



## The dissociative subtype of PTSD in trauma-exposed individuals: a latent class analysis and examination of clinical covariates

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### ABSTRACT

**Background:** A dissociative subtype of posttraumatic stress disorder (D-PTSD) was introduced into the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) but latent profiles and clinical correlates of D-PTSD remain controversial.

**Objective:** The aims of our study were to identify subgroups of individuals with distinct patterns of PTSD symptoms, including dissociative symptoms, by means of latent class analyses (LCA), to compare these results with the categorization of D-PTSD vs. PTSD without dissociative features according to the CAPS-5 interview, and to explore whether D-PTSD is associated with higher PTSD severity, difficulties in emotion regulation, and depressive symptoms.

**Method:** A German sample of treatment-seeking individuals was investigated ( $N = 352$ ). We conducted an LCA on the basis of symptoms of PTSD and dissociation as assessed by the CAPS-5. Moreover, severity of PTSD (PCL-5), difficulties in emotion regulation (DERS), and depressive symptoms (BDI-II) were compared between patients with D-PTSD according to the CAPS-5 interview and patients without dissociative symptoms.

**Results:** LCA results suggested a 5-class model with one subgroup showing the highest probability to fulfill criteria for the dissociative subtype and high scores on both BDI and DERS. Significantly higher scores on the DERS, BDI and PCL-5 were found in the D-PTSD group diagnosed with the CAPS-5 ( $n = 75$ ; 35.7%). Sexual trauma was also reported more often by this subgroup. When comparing the dissociative subtype to the LCA results, only a partial overlap could be found.

**Conclusions:** Our findings suggest that patients with D-PTSD have significantly more problems with emotion regulation, more depressive symptoms, and more severe PTSD-symptoms. Given the results of our LCA, we conclude that the dissociative subtype seems to be more complex than D-PTSD as diagnosed by means of the CAPS-5.

### El subtipo disociativo del TEPT en individuos expuestos al trauma: Un análisis de clase latente y un examen de las covariables clínicas

**Antecedentes:** Un subtipo disociativo del trastorno de estrés postraumático (TEPT-D) fue introducido en la 5ª edición del Manual Diagnóstico y Estadístico de los Trastornos Mentales (DSM-5), pero los perfiles latentes y los correlatos clínicos del TEPT-D siguen siendo controversiales. **Objetivo** Los objetivos de nuestro estudio fueron identificar subgrupos de individuos con distintos patrones de síntomas de TEPT, incluyendo síntomas disociativos, mediante análisis de clases latentes (LCA, por sus siglas en inglés), comparar estos resultados con la categorización de TEPT-D vs. TEPT sin rasgos disociativos según la entrevista CAPS-5, y explorar si el TEPT-D se asocia con una mayor gravedad del TEPT, dificultades en la regulación de las emociones y síntomas depresivos.

**Método:** Se investigó una muestra alemana de individuos que buscaban tratamiento ( $N = 352$ ). Se realizó un LCA sobre la base de los síntomas de TEPT y disociación evaluados por el CAPS-5. Además, se comparó la gravedad del TEPT (PCL-5), las dificultades en la regulación de las emociones (DERS) y los síntomas depresivos (BDI-II) entre los pacientes con TEPT según la entrevista CAPS-5 y los pacientes sin síntomas disociativos.

**Resultados:** Los resultados del LCA sugirieron un modelo de 5 clases con un subgrupo que mostraba la mayor probabilidad de cumplir los criterios del subtipo disociativo y altas puntuaciones tanto en el BDI como en el DERS. Se encontraron puntuaciones significativamente más

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### PALABRAS CLAVE

TEPT; subtipo disociativo; disociación; depresión; regulación emocional; desrealización; despersonalización; análisis de clases latentes

### 关键词

PTSD; 解离亚型; 解离; 抑郁; 情绪调节; 现实解体; 人格解体; 潜在类别分析

### HIGHLIGHTS

- First study to examine overlap of LCA results on dissociative symptoms in patients with PTSD and dissociative subtype according to CAPS-5, relationships between dissociative subtype and sexual assault, higher levels of depression, more emotion regulation difficulties confirmed.

altas en el DERS, el BDI y el PCL-5 en el grupo de TEPT-D diagnosticado con el CAPS-5 ( $n = 75$ ; 35,7%). Este subgrupo también informó con más frecuencia de traumas sexuales. Al comparar el subtipo disociativo con los resultados del LCA, sólo se pudo encontrar una superposición parcial. Conclusiones Nuestros resultados sugieren que los pacientes con TEPT-D tienen significativamente más problemas con la regulación emocional, más síntomas depresivos y síntomas de TEPT más graves. Dados los resultados de nuestro LCA, concluimos que el subtipo disociativo parece ser más complejo que el TEPT-D diagnosticado mediante el CAPS-5.

### 创伤暴露个体PTSD的解离亚型:一项潜在类别分析和对临床协变量的考查

**背景:** 第5版《精神疾病诊断和统计手册》(DSM-5)中引入了一种创伤后应激障碍(D-PTSD)解离亚型,但D-PTSD的潜在特征和临床相关变量仍然存在争议。

**目的:** 我们的研究旨在通过潜在类别分析(LCA)识别具有不同PTSD症状模式(包括解离症状)的个体亚组,以将这些结果与D-PTSD与根据CAPS-5访谈无解离特征的PTSD分类进行比较,并探讨D-PTSD是否与更高的PTSD严重程度,情绪调节困难和抑郁症状相关。

**方法:** 考查了一个德国寻求治疗的个体样本( $N = 352$ )。我们根据CAPS-5评估的PTSD和解离症状进行了LCA。此外,比较了根据CAPS-5访谈的D-PTSD患者和没有解离症状的患者的PTSD严重程度(PCL-5),情绪调节困难(DERS)和抑郁症状(BDI-II)。

**结果:** LCA结果表明一个5类模型,其中一个亚组显示满足解离亚型标准的最高概率以及BDI和DERS的高分。在用CAPS-5诊断为D-PTSD的组中发现DERS,BDI和PCL-5的得分显著更高( $n = 75$ ; 35.7%)。该亚组也更频繁地报告性创伤。将解离亚型与LCA结果进行比较时,只能发现部分重叠。

**结论:** 我们的研究表明,D-PTSD患者的情绪调节问题显著更多,抑郁症状更严重,PTSD症状更严重。鉴于我们LCA的结果,我们得出结论,解离亚型似乎比通过CAPS-5诊断的D-PTSD更复杂。

## 1. Introduction

The diagnosis of posttraumatic stress disorder (PTSD) has undergone important changes in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association, 2013). One of these changes is the inclusion of a dissociative subtype of PTSD (D-PTSD). The inclusion of this subtype is based on neurobiological, clinical and psychometric findings (e.g. Lanius, Brand, Vermetten, Frewen, & Spiegel, 2012; Lanius et al., 2010; Stein et al., 2012; Wolf et al., 2012a). Studies have shown that patients suffering from dissociation in addition to the core symptoms of PTSD show more severe PTSD symptoms (Kim et al., 2019) as well as a higher level of disability and worse treatment outcomes (e.g. Bae, Kim, & Park, 2015; Cloitre, Petkova, Wang, & Lu Lassell, 2012; Dalenberg & Carlson, 2012; Price & Herting, 2013; Resick, Suvak, Johnides, Mitchell, & Iverson, 2012). However, other findings suggest that treatment outcomes are not negatively affected by the presence of D-PTSD (Zoet, Wagenmans, van Minnen, & de Jongh, 2018). Latent Class Analyses (LCA) and Latent Profile Analyses (LPA) (Hagenaars & McCutcheon, 2002) can be used to identify subgroups of patients with distinct patterns of quantitative (e.g. symptom severity) and qualitative (e.g. core symptoms) characteristics. A recent systematic review identified 11 studies using LCA or LPA to analyse D-PTSD (Hansen, Ross, & Armour, 2017). All but one of these studies found a class of patients whose characteristics are similar to the concept of the dissociative subtype of PTSD (Hansen et al., 2017). According to the DSM-5 version of the CAPS (Müller-Engelmann & Schnyder et al., 2018; Weathers et al., 2017), D-PTSD is diagnosed in

individuals meeting full criteria for PTSD as well as showing symptoms of depersonalization and/or derealization. Most of the existing studies using LCA/LPA identified such a subtype of PTSD with high levels of derealization and/or depersonalization. Moreover, this subtype was often associated with higher PTSD symptomatology (Hansen et al., 2017). For instance, Wolf et al. (2012b) found three latent classes in a sample of 492 veterans: a low and a high PTSD severity group, as well as a high PTSD and dissociative group. However, only 6% of participants were classified as the D-PTSD group. These three classes were replicated in two samples of 360 male veterans assessed via the CAPS-IV, and 284 female veterans assessed via the Trauma Symptom Inventory (Wolf et al., 2012a). Of note, a higher prevalence of the dissociative subtype in the LPA was found in females (30%) as compared to males (15%). Another study investigating a civilian sample ( $n = 134$ ) also found three latent classes in the LPA (Steuwe, Lanius, & Frewen, 2012), with 25% of participants meeting criteria for D-PTSD (25%). Up to date, only few studies were based on the diagnostic criteria of DSM-5, and none of these studies investigated participants with clinician administered rating tools based on the DSM-5 like the Clinician Administered PTSD Scale (CAPS) (Blake et al., 1995). However, the CAPS is typically regarded as the gold standard to diagnose PTSD according to DSM criteria and now allows to categorize PTSD with and without dissociative symptoms (D-PTSD vs. PTSD). It appears promising to use latent class approaches such as LCA to validate the concept of a dissociative subtype of PTSD. Although past studies applying LCA to PTSD

have typically identified a latent class that is characterized by high dissociation (Hansen et al., 2017), it has not been tested whether this latent class is consistent with the dissociative subtype of PTSD according to DSM-5 assessed with the CAPS-5 as the current gold standard.

Patients with PTSD and dissociative symptoms appear to suffer from a high level of distress (e.g. Dalenberg & Carlson, 2012; Hansen & Hyland et al., 2018; Waelde, Silvern, & Fairbank, 2005). While a recent meta-analysis showed that PTSD treatment is also effective when dissociative symptoms are present (Hoeboer et al., 2020), some clinicians have suggested that treatment approaches need to be adapted in this group of patients (e.g. Cloitre et al., 2012; Price & Herting, 2013). To inform such adaptations, it seems important to further investigate the diagnostic category of D-PTSD including clinically meaningful symptoms. With regard to dissociative symptoms, chronic and interpersonal trauma plays an important role in their development (Lanius et al., 2010). Several studies reported that in patients with D-PTSD the likelihood of a history of sexual trauma is particularly high (Frewen, Brown, Steuwe, & Lanius, 2015; Steuwe et al., 2012; Wolf et al., 2012b). Others did not report such an association (Armour, Karstoft, & Richardson, 2014; Wolf et al., 2015). The impact of interpersonal trauma on dissociative symptoms in D-PTSD thus needs to be further clarified. Apart from the core symptoms of PTSD and dissociative symptoms, patients with D-PTSD often seem to suffer from difficulties in emotion regulation (Frewen et al., 2015; Hansen, Mullerova, Elklit, & Armour, 2016a), including overmodulation of emotions (Lanius et al., 2010). Moreover, there seems to be a link between peritraumatic dissociation and emotion regulation deficits, potentially leading to higher severity of later PTSD (Lilly, 2011). Other forms of emotional detachment with avoidance of necessary cognitive and affective processing as well as emotional numbing could also be related to higher severity of PTSD and more depressive symptoms (e.g. Feeny, Zoellner, Fitzgibbons, & Foa, 2000). Interestingly, D-PTSD was also found to be associated with more depressive symptoms (Armour et al., 2014; Blevins, Weathers, & Witte, 2014; Steuwe et al., 2012).

Finally, most studies in the field of D-PTSD were conducted in specific samples, e.g. female sexual assault survivors (Armour et al., 2014), veterans (Armour et al., 2014; Wolf et al., 2012a, 2012b, 2015), or trauma-exposed college students (Blevins et al., 2014). It is thus unclear whether their results are generalizable to more heterogeneous populations of trauma survivors. In our study, we therefore aimed to replicate and extend earlier findings on the validity and clinical characteristics of the D-PTSD subtype. Specifically, it was aimed

- (i) to replicate earlier findings on a subgroup of patients with dissociative symptoms in a clinical sample of PTSD patients by means of LCA,
- (ii) to compare the results of LCA with the categorization of D-PTSD vs. PTSD according to the gold standard CAPS-5 assessment, and,
- (iii) to explore whether D-PTSD according to the CAPS-5 is associated with higher PTSD severity, difficulties in emotion regulation, and depressive symptoms.

## 2. Materials and methods

### 2.1. Participants and procedure

The analyses presented here are part of a larger multi-centre study (Krüger-Gottschalk et al., 2017). For this study, a sample of trauma-exposed participants ( $N = 354$ ) was investigated at five clinical treatment centres in Germany (Münster, Berlin, Dresden, Mannheim, Hamburg). Participants were assessed by experienced clinicians trained in the administration of the study interviews. The assessment included a clinical interview and a range of self-rating questionnaires. Participants were fully informed about the purpose and procedures of the study before providing written informed consent. The study was approved by the local ethical committees.

Most of the participants were treatment-seeking, only a few ( $n = 32$ ) were recruited via newspaper announcement and were non-treatment seeking participants. Most participants received counselling for their trauma-related problems, a smaller proportion also received trauma-specific treatment. For the current analysis, we only included patients fulfilling the diagnosis of PTSD according to DSM-5 ( $n = 220$ ). Of these, 10 had to be excluded because of missing values regarding some PTSD criteria or other relevant variables. Hence, 210 patients could be included in the analysis. The mean age of this sample was 36.5 years ( $\pm 11.7$  SD), 128 were female (60.7%), 47 participants (22.3%) went to school for less than 5 years, 60 (28.4%) went to school 10 to 13 years and 10 (4.7%) had a university degree. 66 Participants (31.3%) had a full-time job, 20 (9.5%) had a part-time job and 67 (31.8%) were out of work or worked less than part-time. Regarding their living status, 54 (25.6%) participants lived alone. 112 participants (53.1%) had at least one child and 116 participants (55.0%) were in a relationship.

### 2.2. Measures

Trauma exposure and symptoms of PTSD were measured with the *PTSD Checklist for DSM-5 (PCL-5)* (Weathers & Litz et al., 2013). This self-report measure includes the *Life Events Checklist for DSM-5* and 20 items that correspond to the DSM-5 criteria for PTSD.



Participants report the intensity of their symptoms over the past month on a 5-point-scale ranging from 0 = *not at all* to 4 = *extremely*.

The German version of the *Clinician Administered PTSD Scale for DSM-5* (CAPS-5) (Müller-Engelmann & Schnyder et al., 2018) was administered to determine whether participants fulfilled the diagnostic criteria for PTSD according to DSM-5 and to obtain an interviewer-based rating of the severity of PTSD symptoms. The CAPS-5 is a structured clinical interview assessing the presence or absence of DSM-5-criteria for PTSD and providing a symptom severity score. Clinicians rate the frequency and intensity of each symptom over the past month on a 5-point-scale ranging from 0 = *absent* to 4 = *extreme/incapacitating*. The CAPS-5 includes 1 item regarding depersonalization and 1 item regarding derealization to assess dissociative symptoms. According to DSM-5 diagnostic criteria (American Psychiatric Association, 2013), patients meeting criteria for PTSD and reporting depersonalization and/or derealization in a clinically significant severity are classified as suffering from the dissociative subtype of PTSD.

To assess comorbid depressive symptoms, the *Beck Depression Inventory-II* (BDI-II) (Beck, Steer, & Brown, 1996; Hautzinger & Keller et al., 2006) was used. The BDI-II is a widely used and a well-validated measure of depressive symptom severity (Kuhner, Burger, Keller, & Hautzinger, 2007).

The FDS (*Fragebogen zu dissoziativen Symptomen*) (Spitzer et al., 1998) is the German adaptation of the Dissociative Experience Scale (DES; Bernstein & Putnam, 1986), measuring the frequency and the variability of dissociative symptoms. The patients endorse the frequency of past dissociative experiences on a scale from 0% to 100%. We used the validated 20-item short version of the FDS.

Difficulties in emotion regulation were assessed by means of the *Difficulty in Emotion Regulation Scale* (DERS) (Gratz & Roemer, 2004). The DERS is a 36-item self-report measure to assess difficulties in emotion regulation across six domains. Participants rate the frequency with which the 36 statements apply to themselves on a scale from 0 (almost never) to 5 (almost always). The DERS showed high internal consistency ( $\alpha = .93$ ), good test-retest reliability, and adequate constructive and predictive validity (Gratz & Roemer, 2004).

### 2.3. Data analysis

The latent structure of the 20 DSM-5 core criteria for PTSD and the two criteria regarding dissociative symptoms were examined by applying Latent Class Analysis (LCA) (Goodman, 1974; Lazarsfeld & Henry, 1968). We conducted the LCA on the basis of symptoms of PTSD and dissociation as assessed by the CAPS-5, namely participants fulfilling PTSD but not

the dissociative subtype were defined as non-D-PTSD and those fulfilling PTSD and the dissociative subtype were defined as D-PTSD.

Model parameters were estimated by maximum likelihood with robust standard errors. The latent class analysis assumption of local independence (independence of items within latent classes) was tested by examining the modification indices, i.e. the bivariate residuals between pairs of indicators. Bivariate residuals larger than 3.84 identify significant correlations between pairs of indicators that have not been adequately explained by the model (Magidson & Vermunt, 2004). As information criteria, the Bayesian information criterion (BIC; Schwarz, 1978) and the sample-size adjusted BIC (ssBIC; Sclove, 1987) were used to determine the number of classes. Information criteria are indices for model comparisons that weight the fit to the data and parsimony of the model (number of estimated parameter). Lower values indicate better fit.

The relative fit of the models was evaluated using the Vuong-Lo-Mendell-Rubin adjusted likelihood ratio (VLMR) test (Lo, Mendell, & Rubin, 2001) and the bootstrap likelihood ratio (BLR) test (McLachlan & Peel, 2000). A significant *p*-value indicates that the estimated model fits significantly better than the model with one class less. If the BLR test and the VLMR test indicated different number of classes, we preferred the results of the BLR test, because the BLR test has been shown to be a more accurate indicator of the number of classes than the VLMR test (Nylund, Asparouhov, & Muthén, 2007). Classification accuracy was assessed by model entropy (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993). Values close to 1 indicate good classification accuracy, whereas values close to 0 indicate lack of accuracy.

After the best LCA solution had been identified, the variables sex, age, years of education and ethnicity were added to the model as potential confounders, to avoid that such potentially relevant variables influence both, a latent variable as well as the indicators and thereby lead to incorrect classification (Muthén, 2004, p. 250). If the potential confounders were not significantly related to the latent variables, the variables were removed from the model. The final model included sex and years of education as covariates. The inclusion of covariates did not change the structure of the classes.

Demographic data were compared between participants fulfilling the diagnosis of the dissociative subtype and those not fulfilling the subtype according to CAPS-5 using  $\chi^2$ -Tests and independent two-sided T-tests, where appropriate.

In a next step, differences in the severity of emotional dysregulation and depressive symptoms between the class of patients with the lowest symptom endorsement and the other latent classes were examined using regression analysis. Moreover, these variables were compared between the D-PTSD group and

the non-D-PTSD group according to CAPS-5 using a two-sided t-test.

Latent classes were dummy coded. LCA was conducted with MPLUS Version 7.31 (LCA);  $\chi^2$ -Tests and independent two-sided t-Tests regression analysis were conducted with SPSS 22.0.

### 3. Results

#### 3.1. Results of the latent class analysis (LCA)

Table 1 presents the goodness-of-fit indices for the 2- to 5-class models. None of the modification indices was above the value of 3.84, indicating no local dependence. The values of loglikelihood, VLMR and BLR were decreasing up to the 5-class solution, indicating a better fit of the 5-class solution relative to the solutions with a lower number of classes. The sample-size adjusted BIC values were lowest for the 4-class solution and only slightly increased for the 5-class solution. However, the BIC that was not adjusted for sample sized increased from the 2-class to 5-class solution, indicating no better fit of solutions with a greater number of classes. The BLR test was significant for the 5-class solution, indicating that the 5-class solution differed from the 4-class solution, although the relative fit index of the VLMR indicated that the 2-class model fitted significantly better than the 1-class solution. According to the entropy values, the 5-class solution showed the best classification accuracy. The 6-class model did not converge, indicating the extraction of too many classes (Lo et al., 2001). Given the overall picture of the examined indices, in addition to the meaningfulness and interpretability of the different class solutions, we retained the 5-class model as the best fitting class solution. The alternative 2-class and 4-class solutions were added to the supplement (Supplement 1). In the selected 5-class model, the average latent class probabilities for the most likely latent class membership (class 1 = 0.88; class 2 = 0.93; class 3 = 0.93; class 4 = 0.91; class 5 = 0.89) for the final 5-class model indicated a high precision of class assignments ( $\leq .80$  is considered as high; (Rost, 2006)).

The profiles of the DSM-5 PTSD symptom criteria for each of the five latent classes are shown in Figure 1. Patients of class 1 ( $n = 57$ , 28.2%) showed low levels of PTSD symptoms, especially of the cluster alterations

in cognitions and mood (cluster D), relative to most other classes. The probabilities of fulfilling the two dissociation criteria 'depersonalization' and 'derealization' were also very low in this class. Class 2 ( $n = 30$ , 14.9%) showed a similar pattern with a higher probability of symptoms in cluster D (alterations in cognitions and mood). Class 3 ( $n = 32$ , 15.8%) represented patients that had a higher probability of intrusive symptoms than class 1 and class 2, and a lower probability or alterations in cognitions and mood (cluster D); again, probabilities of fulfilling the dissociation criteria were low in this class. Class 4 ( $n = 70$ , 34.7%) comprised patients with a higher level of symptoms of most clusters (B, C, D, and E) relative to the classes 1, 2 and 3, and of medium levels of the two dissociation criteria. Class 5 ( $n = 13$ , 6.4%), finally, was representative of PTSD patients with a high probability of fulfilling many PTSD symptoms across the different clusters, combined with a high probability for the two dissociation criteria.

Patients of class 1, which were characterized by the lowest probabilities of PTSD symptom endorsements, also showed the lowest severity of emotion dysregulation (Table 2). Patients of class 2 and class 3 did not significantly differ in their severity of emotion dysregulation compared to patients of class 1. Patients of class 4, who had intermediate probabilities of dissociation symptoms, showed a significantly higher severity of emotion dysregulation than patients of class 1. Patients of class 5, who were characterized by very high probabilities of dissociation symptoms, reported the highest severity of emotion dysregulation of all classes and significantly differed from class 1 in their severity of emotion dysregulation. Patients of class 3 reported the lowest level of depressive symptoms. Patients of class 2 and class 3 did not significantly differ from class 1 in their severity of depressive symptoms. In contrast, patients of class 4 and class 5 showed significantly higher severities of depressive symptoms than patients of class 1.

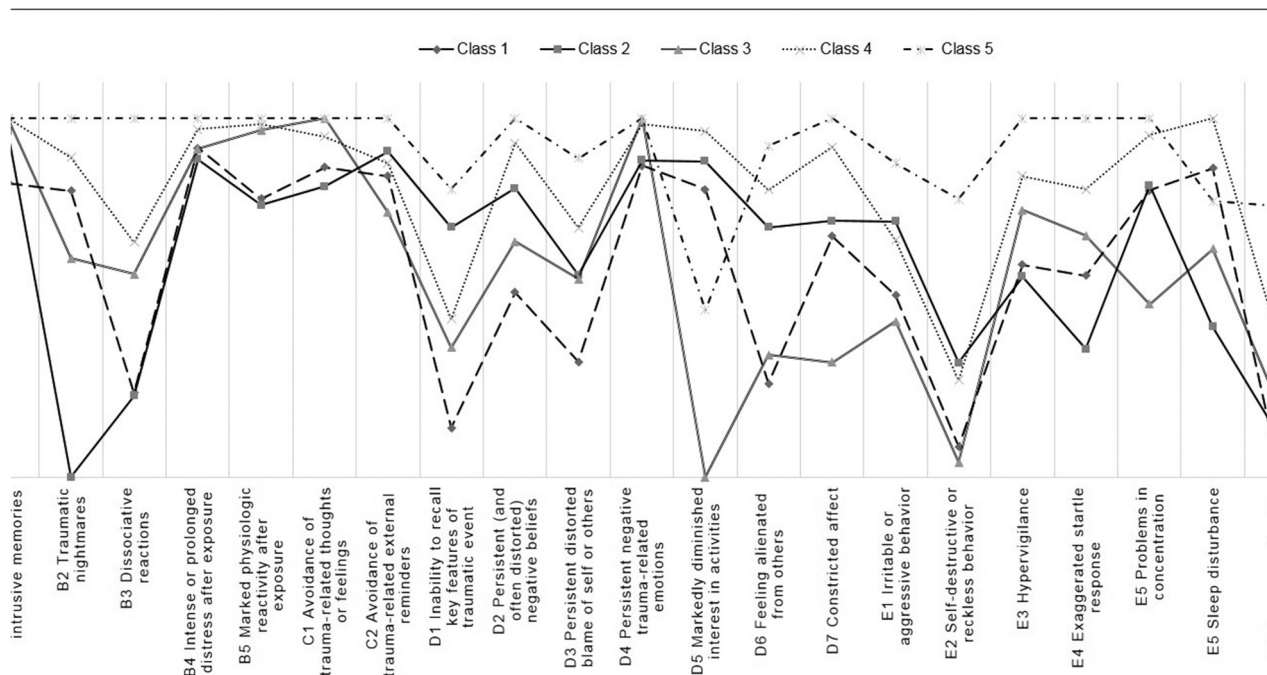
Given that some model fit indices supported the 2-class model and the 4-class model rather than the 5-class model (Table 1), we also examined the characteristics of these two models. The 2-class model suggested (1) one class with low probabilities of all symptoms and (2) one class with higher probabilities of PTSD symptoms and higher probabilities for

**Table 1.** Model fit indices of latent classes of DSM-5 PTSD and dissociative subtype criteria in patients with PTSD ( $N = 202$ ).

Model	Loglikeli-hood	BIC	ssBIC	VLMR	VLMR <i>p</i> -value	BLR	BLR <i>p</i> -value	Entropy
2-class	-2178.8	4607.0	4458.1	220.1	<.001	-2289.7	<.001	0.766
3-class	-2145.4	4672.9	4444.8	66.3	.216	-2178.8	<.001	0.815
4-class	-2111.8	<b>4738.4</b>	<b>4431.1</b>	66.7	.461	-2145.4	<.001	0.846
5-class	<b>-2086.3</b>	4820.1	4433.6	<b>54.7</b>	.242	<b>-2113.8</b>	<b>&lt;.001</b>	<b>0.857</b>
6-class	-	-	-	-	-	-	-	-

Bold font indicates the optimal model. Latent class models are controlled for confounding effects of sex and years of education. Non-convergence of the 6-class model indicated the extraction of too many classes.

BIC = Bayesian Information criterion. ssBIC = Sample-Size Adjusted BIC. VLMR = Vuong-Lo-Mendell-Rubin adjusted likelihood ratio. BLR = bootstrap likelihood ratio.



**Figure 1.** Probabilities of DSM-5 PTSD symptom and dissociative subtype criteria by latent class.

**Table 2.** Means, standard deviations and unstandardized coefficients of regression analyses for latent classes predicting emotion dysregulation and depressive symptoms.

Class	Emotion dysregulation ( <i>n</i> = 198)					Depressive symptoms ( <i>n</i> = 195)				
	<i>M</i>	<i>SD</i>	<i>B</i>	95% CI	<i>p</i>	<i>M</i>	<i>SD</i>	<i>B</i>	95% CI	<i>p</i>
Class 1	103.3	26.1	–2.4	–9.5; 10.9	.897	26.2	12.7			
Class 2	104.0	22.8	–2.4	–9.5; 10.9	.897	29.2	12.0	2.9	–2.1; –8.6	.255
Class 3	100.9	20.4	20.6	–12.7; 7.9	.644	22.5	10.6	–3.7	–8.6; 1.2	.140
Class 4	117.3	21.3	14.1	6.0; 22.1	<.001	34.2	9.5	8.0	4.0; 3.8	<.001
Class 5	123.9	21.5	0.8	6.7; 34.5	.004	36.8	11.0	10.6	3.8; –2.1	.002

Reference category is class 1.

dissociative symptoms. The 4-class solution (Supplement 1) suggested (1) a class with low probabilities for PTSD symptoms and very low probabilities for dissociative symptoms, (2) a class with a similar pattern but in addition a higher probability of symptoms in cluster B PTSD symptoms (i.e. re-experiencing symptoms), (3) a class with higher probabilities of persistent negative trauma-related emotions and low to medium probabilities for dissociative symptoms, and (4) a class with higher probabilities of PTSD symptoms and medium probabilities of dissociative symptoms. The selected 5-class solution was similar to the 4-class solution regarding four classes, but included one additional class with high probabilities of PTSD symptoms and higher probabilities of dissociative symptoms.

### 3.2. Comparing patients with and without D-PTSD according to the CAPS-5

According to the CAPS, 75 patients (35.7%) fulfilled a diagnosis of the dissociative subtype of PTSD. There were no significant differences in sociodemographic data between patients with and without the dissociative

subtype (Table 3). On trend level, more patients with D-PTSD were female (69.3% vs. 56.3%;  $p = .062$ ) and younger (mean 34.3 vs. 37.3 years;  $p = .074$ ). Descriptively, the PTSD group was slightly better educated, was more likely to be in a full-time position, to have children and to be in a relationship compared to D-PTSD (see Table 3).

Significantly, more participants who were sexually assaulted ( $p = .005$ ) or had other unwanted sexual experiences ( $p = .004$ ) fulfilled criteria for the dissociative subtype, whereas the experience of any form of physical assault was not associated with the dissociative subtype of PTSD (see Table 3).

Participants with D-PTSD showed a significantly higher severity of depressive symptoms according to the BDI ( $p = .032$ ) and more difficulties in emotion regulation as assessed with the DERS ( $p < .001$ ) compared to those with PTSD only. Scores for the severity of PTSD-symptoms both assessed with the CAPS-5 ( $p = .001$ ) and the PCL-5 ( $p < .001$ ) revealed significantly higher PTSD-symptoms in participants with D-PTSD as compared to participants with PTSD (see Table 4). Moreover, patients with D-PTSD had significantly higher dissociative experiences (31.6 vs. 16.49 mean score;  $p < .001$ ).

**Table 3.** Sociodemographic characteristics in patient with and without D-PTSD (*N* = 210).

Characteristic	<i>non-D-PTSD</i>		<i>D-PTSD</i>		<i>p</i>
<b>Age</b>	37.3 (± 11.9 SD)		34.3 (± 11.3 SD)		
	<i>n</i>	%	<i>n</i>	%	
<b>Gender<sup>a</sup></b>					.062
Female	76	56.3	52	69.3	
Male	57	42.2	22	29.3	
<b>Years of School<sup>b</sup></b>					n.s.
<5 yrs.	29	21.5	18	24.0	
5–9 yrs.	48	35.6	33	44.0	
10–13 yrs.	43	31.9	17	22.7	
University degree	6	4.4	4	5.3	
Others	4	3.0	1	1.3	
<b>Work status<sup>c</sup></b>					n.s.
Full-time	49	36.3	17	22.7	
Part-time	13	9.6	7	9.3	
No work/other	67	49.7	46	61.3	
<b>Living status<sup>d</sup></b>					n.s.
Co-habiting	92	68.2	54	72.0	
Alone	35	25.9	19	25.3	
<b>Number of children<sup>e</sup></b>					n.s.
0	52	38.5	35	46.6	
1	33	24.4	15	20.0	
2	21	15.6	11	14.7	
≥ 3	21	15.6	11	14.7	
<b>Partnership<sup>f</sup></b>					n.s.
Yes	79	58.5	37	49.3	
No	51	37.8	36	48.0	
<b>Type of trauma(LEC)<sup>g</sup></b>					
Sexual assault ( <i>n</i> = 201)	55	42.6	46	63.9	.005
Other unwanted sexual experience ( <i>n</i> = 196)	48	38.1	42	60.0	.004
Physical assault ( <i>n</i> = 205)	105		54		n.s.

<sup>a</sup>*N* = 207; <sup>b</sup>*N* = 204; <sup>c</sup>*N* = 199; <sup>d</sup>*N* = 200; <sup>e</sup>*N* = 199; <sup>f</sup>*N* = 203; <sup>g</sup>*N* = 350

**3.3. Overlap of LCA results and D-PTSD according to the CAPS**

As depicted in Table 5, we found that most patients classified as class 5 were as well classified as the dissociative subtype in the CAPS-Interview (*n* = 12; 92.3%). Only one participant in class 5 did not fulfill the CAPS criteria for the dissociative subtype (7.7%). Moreover, in class 1 most of the participants (*n* = 51, 92.7%) did not fulfill the dissociative subtype according to the CAPS. A similar distribution was found for class 2 (see Table 5) while in class 3 and class 4 patients with and without D-PTSD were more evenly distributed.

**4. Discussion**

In our study, we assessed PTSD in 210 patients by means of the CAPS-5, the gold standard for diagnosing PTSD

**Table 5.** Overlap of the LCA results and D-PTSD according to the CAPS-5 (*N* = 198).

Characteristic	<i>CAPS non-D-PTSD</i>		<i>CAPS D-PTSD</i>	
	<i>n</i>	%	<i>n</i>	%
Class 1	51	40.5	4	5.6
Class 2	25	19.8	5	6.9
Class 3	19	15.1	12	16.7
Class 4	30	23.8	39	54.2
Class 5	1	0.8	12	16.7

according to DSM-5, which also allows the diagnostic categorization of patients with the dissociative subtype of PTSD. While previous studies provided evidence for the dissociative subtype using confirmatory factor analysis, LPA or LCA (for review see Hansen et al., 2017), only few of them applied diagnostic criteria according to DSM-5 and most relied on self-report measures (Hansen et al., 2017). To our knowledge, none of these studies was based on the CAPS-5 so far.

By means of LCA, five distinct PTSD-classes were identified: (1) a class with relatively low probabilities of PTSD symptoms and a very low probability for dissociative symptoms, (2) a class with a similar pattern with a higher probability of symptoms in cluster D (alterations in cognitions and mood), (3) a class with a higher probability for persistent negative trauma-related emotions and a low to medium probability for dissociative symptoms, (4) a class with a high probability of PTSD symptoms and a medium probability of dissociative symptoms, (5) and a class with a high probability of PTSD symptoms and high dissociative symptoms. LCA thus yielded one class with a very high probability and two classes with very low probabilities of dissociative symptoms, as well as two classes with medium probabilities of dissociative symptoms. Some model fit indices also supported a 4-class model with classes similar to the first four classes of the 5-class model. The main difference between the two models concerned an additional class with high probabilities of PTSD symptoms and high probabilities of dissociative symptoms in the 5-class model.

A big proportion of the sample (*n* = 100) was classified in classes 3 and 4 of the 5-class model, including *n* = 51 patients with D-PTSD according to CAPS-5. These participants, however, showed either high persistent negative trauma-related emotions or high PTSD symptoms in general. Interestingly, regression analysis revealed that patients from Class 4 and 5

**Table 4.** Clinical characteristics of patients with and without D-PTSD (*N* = 210).

Characteristic	PTSD ( <i>n</i> = 135, 64.3%)				D-PTSD ( <i>n</i> = 75, 35.7%)				<i>P</i>
	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	
BDI	27.6	12.0	3	55	31.6*	11.8	6	54	.032
DEERS	103.1	22.4	47	153	118.5**	19.1	71	163	<.001
FDS	16.45	14.97	0	74.5	31.57**	19.02	1	80.5	<.001
PCL-Score	46.1	15.1	7	80	53.3*	13.0	13	77	.001
CAPS-Score	36.6	9.9	17	62	43.7**	10.2	19	70	<.001



also showed marked difficulties in emotion regulation and high levels of depressive symptomatology. We thus did not confirm the results of a clear-cut dissociative subtype of PTSD using LCA. Our analyses point to different groups of PTSD patients with medium to high rates of dissociative symptoms (class 3, 4 and 5), including a class with both, a high level of dissociation and a high level of PTSD symptoms. According to the DSM-5 version of the CAPS, patients fulfilling the dissociative subtype in our study were present in most of the classes. This is in contrast to former studies, which mostly found one single latent class of patients with a dissociative subtype of PTSD (for review Hansen et al., 2017). Our findings suggest a more complex picture of D-PTSD. More specifically, a continuous rather than a categorical model of PTSD with additional dissociative symptoms might be appropriate. One explanation for the high levels of dissociation in class 5 could also be additional dissociative disorders. Given our focus on depersonalization and derealization, we are not able to answer this question, but both explanations would suggest a more sophisticated routine assessment of dissociative symptoms in patients with PTSD. Given that previous studies found that 6–30% of their sample belonged to a dissociative subtype of PTSD (e.g. Armour et al., 2014; Blevins et al., 2014; Cloitre et al., 2012; Lanius et al., 2010; Resick et al., 2012; Stein et al., 2012; Steuwe et al., 2012) the proportion of these patients in our sample was rather high (35.7%). In line with most previous studies, we did not find significant differences between patients with and without dissociative symptoms regarding sociodemographic data. Having experienced sexual trauma, however, was significantly associated with D-PTSD, which is also in good agreement with previous studies (Frewen et al., 2015; Steuwe et al., 2012; Wolf et al., 2012b).

In accordance with our hypotheses, patients fulfilling the diagnosis of a dissociative subtype according to CAPS-5 had significantly higher scores in depressive symptomatology and difficulties in emotion regulation. Moreover, they presented with higher severity of the core symptoms of PTSD as assessed by both the CAPS-5 and the PCL-5. These characteristics were also present in the two subgroups with a medium to high probability of dissociative symptoms according to the LCA (class 4 and class 5). This is in good agreement with studies suggesting that the dissociative subtype is related to a more severe comorbidity pattern (Steuwe et al., 2012). Moreover, almost all studies identified at least one D-PTSD profile associated with high symptom severity of PTSD symptoms (Hansen, Hyland, & Armour, 2016b). The finding that higher levels of dissociative symptoms are associated with a higher symptom burden seems to be plausible in light of the theory that dissociation is used to distance oneself from reality in situations of subjective threat or danger (Armour et al., 2014). While

many studies reported relationships between difficulties in emotion regulation and PTSD in general (e.g. Bradley et al., 2011; Cloitre, Miranda, Stovall-McClough, & Han, 2005; Michopoulos et al., 2015; Powers, Cross, Fani, & Bradley, 2015; Tull, Barrett, McMillan, & Roemer, 2007; van Dijke, Hopman, & Ford, 2018; Weiss et al., 2011) only one other study apart from ours reported such an association with D-PTSD according to DSM-5 (Frewen et al., 2015). This result seems, however, to underline the importance of providing emotion regulation strategies within trauma-specific psychotherapeutic interventions, especially for patients with additional dissociative symptoms. Recent findings suggest that the severity of emotion regulation difficulties is not associated with poorer outcomes of trauma-focused treatment in patients with PTSD (van Toorenburg et al., 2020). Moreover, even in patients with D-PTSD, emotion regulation difficulties improved after trauma-focused treatment (van Toorenburg et al., 2020).

Another important aspect, especially when it comes to trauma therapy, are trauma-related cognitions in PTSD. It has been proposed that patients with high dissociative symptoms have problems with the processing of necessary cognitive and emotional aspects of the trauma and studies suggest that dissociative symptoms can contribute to negative beliefs about the self (Thompson-Hollands, Jun, & Sloan, 2017). Interestingly, in our sample, patients from class 4 and 5 with medium to high probabilities of dissociative symptoms presented with high symptoms of trauma-related cognitions as measured by the CAPS-5, while these were also present in class 2, which had a very low probability of dissociation. The association between trauma-related cognitions and dissociation thus seemed to be not clear in our sample. Interestingly, treating PTSD patients with cognitive-processing therapy, which focuses on trauma-related cognitions, may help to improve dissociative symptoms over the course of the treatment (Resick et al., 2012), although this was not found in a study in patients with complex PTSD (Bohus et al., 2020).

The finding that participants with D-PTSD displayed significantly higher depressive symptoms is in line with several studies on the dissociative subtype using LCA or LPA (Armour et al., 2014; Blevins et al., 2014; Steuwe et al., 2012). Another study (Contractor, Roley-Roberts, Lagdon, & Armour, 2017) found a depressive subtype of PTSD being associated with lower levels of distress tolerance and greater dissociative experiences, which would also be in accordance with our data. This finding could reflect the consequences of sexual abuse, as patients with D-PTSD were significantly more likely to endorse sexual trauma. In line with this, studies among sexual assault survivors showed that PTSD symptom severity was related with the severity of depressive symptoms (e.g. Au, Dickstein, Comer, Salters-Pedneault, & Litz, 2013).

Neurobiological studies also support the finding of increased comorbid symptoms in the dissociative



subtype of PTSD. Lanius and colleagues (Lanius et al., 2010) as well as Spiegel and colleagues (Spiegel et al., 2013) describe a corticolimbic model of dissociation based on findings in previous studies (among others Bremner, 1999; Etkin & Wager, 2007; Felmingham et al., 2008). According to this model the dissociative subtype of PTSD is supposed to comprise emotion dysregulation in terms of emotional overmodulation mediated by midline prefrontal inhibition of limbic regions such as the amygdala. Further investigation is needed to disentangle the differential relationships of dissociation, emotion regulation, depressive symptoms and other clinical covariates in the dissociative subtype of PTSD and neurobiological correlates possibly enabling innovative treatment methods.

#### 4.1. Strengths and limitations

Our study has a number of strengths, including the investigation of a heterogeneous sample of patients with PTSD based on DSM-5 criteria by means of the CAPS-5. Nevertheless, a number of limitations have to be considered. First, although we could include 210 patients into our analysis, the size of our sample might have affected the LCA results. In addition, the indices we used to select the number of classes were not all pointing to the 5-class solution. Particularly, the BIC did not decrease with increasing numbers of classes. Future LCAs in other PTSD samples should replicate the results found in this study to test the stability of the classes found.

In our analysis the auxiliary variables sex and years of education were added to the LCA model as potential confounders after the best LCA solution had been identified, to avoid that such potentially relevant variables influence both, a latent variable as well as the indicators and thereby lead to incorrect classification (Muthén, 2004). More recent developments in LCA methodology may suggest to include auxiliary variables to estimate covariate–outcome relations using a 3-step procedure (e.g. Asparouhov & Muthén, 2014), which we did use in our analysis. Therefore, we cannot exclude that not using this approach could have introduced biased estimates.

An additional limitation can be seen in the approach of conducting an LCA on the basis of single indicators rather than summary scores which might lead to more robust results in some cases. However, our approach is consistent with common standards (e.g. Clogg, 1995), and simulation studies showed that a higher number of indicators were related to proper replications, fewer boundary parameter estimates and less parameter bias, and could sometimes compensate for smaller sample sizes (e.g. Wurpts & Geiser, 2014).

Moreover, we did not use structured interviews to assess psychiatric comorbidities systematically nor assessed history of childhood trauma, which could have

influenced our results. Future studies should combine a thorough diagnostic assessment for psychiatric disorders with evaluations of PTSD-symptoms and difficulties in emotion regulation. Furthermore, our measure of dissociation, the German version of the Dissociative Experiences Scale (DES), has been found to measure both pathological and non-pathological forms of dissociation (i.e. absorption). This could be the reason for elevated scores of dissociation in several of our classes. Besides, the DES might show falsely elevated dissociative symptoms when the participants do not identify with the implemented language for their dissociation. This could also have affected our LCA results and future work should replicate these constructs with a more nuanced measure of pathological dissociation (e.g. the Multidimensional Inventory of Dissociation).

Finally, one potential flaw of this study is the absence of a measure of post-trauma cognitions, which are known as a key determinant and maintenance factor of PTSD. Change in trauma-related cognitions is also a mechanism of PTSD treatments, specifically in cognitive processing therapy (Resick et al., 2012).

## 5. Conclusion and future directions

To our knowledge, we are the first to investigate a sample of PTSD patients with and without the dissociative subtype according to CAPS-5 and compare the subtypes to classifications via LCA of the single CAPS-5 items. Individuals with the dissociative subtype of PTSD showed significantly higher severity of depressive symptoms and difficulties in emotion regulation and reported sexual trauma more often. LCA, however, defined several classes where D-PTSD was present, suggesting that this subtype of PTSD is more complex than suggested by the dichotomous characterization of the CAPS-5.

### Data availability statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request. The data are not publicly available due to them containing information that could compromise research participant consent.

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