were located on DSM-5 cluster D (negative beliefs or expectations; persistent negative emotional state) (Cero & Kilpatrick, 2020). It remains unclear if these dysphoric symptoms have a common aetiological background with PTSD symptoms like re-experiencing. For an effective treatment, the understanding of aetiological and psychological processes is indispensably important and therefore we need an empirical validated theoretical understanding of these processes. Within this context, our results represent on the one hand the validity of the narrow ICD-11 conceptualization with the three factors re-experiencing, avoidance, hyperarousal and on the other hand the good model fit for the Dysphoria Model (based on 19 DSM-5 items) represents the relevance of dysphoric symptoms on three factors next to the three common factors re-experiencing, avoidance and hyperarousal. Here, it would be interesting to conduct subgroup analyses to investigate if these models symbolize variations of PTSD.

Although it is important to be cautious when comparing non-nested models, the AIC indice indicates superiority of the ICD-11 model (Cavanaugh & Neath, 2019). Taken into account empirical findings, theoretical considerations on dysphoric symptoms as an aftermath of PTSD, clinical utility and applicability,

Table 4. Factor loadings (standardized regression weights) for the DSM-5 Anhedonia model (M4), the DSM-5 seven factor hybrid model (M7) and the ICD-11 model (M11).

		M4: DSM-5 Anhedonia Model (6-factor)		M7: DSM-5 Seven Factor Hybrid Model (7-factor)		M11: ICD-11 Model (3-factor)	
PTSD Symptom		Factor	Factor loadings**	Factor	Factor loadings**	Factor	Factor loadings**
B1: uncontrollable memories	< –	Re-experiencing (R)	.816	Re-experiencing (R)	.815		
B2: recurrent dreams of trauma	< –	Re-experiencing (R)	.636	Re-experiencing (R)	.641	Re-experiencing (R)	.742
B3: flashbacks	< –	Re-experiencing (R)	.543	Re-experiencing (R)	.543	Re-experiencing (R)	.610
B4: psychological cue reactivity	< –	Re-experiencing (R)	.832	Re-experiencing (R)	.832		
B5: physiological cue reactivity	< –	Re-experiencing (R)	.843	Re-experiencing (R)	.840		
C1: avoidance of thoughts of trauma	< –	Avoidance (AV)	.832	Avoidance (AV)	.832	Avoidance (AV)	.814
C2: avoidance of reminders of trauma	< –	Avoidance (AV)	.757	Avoidance (AV)	.757	Avoidance (AV)	.774
D1: memory impairment	< –	Negative Affect (NA)	.345	Negative Affect (NA)	.346		
D2: negative beliefs	< –	Negative Affect (NA)	.755	Negative Affect (NA)	.754		
D3: blamed self or others	< –	Negative Affect (NA)	.567	Negative Affect (NA)	.569		
D4: persistent negative emotional state	< –	Negative Affect (NA)	.879	Negative Affect (NA)	.879		
D5: diminished interest in activities	< –	Anhedonia (AN)	.730	Anhedonia (AN)	.728		
D6: feelings of detachment from others	< –	Anhedonia (AN)	.677	Anhedonia (AN)	.683		
D7: inability to experience pos. emotions	< –	Anhedonia (AN)	.775	Anhedonia (AN)	.771		
E1: irritability or anger	< –	Dysphoric Arousal (DA)*	.529	Externalizing-Behaviours (EB)	.615		
E2: reckless or self-destructive behaviour	< –	Dysphoric Arousal (DA)*	.342	Externalizing-Behaviours (EB)	.421		
E3: hypervigilance	< –	Anxious Arousal (AA)	.683	Anxious Arousal (AA)	.762	Arousal (A)	.774
E4: exaggerated startle response	< –	Anxious Arousal (AA)	.658	Anxious Arousal (AA)	.719	Arousal (A)	.708
E5: difficulty concentrating	< –	Dysphoric Arousal (DA)*	.763	Dysphoric Arousal (DA)	.678		
E6: sleeping difficulties	< –	Dysphoric Arousal (DA)*	.719	Dysphoric Arousal (DA)	.669		

*equal factor **standardized Regression weights (all non-standardized regression weights were significant $p < .001$).

Table 5. Adjustes Satorra-Bentler scaling correction χ^2 – difference Test for ICD 11 (Proposal) comparing nested models.

Models	Delta (SB) χ^2	Delta *df*	*p*
model 10 vs. model 9	18.41	1	<.001***
model 11 vs. model 9	34.17	3	<.001***
model 11 vs. model 10	16.38	2	<.001***

* = significance level, (M9) ICD-11 One Factor Model (2-factor), (M10) ICD-11 Two Factor Model (2-factor), (M11) ICD-11 (Proposal) Model (3-factor).

we conclude that the three-factor ICD-11 model is a good representation of our data.

5.1. Limitations

As in most earlier research in the field, the comparison between different structural models of PTSD in our manuscript was based on model fit. Future research should use additional criteria to decide between models, e.g. differential relationship of subfactors with important external indicators, such as comorbidity, functional impairment, or treatment outcome. A further limitation for the DSM-5 based CFA models and for the three-factor ICD-11 model is the small number of indicators across factors. The DSM-5 based models with five, six or seven factors include two, three or four factors that are represented by only two symptoms. All three ICD-11 factors include only two symptoms respectively. This small number of indicators might lead to an empirical under-identification of the model (Kline, 2016). Further limitations are the restricted sample size, the heterogenous sample and the lack of assessing the ICD-11 symptoms with a validated instrument like the ITQ. The lack of assessing the ICD-11 symptoms with an instrument explicitly developed to capture the ICD-11 diagnostic criteria (e.g. the ITQ) is especially relevant for the interpretation of the prevalence rates according to DSM-5 vs. ICD-11 criteria. With regard to the CAPS interviews, it is a limitation that we did not assess interrater reliability. Also, the involvement of Bachelor level psychologists for the CAPS-5 interviews is a limitation.

5.2. Implications

The factor structure of PTSD has relevant clinical impact for the diagnostic algorithm and therefore on the diagnostic status of PTSD. A rather complex PTSD model, such as the seven factor hybrid model, might on the one hand be too complex for broad clinical utility, and it remains to be tested whether externalizing behaviour should be indispensable for fulfiling PTSD. On the other hand, such complex models might increase a better understanding of subconstructs of PTSD and therefore help to improve treatment strategies (cf. e.g. Armour et al., 2016). The ICD-11 approach with a focus on the core elements of PTSD and the differentiation between PTSD and CPTSD increases clinical utility. However, the narrow understanding of PTSD might lead to the reduced diagnostic rates we and other studies have found (see e.g. Hansen et al., 2017) and may therefore be a significant limitation for access to treatment. In order to decide between the different models for diagnostic and treatment purposes, more research is needed. In this future research on the construct validity of PTSD models, it is important to (a) use measurements that represent both the DSM-5 and the ICD-11 PTSD symptoms, (b) to assess these measures as self-report and as clinical interview, and c) to assess relevant external correlates beyond and above e.g. the BDI-II or the BSI. An additional categorical approach could help to investigate whether different factor models represent different subtypes of PTSD, e.g. a dysphoric subtype, an anxious subtype or an externalizing subtype (see also Hunt et al., 2018).

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Data availability statement

Dataset and materials are available from the corresponding author due to privacy reasons.

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