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Psychometric properties and validity of the German version of the Post-Traumatic Diagnostic Scale for DSM-5 (PDS-5)

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ABSTRACT

Background: The availability of psychometrically sound instruments for the assessment of Post-Traumatic Stress Disorder (PTSD) is indispensable for clinical and scientific work with individuals suffering from trauma-related distress.

Objective: The aim of the present study was to translate the Post-Traumatic Diagnostic Scale for DSM-5 (PDS-5) into German and to evaluate its psychometric properties as well as convergent, discriminant, and factorial validity.

Method: The authorized German translation of the PDS-5 was completed by 270 patients admitted to specialized outpatient trauma clinics. Of these, 57.8% completed the PDS for a second time (mean time between assessments was 12.0 days). In order to examine convergent and discriminant validity of the PDS-5, the Post-traumatic Stress Disorder Checklist for DSM-5 as well as Patient Health Questionnaire subscales assessing depression (PHQ-9), somatization (PHQ-15), and Generalized Anxiety Disorder (GAD-7) were applied.

Results: The PDS-5 total score showed excellent internal consistency (α = .91) and re-test reliability (rho = .84). Convergent validity was supported by a strong correlation with the total score of the Post-traumatic Stress Disorder Checklist for DSM-5 (PCL-5; rho = .91). Correlations with Patient Health Questionnaire subscales of depression (rho = .81), anxiety (rho = .72), and somatization (rho = .65) were significantly lower (all $p < .001$) indicating discriminant validity of the PDS-5. Confirmative Factor Analysis did not result in a clear preference for one of the tested models. Defining a diagnostic cut-off value of ≥36 based on ROC analysis resulted in high sensitivity (.92) and specificity (.96) compared to a probable PTSD diagnosis according to the PCL-5.

Conclusions: In summary, our results indicate that the German PDS-5 translation provides valid and reliable information concerning both PTSD severity and diagnosis.

Propiedades psicométricas y validez de la versión alemana de la Escala Diagnóstica postraumática del DSM-5 (PDS-5)

Antecedentes: La disponibilidad de instrumentos psicométricamente sólidos para la evaluación del trastorno de estrés postraumático (TEPT) es indispensable para el trabajo clínico y científico con personas que sufren angustia relacionada con el trauma.

Objetivo: El objetivo del presente estudio fue traducir la Escala de Diagnóstico Postraumático del DSM-5 (PDS-5) al alemán y evaluar sus propiedades psicométricas, así como su validez convergente, discriminante y factorial.

Método: La traducción al alemán autorizada del PDS-5 fue completada por 270 pacientes ingresados en clínicas de trauma ambulatorias especializadas. De estos, el 57,8% completó la PDS por segunda vez (el tiempo medio entre evaluaciones fue de 12,0 días). Con el fin de examinar la validez convergente y discriminante del PDS-5, la lista de verificación del trastorno de estrés postraumático para el DSM-5, así como las subescalas de depresión del Cuestionario de salud del paciente (PHQ-9), de somatización (PHQ-15) y de trastorno de ansiedad generalizada (GAD-7) fueron aplicadas.

Resultados: La puntuación total del PDS-5 mostró una excelente consistencia interna (α = .91) y confiabilidad al replicar (rho = .84). La validez convergente fue apoyada por una fuerte correlación con la puntuación total de la lista de verificación de trastorno de estrés postraumático para el DSM-5 (PCL-5; rho = .91). Las correlaciones con las subescalas del Cuestionario de Salud del Paciente de depresión (rho = .81), ansiedad (rho = .72) y somatización (rho = .65) fueron significativamente más bajas (todas $p < .001$) lindicando

validez discriminante del PDS-5. El Análisis Factorial Confirmativo no resultó en una preferencia clara por uno de los modelos probados. La definición de un valour de corte de diagnóstico de ≥36 basado en el análisis ROC resultó en una alta sensibilidad (.92) y especificidad (.96) en comparación con un diagnóstico de TEPT probable según el PCL-5.
Conclusiones: En resumen, nuestros resultados indican que la traducción al alemán PDS-5 proporciona información válida y confiable sobre la severidad y diagnóstico del TEPT.

德语版 DSM-5创伤后诊断量表(PDS-5)的心理测量特性和有效性

背景:评估创伤后应激障碍 (PTSD) 的心理测量学上可靠工具的可用性对于围绕遭受创伤相关痛苦个人进行临床和科学工作是必不可少的。
目的:本研究旨在将 DSM-5 创伤后诊断量表 (PDS-5) 翻译成德语,并评估其心理测量特性以及收敛,区分和因素效度。
方法: 270 名创伤专科门诊患者完成了德语授权翻译版的PDS-5。其中, 57.8%完成了第二次 PDS (评估之间的平均时间为 12.0 天) 。为了考查PDS-5的收敛效度和区分效度, 使用了DSM-5 创伤后应激障碍检查表以及, 躯体化 (PHQ-15) 和患者健康问卷抑郁子量表(PHQ-9)和广泛性焦虑障碍子量表 (GAD-7) 。
结果:PDS-5 总分展现出极好的内部一致性 (α = .91) 和重测信度 (rho = .84)。与 DSM-5 创伤后应激障碍检查表总分 (PCL-5;rho = .91) 的强相关性支持收敛效度。与抑郁 (rho = .81),焦虑 (rho = .72) 和躯体化 (rho = .65) 的患者健康问卷子量表的相关性显著更低 (所有 *p*< .001), 表现出PDS-5 的区分效度。验证性因素分析结果没有对某一测试模型的明显偏好。与根据 PCL-5 的可能 PTSD 诊断相比, 根据 ROC 分析确定 ≥ 36 的诊断临界值会导致高的敏感性 (.92) 和特异性 (.96)。
结论:总而言之, 我们的结果表明德语 PDS-5 翻译提供了关于 PTSD 严重程度和诊断有效和可靠的信息。

1. Introduction

The availability of psychometrically sound instruments for the assessment of mental disorders is an indispensable prerequisite for clinical and scientific work with individuals suffering from mental health problems. For the assessment of Post-Traumatic Stress Disorder (PTSD), fundamental changes in the diagnostic criteria in DSM-5 (APA, 2013) require the adaptation of existing diagnostic and research instruments. These changes include the deletion of the subjective trauma criterion (A2 in DSM-IV; APA, 2000), the addition of the cluster 'Negative alterations in cognitions and mood', and further changes in symptomatic criteria resulting in a total of 20 PTSD symptoms as compared to 17 in the previous DSM-IV version.

One of the most frequently applied self-rating scales for PTSD, according to the DSM-IV, was the Post-traumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997). Recently, Foa et al. (2016) published the updated Post-traumatic Diagnostic Scale for DSM-5 (PDS-5). In the validation sample of the original PDS-5 version (*n* = 242), internal consistency was excellent (Cronbach's alpha = .95), and the mean item-total correlation for its 20 items was .67. Test–retest reliability (mean time interval between assessments was 6.2 days) was indicated by a correlation of PDS-5 total scores of r = .90 and by diagnostic agreement in 83% of cases. In favour of convergent and discriminant validity of the scale, correlations with observer and self-rated PTSD measures were significantly higher than those with depression and anxiety measures. Notwithstanding the significance of these differences, correlations of the PDS-5 total score with

depression and trait anxiety scores were still rather strong (r = .77 and .64, respectively). Many different explanations have been suggested to account for the high comorbidity rates reported for individuals suffering from PTSD (McFarlane, 2004). Obviously plausible is, of course, the notion of diagnostic overlap between PTSD and frequent comorbid diagnoses, as depression or anxiety. Recent progress in prospective research designs (DiGangi et al., 2013; Worthington, Mandavia, & Richardson-Vejlgaard, 2020) additionally supports the pre-dispositional model (McFarlane, 2004) assuming that especially individuals suffering from specific pre-existing disorders may develop symptoms of posttraumatic stress following the experiences of potentially traumatic events.

A cut-off PDS-5 total score of ≥28 for a probable PTSD diagnosis was associated with high sensitivity (.79) and specificity (.78) as compared to a diagnosis based on the PTSD Symptom Scale – Interview Version for DSM-5 (PSSI-5; Foa et al., 2016). Meanwhile, the PDS-5 has been translated into several languages, including Arabic (Alghamdi & Hunt, 2020; Byrow, Pajak, McMahon, Rajouria, & Nickerson, 2019), Chinese (Su, Kung, Hung, & Chen, 2020), Polish (Zawadzki et al., 2015), Farsi and Tamil (Byrow et al., 2019), Russian (Slanbekova, Chung, Karipbaev, Sabirova, & Alimbayeva, 2019), and Somali (Zoellner et al., 2018). So far, no authorized and validated German translation of the PDS-5 has been developed.

We are aware of only one validated German version of a DSM-5 PTSD-self rating scale, the Post-traumatic

Stress Disorder Checklist for DSM-5 (PCL-5; Kruger-Gottschalk et al., 2017). A basic difference between the PDS-5 and the German PCL-5 version is that the latter is restricted to 20 items assessing the DSM-5 PTSD-symptoms, while the former additionally includes six items covering trauma history, the 'index trauma,' distress and interference caused by PTSD symptoms, as well as symptom onset and duration. Availability of alternative assessment instruments allows not only for choosing the most suitable tool under given circumstances, but it also enables statistical approaches based on the calculation of latent variables and can simplify cooperation in multi-centre studies.

The aim of the present study was to translate the PDS-5 into German and evaluate its psychometric properties as well as convergent, discriminant, and factorial validity in a sample of patients seen at specialized outpatient trauma facilities. In order to rely on a broader range of constructs for the evaluation of discriminant validity, the assessment of depression and anxiety in the validation study of the original PDS-5 (Foa et al., 2016) was complemented by the assessment of the symptoms of somatization. As many studies failed to confirm the DSM-5 four-factor structure of the PTSD-diagnosis, the following five models (compare Kruger-Gottschalk et al., 2017) were additionally tested with the use of Confirmatory Factor Analysis (CFA): 1. The Dysphoria Model (Simms, Watson, & Doebbelling, 2002), postulating the factors of re-experiencing, avoidance, dysphoria, and hyperarousal; 2. The Dysphoric Arousal Model (Elhai et al., 2011), postulating the five factors of re-experiencing, avoidance, dysphoria, as well as dysphoric and anxious arousals; 3. The Anhedonia Model (Liu et al., 2014), postulating the six factors of re-experiencing, avoidance, negative alterations in cognitions and mood, anhedonia, as well as dysphoric and anxious arousals; 4. The Externalizing Behaviour Model (Tsai et al., 2015), postulating the six factors of re-experiencing, avoidance, negative alterations in cognitions and mood, externalizing behaviour, as well as dysphoric and anxious arousals; and 5. The Hybrid Model (Armour et al., 2015), postulating the seven factors of re-experiencing, avoidance, negative affect, anhedonia, externalizing behaviour, as well as dysphoric and anxious arousals (for the assignment of items to factors compare Kruger-Gottschalk et al., 2017, Table 1).

2. Material and methods

2.1. Procedure and participants

Data were collected between 03/13/2017 and 12/17/2019 during standard intake assessments of the outpatient trauma wards of the Department of Psychosomatics and Psychotherapy, University Hospital Münster,

Table 1. Types of trauma and post-traumatic stress severity scores in the sample.

Trauma type	N	%
Severe life threatening illness	70	25.9
Physical violence	124	45.9
Sexual assault	109	40.4
Military combat	9	3.3
Child abuse	102	37.8
Accident	94	34.8
Torture or imprisonment*	17	6.3
Natural disaster	13	4.8
Other trauma	89	33.0
Post-traumatic stress severity scores	M	SD
PDS-5 total	42.3	16.7
PDS-5 intrusion	12.1	4.8
PDS-5 avoidance	5.0	2.5
PDS-5 changes in mood and cognition	13.4	7.4
PDS-5 arousal and hyperreactivity	11.9	5.3
PCL-5 total	43.7	16.9

*This item was added in accordance with the authors of the original version.
PDS-5 = Posttraumatic Diagnostic Scale for DSM-5; PCL-5 = PTSD Checklist for DSM-5.

Germany (n = 175), the Department of Psychosomatic Medicine and Psychotherapy, LWL-University Hospital, Ruhr-University Bochum, Germany, (n = 49), and the Department of Psychotherapy and Psychosomatic Medicine, Technical University Dresden, Germany (n = 46). Exclusion of four subjects with more than three missing values among PDS symptom items (see section data analysis) and ten subjects not reporting any traumatic event resulted in a sample of 270 patients. For the assessment of test–retest reliability, one hundred and fifty-six (57.8%) of participants completed the PDS for a second time. Of these, one was excluded with more than three missing values. The mean time interval between assessments was 12.0 days (SD = 7.8; Range = 1–42, eight missing values).

2.2. Measures

2.2.1. Development of the German version of the Post-Traumatic Diagnostic Scale for DSM-5 (PDS-5; Foa et al., 2016)

The PDS-5 assesses trauma history with two questions, followed by 20 items assessing PTSD symptom severity in the last month based on DSM-5. Distress and interference as well as the history of symptoms are assessed with two further items each, summing up to a total of 26 items. The first question screens the respondent's trauma history presenting a list of seven specific traumatic event types plus an open category for other trauma types (see Table 1). The second question assesses which of these single traumatic experiences is on the respondent's mind and currently bothers them the most ('index trauma'). The following 20 items apply a 5-point scale of frequency and severity ranging from 0 ('not at all') to 4 ('6 or more times a week/severe') in assessing the PTSD symptoms

according to the DSM-5. Based on these 20 items, a PDS total sum score can be computed, as well as subscores for the PTSD symptom cluster of intrusion (items 1–5), avoidance (items 6–7), changes in mood and cognition (items 8–14), and arousal and hyper-reactivity (items 15–20). Four additional items refer to distress and interference caused by these symptoms, as well as the onset and duration of the symptoms. The PDS-5 total score is the sum of the 20 PTSD symptom scores.

The PDS-5 was translated into German by the authors. The questionnaire was then back-translated into English by a bi-lingual (American/German) BA-level student of Language and Cultural Studies who did not know the original scale. The German translation of the respective items was adopted and back-translated based on the differences between the original and back-translated versions. The final back-translation was then approved by the developer of the original version (Edna B. Foa). For the German version, one additional category of trauma event type (torture or imprisonment) was added with the agreement of the authors of the original version. With torture, one of the most harmful traumatic experiences was not covered by the original PDS-5 version. The specific focus on imprisonment originates from Germany´s recent history (political imprisonment in the former Eastern Germany, GDR). Due to a vast number of missing values concerning the repetition of traumatic event types for the specification of an index trauma (PDS-5 item 2), this item was not included in the present analyses.

2.2.2. Post-traumatic Stress Disorder Checklist for DSM-5 (PCL-5; Weathers et al., 2013), German version Kruger-Gottschalk et al., 2017)

In this study, the PCL-5 was used to examine convergent validity for the PDS-5 and calculate a diagnostic cut-off score. The validated German version is a 20 item self-report measure assessing the DSM-5 symptom criteria for PTSD. It applies a five-point-scale (0 = 'not at all' to 4 = 'extremely') measuring the intensity of symptoms over the past month. The German version of the PCL-5 proved reliable (e.g. the total score's internal consistency was α = .95, re-test-reliability was r = .91 (Kruger-Gottschalk et al., 2017)). Convergent validity and diagnostic utility were assessed by comparing the PCL-5 with the German version of the Clinician-Administered PTSD Scale for DSM-5 (Schnyder, 2013; Weathers et al., 2013). Correlation of the total PCL-5 and CAPS-5 scores was r = .77, a PCL-5 cut-off score of 33 resulted in acceptable diagnostic efficiency in predicting CAPS-5 diagnosis (sensitivity = .86, specificity = .68, overall efficiency = .79; Kruger-Gottschalk et al., 2017).

2.2.3. Patient Health Questionnaire (PHQ-9 (Kroenke, Spitzer, & Williams, 2001), PHQ-15 (Kroenke, Spitzer, & Williams, 2002), GAD-7 (Spitzer, Kroenke, Williams, & Lowe, 2006))

The PHQ is a self-administered version of the Primary Care Evaluation of Mental Disorders (PRIME-MD; Spitzer et al., 1994). In this study, German versions of the PHQ subscales assessing depression (PHQ-9), somatization (PHQ-15), and Generalized Anxiety Disorder (GAD-7) were applied in order to examine discriminant validity for the PDS-5. The PHQ-9 assesses how often one has been bothered over the last two weeks by each of nine depressive symptoms (e.g. item 1: 'Little interest or pleasure in doing things') rated on a four-point scale ranging from 0 = 'not at all' to 3 = 'nearly every day.' The PHQ-15 assesses how much the respondent has been bothered during the past four weeks by each of 15 somatization symptoms (e.g. item 1: 'Stomach pain') on a three-point-scale ranging from 0 = not at all" to 2 = 'bothered a lot.' The GAD-7 assesses how often the respondent has been bothered by each of the seven symptoms of Generalized Anxiety Disorder (e.g. item 1: 'Feeling nervous, anxious or on edge') on a four-point-scale ranging from 0 = 'not at all' to 3 = 'nearly every day.' In a systematic review of studies applying the PHQ, Kroenke, Spitzer, Williams, and Lowe (2010) summarize the evidence for the reliability and validity of these scales. For PHQ-9, internal consistencies ranging from alpha = .86 – .89 as well as a test-retest-reliability of r = .84 are reported. Sensitivity (ranging in different publications from .77 to .88) and specificity (ranging in different publications from .88 to .94) convincingly indicated criterion validity of the recommended cut-off score for a probable diagnosis of major depressive disorder). For the PHQ-15, two studies reporting an internal consistency of alpha = .80 and test–retest reliabilities ranging from r = .60 to .83 are summarized. The sensitivity and specificity of the PHQ-15 diagnostic algorithm were .78 and .71, respectively. For GAD-7, an internal consistency of alpha = .92 and test–retest reliability of r = .83, are reported. Sensitivity (ranging in different publications from .66 to .89) and specificity (ranging from .80 to .82) convincingly indicated criterion validity of the recommended cut-off score for a probable diagnosis of generalized anxiety disorder). The applied PHQ measures are available at www.phqscreeners.com.

2.3. Data analysis

Statistics were computed with IBM SPSS Statistics 25, IBM SPSS Amos 27 Graphics, and R statistical computing environment. PDS-5 and PCL-5 total scores were calculated if no more than three values among the 20 items were missing. For PDS-5 and PCL-5

subscales and the three PHQ measures, one missing value was allowed. Four subjects with more than three missing values among PDS symptom items were excluded. In 53 of the remaining 270 patients (19.6%), one to three missing values among PDS-5 items were observed. For one patient, a PDS-5 avoidance scale sum score could not be computed as this participant answered neither of its two items. The number of missing values for PCL-5 total and subscale sum scores ranged from two to six. The number of missing values for the three PHQ scales ranged from seven to twenty-three. Following Kruger-Gottschalk et al. (2017) in applying conservative estimates, sum scores were computed based on all valid items.

As Kolmogorov–Smirnov tests indicated significant deviations from normal distributions for all PDS-5, PCL-5, and PHQ scales, bivariate associations were tested applying non-parametric statistics. Cronbach's alpha a coefficient was computed to assess the internal consistency of the PDS-5 at the first visit. As an alternative reliability measure, Composite reliability (CR) was calculated based on the standardized factor loadings in a confirmatory factor analysis (CFA). For CR of the total score, we performed a one-factor CFA including all items. In order to compute CR for the subscales, an additional four-factor CFA was calculated. Test–retest reliability for PDS-5 total and subscale scores at first and second study visit was computed with Spearman rank correlations (rho). To determine the diagnostic agreement between PDS-5 at both study visits and between PDS-5 and PCL-5, Cohen's kappa coefficient (κ) was computed applying the diagnostic cut-off as reported below. Spearman rank correlations were computed to examine convergent (PCL-5) and discriminant validity (PHQ-9, PHQ-15, and GAD-7) based on data from the first assessment time point. Differences between correlations indicating convergent and discriminant validity were tested for significance, according to Steiger (1980) and Hoerger (2013). CFA were calculated on basis of the 217 participants without missing values among the 20 PDS symptom items. Model-fit was evaluated following indications by Schermelleh-Engel, Moosbrugger, and Müller (2003). In order to identify an optimal diagnostic cut-off score as well as sensitivity and specificity of the PDS-5 total sum score as compared to the validated PCL-5 cut-off score of 33 (Kruger-Gottschalk et al., 2017), receiver operating characteristic (ROC) analysis was applied. A ROC curve is depicted plotting sensitivity of the PDS diagnosis as compared to PCL diagnosis against its specificity. The area under the curve (AUC) reflects the ability of a measure to correctly differentiate between positive and negative cases (separation capacity). An AUC value significantly differing from 0.5 reflects a separation capacity better than chance with an AUC value of one reflecting a perfect separation of positive and negative cases.

3. Results

3.1. Socio-demographic sample characteristics and traumatic event types

Mean age was 37.3 years (SD = 13.6, Range = 18–72), 72.2% (n = 195) of the sample were females. Participants reported a mean of 2.3 (SD = 1.4, Range = 1–7) traumatic event types. Having suffered one traumatic event type was reported by 38.9% of the sample; 2–5 event types were experienced by 23.7, 17.0, 11.5, and 5.6% of participants, respectively. Six or seven event types were reported by 3.3%. Most frequently reported were physical or sexual violence, child abuse, accidents, and 'other trauma' (Table 1). Mean values for PDS-5 total and subscale sum scores, as well as PCL-5 total score, are reported in Table 1.

3.2. Reliability

Internal consistency of the PDS-5 was α = .91 (CR = .92; n = 217) for the full scale. Mean item-total correlation was $r_{i(t-i)}$ = 0.56 (Range = .20–74). The only items with a corrected item-total correlation below .4 were items 8 ('Trying to avoid activities, situations, or places that remind you of the trauma or that feel more dangerous since the trauma') and 16 ('Taking more risks or doing things that might cause you or others harm'). Internal consistencies and mean item-total correlations for the subscales were as follows: intrusion: α = .80 (CR = .81; n = 257); $r_{i(t-i)}$ = 0.59 (Range = .48 – .64); avoidance: α = .64 (CR = .63; n = 258); $r_{i(t-i)}$ = 0.47 (Range = .47 – .47); negative alterations in cognitions and mood: α = .85 (CR = .86; n = 243); $r_{i(t-i)}$ = 0.61 (Range = .34 – .74); alterations in arousal and reactivity: α = .75 (CR = .76; n = 257); $r_{i(t-i)}$ = 0.49 (Range = .19 – .63). Test-retest reliability for PDS-5 total and subscale scores was rho = .84 (total score), rho = .66 (intrusion subscale), rho = .58 (avoidance subscale), rho = .85 (negative alterations in cognitions and mood subscale), and rho = .85 (alterations in arousal and reactivity) (n = 155, all p < .001). The test–retest reliability for a probable PTSD diagnosis as measured by the PDS cut-off score described below was good (κ = .68, p < .001). Percentage agreement between probable diagnoses at the two time points was 85.8%, indicating a high degree of test–retest reliability.

3.3. Convergent validity

Table 2 shows Spearman's rank correlation coefficients between the PDS-5 and the PCL-5. The PDS-5 total severity score was significantly correlated with the PCL-5 total score (rho = .91, p < .001), providing evidence of convergent validity for the PDS-5. Correlations of PDS-5 and PCL-5 subscales ranged from rho = .67 (avoidance subscale) to rho = .88

Table 2. Spearman´s rank correlations between PTSD symptom scale scores and further measures of psychopathology.

	Measure	1	2	3	4	5	6	7	8	9	10	11	12
1	PDS-5 total	-											
2	PDS-5 intrusion	.77	-										
3	PDS-5 avoidance	.65	.51	-									
4	PDS-5 changes in mood and cognition	.89	.53	.48	-								
5	PDS-5 arousal and hyperreactivity	.86	.56	.47	.70	-							
6	PCL-5 total	.91	.68	.60	.81	.81	-						
7	PCL-5 intrusion	.72	.80	.48	.52	.60	.79	-					
8	PCL-5 avoidance	.58	.40	.67	.50	.46	.66	.48	-				
9	PCL-5 changes in mood and cognition	.82	.50	.49	.88	.67	.90	.57	.52	-			
10	PCL-5 arousal and hyperreactivity	.80	.56	.47	.65	.88	.88	.62	.48	.72	-		
11	PHQ-9 depression	.81	.57	.42	.77	.74	.85	.63	.46	.82	.76	-	
12	PHQ-15 somatization	.65	.49	.37	.59	.61	.64	.58	.37	.57	.56	.69	-
13	GAD-7 generalized anxiety	.72	.55	.40	.67	.65	.72	.55	.39	.67	.68	.77	.58

All correlations are significant at $p < .001$. PTSD = Post-Traumatic Stress Disorder; PDS-5 = Post-traumatic Diagnostic Scale; PCL-5 = PTSD Checklist for DSM-5; PHQ-9 = Depression subscale of the Patient Health Questionnaire-D; PHQ-15 = Somatization subscale of the Patient Health Questionnaire-D; GAD-7 = Anxiety subscale of the Patient Health Questionnaire-D; DSM-5 = Diagnostic and Statistical Manual of Mental Disorders (5th ed.).

Table 3. Model-fit indices for confirmatory factor analyses.

Model	CHI^2	df	CHI^2/df	NFI	CFI	RMSEA	AIC
DSM-5 Model	299.63***	161	1.86	.85	.93	.06	397.6
Dysphoria Model	291.44***	159	1.83	.86	.93	.06	393.4
Dysphoric Arousal Model	299.45***	158	1.90	.85	.92	.06	403.5
Anhedonia Model	260.66***	154	1.69	.87	.94	.06	372.7
Externalizing Behaviour Model	291.92***	154	1.90	.86	.93	.06	403.9
Hybrid Model	306.2***	149	2.06	.88	.93	.06	468.2

*** = $p < .001$; df = degrees of freedom; AIC = Akaike information criterion; CFI = comparative fit index; NFI = normed fit index; RMSEA = root mean square error of approximation.

(negative alterations in cognitions as well as mood and hyperarousal subscales).

3.4. Discriminant Validity

Discriminant validity was assessed using Spearman's rank correlation coefficients of the PDS-5 with the PHQ-9, the PHQ-15, and the GAD-7 (Table 2). The PDS-5 total severity score was significantly correlated with the PHQ-9 (rho = .81), the PHQ-15 (rho = .65), and GAD-7 (rho = .72). A strong correlation was found between PDS-5 subscale negative alterations in cognitions and mood and the PHQ-9 depression subscale (rho = .77). The PDS-5 alterations in arousal and reactivity subscale substantially correlated with PHQ-15 somatization (rho = .61) and the GAD-7 generalized anxiety scale (rho = .65). To compare the convergent and discriminant validity correlation coefficients, we used the method developed by Steiger (1980) and Hoerger (2013). Associations of the PDS-5 with the three PHQ subscales were significantly lower than its associations with the PCL-5 (all Z_H > 6.63, p < .001), providing evidence of discriminant validity.

3.5. Factorial validity

Model-fit indices for the six models tested by CFA are presented in Table 3. Overall, none of the models demonstrated a convincing fit between model-implied and empirical covariance matrix. Some indices reflected a low fit for all models (normed fit index, comparative fit index), while others reflected a good (Chi^2/df) or at least sufficient (root mean square error of approximation) fit. While the Akaike information criterion favoured the Anhedonia Model, the Hybrid Model generally showed the poorest fit.

3.6. Cut-off point for probable PDS-5 PTSD diagnosis compared to validated PCL-5 cut-off

Receiver operating characteristic (ROC; Figure 1/ Table 4 online supplemental material) analysis was applied to establish the sensitivity and specificity of the PDS-5 total sum score compared to the PCL-5 cut-off score of 33 (Kruger-Gottschalk et al., 2017). As indicated by an area under the curve of .98 (CI (95) = .96 – .98; p < .001), accuracy of PDS-5 total score was excellent. A PDS-5 cut-off score of ≥36 was associated with very high sensitivity (.92) and specificity (.96). The positive and negative predictive value was 98.4, and 80.7, respectively, and 92.8% of cases were correctly identified.

4. Discussion

This study aimed at evaluating the reliability and validity of the authorized German translation of the PDS-5 in a sample of patients admitted to specialized outpatient trauma clinics. Concerning post-traumatic stress severity, our sample is comparable with other samples recruited at treatment centres specializing in the treatment of trauma-related disorders in Germany (PCL-5 mean score in our sample was 43.7 (SD = 16.9) as compared to 39.1 (SD = 20.0) in the study by Kruger-Gottschalk et al. (2017)).

The PDS-5 total score's internal consistency was excellent and sound for all subscales, except for the avoidance subscale (alpha = .64). The reduced reliability of the avoidance subscale is most probably due to the fact that it consists of only two items. With $r_{i(t-i)}$
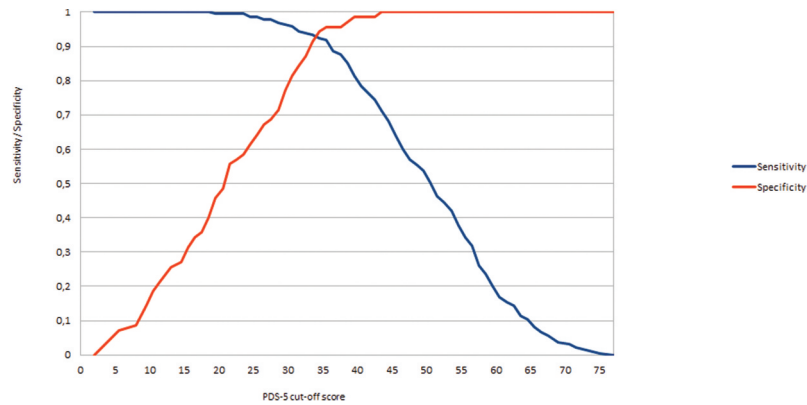
Figure 1. Sensitivity and specificity for PDS-5 scores predicting a PCL-5 score ≥ 33.

= 0.56, mean item-total correlation was somewhat lower as compared to the American validation sample ($r_{i(t-i)}$ = 0.67; Foa et al., 2016). However, given that the same two items (no. 8 and no. 16) showed an exceptionally low corrected item-total correlation, the original pattern of item correlations is replicated by the German PDS-5 version. Test–retest reliability was good on both the dimensional (severity score) and diagnostic (cut-off) level (Cohen, 1988; Robson, 1993) and close to values from the original validation study. With 82.8% of shared variance (rho^2), the German PDS-5 total sum score convincingly demonstrated convergent validity compared to a related measure of PTSD severity. Related PDS-5 and PCL-5 subscales showed very strong correlations (range .77 – .88) with the exception of the avoidance subscale (rho = .67). This weaker correlation can presumably be explained by the fact that the short avoidance subscales demonstrated the lowest reliability in both measures (Goodwin & Leech, 2006).

All correlations with measures used for the assessment of discriminant validity were significantly lower. The substantial associations of the PDS-5 scale scores with the constructs applied for the assessment of discriminant validity are not surprising given the well-known high rates of comorbidity between PTSD and Mood, Anxiety, and Somatization Disorders (Nesterko, Jackle, Friedrich, Holzapfel, & Glaesmer, 2020; Smith, Goldstein, & Grant, 2016). Given that in DSM-IV PTSD was classified as an anxiety disorder, it may be unexpected that the German PDS-5 scale showed slightly stronger correlations with measures of depression as compared to anxiety. This finding, which replicates the correlational matrix of the original validation study (Foa et al., 2016), is most probably a consequence of the changes in DSM-5 diagnostic criteria. For instance, the high correlation between the PHQ-9 depression subscale and PDS-5 subscale negative alterations in cognitions and mood (rho = .85) may be attributed to similar items covering the domains of negative view of self, self-blame, loss of

interest, or difficulties experiencing positive feelings. This notion similarly applies to the strong correlation between PDS-5 alterations in arousal and reactivity subscale and PHQ-9 depression scores (rho = .75), which may be related to items relevant for both diagnoses, like sleep and concentration related problems.

The factorial validity of the German version of the PDS-5 is questionable, as no clear superiority of one of the applied six models emerged. This outcome is in line with inconsistent results from previous CFA on PDS-5 translations. For instance, whereas data based on the Chinese PDS-5 (Su et al., 2020) supported the seven-factor Hybrid model, data based on the Polish translation (Zawadzki et al., 2015) showed the best fit under a six-factor solution based on the Dysphoric Arousal Model additionally separating between numbing and negative cognitions and mood. However, determining the best fitting factor solution for DSM-5 PTSD appears to be a complex task and previous studies concluded that clinician rated instruments may present a more valid approach as compared to self-report measures (Armour et al., 2016; Palmieri, Weathers, Difede, & King, 2007)

Defining a diagnostic cut-off value of ≥36 based on ROC analysis resulted in sensitivity and specificity above .9 compared to a probable PTSD diagnosis based on a PCL-5 cut-off of 33. This is a higher cut-off score than the cut-off score of 28 obtained for the original American version, which was validated against the PTSD Symptom Scale Interview (Foa et al., 2016). A possible reason was that the mean PDS score for Foa et al.'s study was lower (30.8) than in the present study, and that the sample included clinical and nonclinical participants. It can be concluded that the German translation of the PDS-5 provides a diagnostic utility at least comparable to the other already validated PTSD self-rating scale.

The present study is not without limitations, which need to be taken into account when interpreting our results. Most importantly, convergent and diagnostic validity were assessed through a comparison with another self-rating instrument rather than a clinical interview. The reported strong associations with PCL-5 parameters

make it plausible that the PDS-5 would perform at least similarly well compared to a gold-standard interview, as applied by Kruger-Gottschalk et al. (2017). Nevertheless, this assumption needs to be empirically tested, which is specifically critical for the derived diagnostic cut-off value. Most participants did not complete item 2 of the PDS (specification of the index trauma). We can only speculate that this may be due to the repeated presentation of the identical list of traumatic event types. If this explanation is adequate, a small change of the format of items 1 and 2 may improve acceptance of this PDS-5 section. The nine traumatic event types may be presented only once with two answer options for the respondent's trauma history and for selecting the one event currently bothering the respondent the most. Another explanation might be that participants reporting more than one traumatic event type did not feel that a forced choice of one currently most bothering event type would meet their subjective experience. As indicated by Priebe et al. (2018), such a forced choice may lead to underestimating PTSD symptomatology. While our participants reported a broad range of traumatic events, some event types (e.g. military trauma reported by only 3.3% of participants) were underrepresented, which may limit the generalizability of the reported PDS-5 psychometric properties. For the assessment of discriminant validity, only psychopathological constructs frequently associated with post-traumatic stress were applied. Thus, replication studies should include measures reflecting variables hypothesized to be unrelated to PTSD.

In summary, our results indicate that the German version of the PDS-5 is a valid and reliable screening instrument for both PTSD severity and diagnosis. Future studies should evaluate the suggested combination of the items for the assessment of trauma history and the specification of an index traumatic event type as well as the performance of the German PDS-5 in comparison to an observer-rated instrument as the Clinician-Administered PTSD Scale (Weathers et al., 2013). Also, factorial validity of the instrument remains an open issue for future research.

Disclosure statement

Ethics statement

The institutional review boards of the three study sites approved this study (Münster: *Ethik-Kommission der Ärztekammer Westfalen-Lippe und der Westfälischen Wilhelms-Universität Münster* (file no. 2017-303-f-S); Bochum: *Ethik-Kommission der Medizinischen Fakultät der Ruhr Universität Bochum* (file no. 18-6261); Dresden: *Ethikkommission der Medizinischen Fakultät der TU Dresden* (file no. EK 467122017)). At two study sites (Bochum and Dresden), participants provided written informed consent. One study center (Münster) was exempt from obtaining written informed consent for scientific analysis of data collected during the standard intake assessment.

Data availability statement

On basis of the information on which written informed consent was obtained, data cannot be stored in a data depository. Data is available on individual request from the authors.

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