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The distinction between Persistent Complex Bereavement Disorder and Post Traumatic Stress Disorder: Confirmatory Factor Analyses

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Abstract

In response to the establishment of a new bereavement-related diagnostic entity in the Diagnostic and Statistical Manual of mental disorders (DSM-5), named Persistent Complex Bereavement Disorder (PCBD), the question arose if PCBD is a distinct from Post-Traumatic Stress Disorder (PTSD). Prior research on the overlap between PTSD and pathological grief focused on different conceptualizations of grief-related disorders, and has provided mixed findings. Therefore, this study used confirmatory factor analysis to evaluate the factor structure of PTSD and PCBD, and the overlap between the two constructs. Self-reported data from two samples was used. Sample 1 consisted of participants who were bereaved due to the MH17 plane crash (N = 103). Participants in Sample 2 lost a loved one due to traffic accidents (N = 266). For PTSD, the seven factor Hybrid model yielded the best fit. As for PCBD, a three factor model consisting of the factors separation distress, reactive distress and social identity disruption fit the data well. None of the models combining the two disorders fit the data well. Nevertheless, a higher order model combining both aforementioned PCBD and PTSD models exhibited better fit than a unitary model. The findings of this study provide preliminary evidence for PCBD as a distinctive construct. However, replication and further research is necessary for establishing PCBD as an evidence-based diagnostic entity.

Introduction

The death of a loved one may cause serious mental health concerns in bereaved individuals (Jordan & Litz, 2014). Although most individuals adapt to the loss of a loved one over time, a subset of individuals develop grief symptoms that are severely disabling and remain for a prolonged period of time. This is associated with long-term impairments and has been defined as pathological grief (Lenferink, Boelen, Smid & Paap, 2019; Prigerson et al., 1995; Stroebe et al., 2008). Multiple researchers proposed definitions and frameworks for establishing pathological grief as a disorder. Proposals included, but are not limited to, "traumatic grief" (Prigerson et al., 1999), "complicated grief" (Horowitz et al., 2003) and "prolonged grief" (Prigerson et al., 2009).

Recently, both the DSM-5 and ICD-11 defined new pathological entities that concern abnormal grief. ICD-11 includes Prolonged Grief Disorder (PGD) (WHO, 2018), while DSM-5 introduced Persistent Complex Bereavement Disorder (PCBD) under "Conditions for Further Study" (APA, 2013). This not only sparked a debate about the distinctiveness between the two proposed disorders regarding pathological grief (Lenferink & Eisma, 2018; Maciejewski, Maercker, Boelen & Prigerson, 2016), but the proposals also elicited critique about the defining factors of the new DSM-5 disorder PCBD and the possible overlap with Post-Traumatic Stress Disorder (PTSD) (Ehlers, 2006; Middleton, Raphael, Martinek, & Misso, 1993). The debate regarding the distinctiveness of PCBD from PTSD stems from the fact that both disorders are associated with a psychopathological reaction to a potential traumatic event (Barnes et al., 2012). In the DSM-5, both disorders include the death of a significant other under criterion A, with the specification for PTSD that in case of death of a family member or friend, the event must have been violent or accidental (APA, 2013). Furthermore, PCBD and PTSD share characteristics such as: intrusive thoughts, feeling numbed or detached, emotional and behavioural avoidance and experiencing intense emotions

that cause functional impairments (Duffy & Wild, 2017). Therefore, it is not surprising that comorbidity between PCBD and PTSD has been documented in prior research (Lenferink, 2017; Maercker & Znoj, 2010; Prigerson et al., 2009; Simon et al., 2007; Stroebe, Schut & Finkenauer, 2001). The interplay between PTSD and PCBD is most prevalent among bereaved individuals who experienced an unexpected or violent loss (Djelantik et al., 2020; Nakajima, Masaya, Akemi & Takako, 2012; Nickerson et al., 2014), which is defined as "traumatic loss" by Smid et al. (2015).

One way of examining the overlap between PCBD and PTSD is by using factor analysis. Factor analysis uses mathematical procedures to regroup a set of variables into a limited set of underlying factors, based on shared variance (Yong & Pearce, 2013). Factor analysis can be used to either uncover complex patterns by exploring the dataset without prior assumptions (exploratory factor analyses (EFA)) or to test if a hypothesized factor structure fits the dataset (confirmatory factor analyses (CFA)) (Child, 2006).

Several studies employed factor analyses to investigate the latent structure of PTSD. The DSM-5 (APA, 2013) organizes the 20 symptoms of PTSD into four clusters: re-experiencing, avoidance, negative alterations in cognition and mood, and hyperarousal. This implies a four-factor structure of PTSD. While studies examining PTSD factor structure found the DSM-5 model to have a moderately adequate fit, several alternative conceptualizations fit significantly better (Ashbaugh et al., 2016; Blevins et al., 2015; Bovin et al., 2016; Lee et al., 2019). A first alternative model is the six-factor Anhedonia model (Liu et al., 2014). This model divides the DSM-5 cluster of "negative alterations in cognitions and mood" in two factors: anhedonia and negative affect. In addition, this model splits the hyperarousal cluster from DSM-5 into two different clusters, distinguishing anxious arousal and dysphoric arousal. A second alternative model is the six-factor Externalization model as proposed by Tsai et al. (2015). This model divides the DSM-5 cluster of hyperarousal into three different clusters:

separating an externalizing behaviour cluster in addition to anxious arousal and dysphoric arousal. A final proposed alternative is the seven-factor Hybrid model (Armour et al., 2015). This model integrates both the Anhedonia and Externalization model, implementing all proposed symptom cluster divisions. Table 1 shows an overview of these models and their respective factors.

Comparing these alternate models, results seem to favour the fit of the Anhedonia and the Hybrid model over the Externalization model and DSM-5 four-factor model (Bovin et al., 2016). Studies comparing the Anhedonia and the Hybrid model however, have found conflicting results. Blevins et al. (2015) found a slight but non-significant difference in favour of the Anhedonia model, while Ashbaugh et al. (2016) found the Hybrid model to have a significantly better fit than the Anhedonia model. A recent study by Lee et al. (2019) among veterans found the Hybrid model to best fit the data compared to both the Anhedonia and the Externalization model, but with all models fitting the data well.

In contrast to the numerous studies on the factor structure of PTSD, few studies have evaluated the latent structure of PCBD. The DSM-5 (APA, 2013) implies either a two-factor model by organizing symptoms into two clusters of separation distress and both reactive distress and social identity disruption (Claycomb et al., 2016), or a three factor model, further dividing reactive distress and social identity disruption into separate clusters (Boelen, Lenferink, Nickerson & Smid, 2018; Boelen, Lenferink & Smid, 2019).
Boelen et al. (2018) found that a three-factor model fit the data best. It has to be noted that none of these studies used an instrument specifically designed to measure PCBD.

Factor analytic research examining the overlap between PTSD and different conceptualizations of pathological grief has provided mixed findings. Three studies employed CFA. These CFA studies found contradictory results. Using data from two samples consisting of people confronted with loss due to various causes, Boelen et al. (2010) tested a unitary

model in which symptoms of depression, PTSD and PGD all formed one single dimension. The unitary model did not fit the data, while other hierarchical models that clustered the symptoms of the three aforementioned disorders separately yielded acceptable fit. It has to be noted that the constructs of PTSD and PGD strongly correlated ($r > 0.85$). Furthermore, this study did not assess all PGD symptoms and the instrument used to measure PTSD symptoms was designed for DSM-IV. O'Connor et al. (2010) used a sample of married, elderly people with a history of at least one significant loss, to assess the relationship between complicated grief (CG) (Horowitz et al., 2003) and PTSD. In line with Boelen et al. (2010) they found that a higher-order factor model, that differentiated PTSD and CG as separate factors but allowed these factor to correlate, provided the best fit. However, contradictory to Boelen et al. (2010), their unitary model yielded acceptable fit as well. Later research conducted amongst bereaved children (Spuij et al., 2012) found that a model in which PTSD and CG loaded onto different factors yielded better fit than a unitary model. Yet both models displayed acceptable model fit.

These preliminary studies contributed to the understanding of the overlap between PTSD and pathological grief (Boelen et al., 2010; O'Connor et al., 2010; Spuij et al., 2012). However, all of these studies used samples of people bereaved by various causes. To date, no published studies examined the overlap between PTSD and pathological grief in a sample exclusively comprised of traumatically bereaved people. A sample of traumatically bereaved people is more likely to have a high prevalence of both PTSD and PCBD, because this type of comorbidity is more prevalent after traumatic loss than after natural loss (Djelantik et al., 2020; Nakajima, Masaya, Akemi & Takako, 2012; Nickerson et al., 2014). Furthermore, none of the aforementioned studies used the PCBD criteria as suggested by DSM-5.

Assessing the distinctiveness of PCBD is essential for establishing the diagnostic validity of the syndrome. Inaccurate diagnostic criteria can lead to under- or overdiagnosis,

which may prevent functionally impaired individuals from receiving adequate treatment. Further understanding of PTSD and PCBD and the overlap between these two disorders, will also increase the utility of these diagnoses for both research and practice. Regular PTSD treatment does not address symptoms of grief (Maercker & Znoj, 2010). There is no substantial evidence for the effect of PTSD treatment on people suffering from PCBD, while there is growing evidence that treatments specifically designed to target grief or traumatic loss (such as brief eclectic psychotherapy for traumatic grief by Smid et al., 2015), are effective for this group (Asukai, Tsuruta & Saito, 2011; de Heus et al., 2017).

This is why the current study will examine the overlap between PTSD and PCBD among people who experienced a traumatic loss using CFAs. The first aim of this study is to examine the factor structure of PTSD. Second, this study will assess the factor structure of PCBD. The third and final aim of this study is to evaluate the distinction between both constructs.

To examine the factor structure of PTSD, CFA was used to test four competing measurement models. For PTSD, the fit of the four-factor DSM-5 model (Model 1) was compared to three alternate models proposed in literature. The first alternate model (Model 2) is the six-factor Anhedonia model (Liu et al., 2014). The second alternate model (Model 3) is the six-factor Externalization model as proposed by Tsai et al. (2015). The last alternate model (Model 4) is the seven-factor Hybrid model (Armour et al., 2015).

To examine the factor structure of PCBD, the fit of three models was examined. Model 1 is a unidimensional model. Model 2 is a two-factor model with “separation distress” and “social identity disruption and reactive distress” as respective factors. In model 3 “social identity disruption” and “reactive distress” are split in two separate factors, in addition to the factor concerning “separation distress”.

Regarding the factor structure of PTSD, it was hypothesized that the four-factor *DSM*-

5 model would fit the data adequately but that the six- and seven-factor models would provide superior fit. Specifically, expectations were that the Anhedonia model and that Hybrid model would yield superior fit over the Externalization model (Bovin et al., 2016). Additionally, in regard to the factor structure of PCBD, it was hypothesized that the three-factor model would yield the best fit (Boelen et al., 2018).

Regarding the final aim of this study to evaluate the distinction between both PTSD and PCBD, it was hypothesized that PTSD and PCBD would be correlated, but distinctive constructs. Expectations were that a model clustering PCBD symptoms and PTSD symptoms on different factors would yield better fit than a unidimensional model.

Method

Participants and procedure

Data were collected in the context of two studies conducted in the Netherlands. The first study aimed to examine distress over time in Dutch adults who suffered one or more losses of a loved one, due to the MH17 plane crash in Ukraine in 2014 (Lenferink et al., 2017; Lenferink et al., 2019; Lenferink et al., 2020). Data of the fourth and last measurement occasion (N = 103) were used for the current study. This assessment took place from January 2018 through March 2018. Participants for this study were recruited along different pathways, as the bereaved could not be contacted directly due to privacy regulations. All participants provided informed consent and completed the questionnaire either online or with pen and paper. In total, 42 participants (40.8%) were recruited through Victim Support the Netherlands, 35 (34.0%) via the MH17 Disaster Foundation, 21 (20.4%) via referral by an acquaintance and 4 (3.9%) otherwise. One participant failed to answer this question. See Lenferink et al. (2017) for a more in-depth description of the recruitment-process.

The second sample included 266 participants, who were recruited in an ongoing

research project named “TrafVic”; a study examining the psychological consequences for people who lost loved ones due to traffic accidents. Data from this sample was collected between December 2018 and July 2019. Participants were invited to take part in an online survey study. If a participant preferred to complete the questionnaire on paper, a hardcopy was sent per mail. All participants gave informed consent. In total, 216 participants (81.2%) were recruited via Victim Support, 23 participants (8.7%) via referral by an acquaintance, 19 (7.1%) through Social Media (e.g. Facebook) and one participant (0.4%) was recruited via an acquaintance with similar experiences. Three participants (1.1%) could not recall how they were recruited.

Measures

PTSD symptoms as defined by DSM-5 were assessed with the Dutch version of the PTSD Checklist for DSM-5 (PCL-5; Blevins et al., 2015). The PCL-5 measures the severity of PTSD symptoms. Participants rated to what extent they experienced symptoms during the preceding month on 5-point Likert scales ranging from 0 (not at all), to 4 (extremely). The PCL-5 consists of 20 items (e.g. “In the past month, how much were you bothered by: “Repeated, disturbing, and unwanted memories of the stressful experience”?”). Psychometric properties for the PCL-5 are adequate (Blevins et al., 2015), recent preliminary research on the Dutch version of the PCL-5 found the instrument was psychometrically sound (Van Praag et al., 2020).

The 16 items representing PCBD symptoms were assessed with the 18-item Traumatic Grief Inventory-Self Report (TGI-SR; Boelen & Smid, 2017). Items 12 and 13 were omitted from the analyses as these items did not capture PCBD symptoms. Participants rated how frequently they experienced each symptom during the previous month (e.g., “I felt bitter or angry about the loss”) on 5-point Likert scales ranging from 1 (never) to 5 (always). According to Boelen et al. (2018), the psychometric properties of the TGI-SR are adequate.

The original instructions referring to the anchor event for the TGI-SR ("the death of your loved one") and the PCL-5 ("the stressful experience") were changed in both studies, due to the background of the samples. In the MH-17 study, instructions were adapted to refer to the disaster-related loss ("the death of your loved one(s) due to the Ukrainian Plane Crash"), whereas in the TrafVic study, instructions were adapted to refer to the traffic-accident related loss.

Statistical Analyses

To test the differences between the samples in terms of age (in years), time since loss (in months) and mean scores of the PCL-5 and the TGI, a series of independent t-tests were conducted. To account for differences between the samples in gender (0 = male, 1 = female), level of education (0 = primary-, secondary- or pre-vocational education, 1 = college or university) and kinship to the deceased (0 = closely related (child or spouse), 1 = distantly related (parent, sibling or other), chi square analyses were conducted using SPSS.

Series of CFA's were conducted using Mplus (version 8.0, Muthén and Muthén, 1998–2017) to assess the dimensionality of DSM-5 PCBD criteria and DSM-5 PTSD criteria separately. Tables 1 and 2 show symptoms of both criteria sets, as well as the PCL-5 and TGI-SR items representing these symptoms.

Table 1
Item mapping PTSD models

Item PCL-5	PTSD Symptoms for DSM-5	DSM-5	Anhedonia	Externalization	Hybrid
1	B1. Intrusive thoughts	RE-EX	RE-EX	RE-EX	RE-EX
2	B2. Distressing dreams	RE-EX	RE-EX	RE-EX	RE-EX
3	B3. Flashbacks	RE-EX	RE-EX	RE-EX	RE-EX
4	B4. Cued distress	RE-EX	RE-EX	RE-EX	RE-EX
5	B5. Cued physical reactions	RE-EX	RE-EX	RE-EX	RE-EX
6	C1. Avoiding internal reminders	A	A	A	A

7	C2. Avoiding external reminders	A	A	A	A
8	D1. Amnesia	NACM	NAF	NACM	NAF
9	D2. Negative beliefs	NACM	NAF	NACM	NAF
10	D3. Blame	NACM	NAF	NACM	NAF
11	D4. Negative feelings	NACM	NAF	NACM	NAF
12	D5. Loss of interest	NACM	AN	NACM	AN
13	D6. Detachment or estrangement	NACM	AN	NACM	AN
14	D7. Numbing	NACM	AN	NACM	AN
15	E1. Irritability or aggressive behaviour	H	DA	EB	EB
16	E2. Reckless behaviour	H	DA	EB	EB
17	E3. Hypervigilance	H	AA	AA	AA
18	E4. Startle	H	AA	AA	AA
19	E5. Concentration	H	DA	DA	DA
20	E6. Sleep disturbance	H	DA	DA	DA

RE-EX = Re-experiencing, A = Avoidance, NACM = Negative Alterations in Cognitions and Mood, NA = Negative Affect, AN = Anhedonia, DA = Dysphoric Arousal, AA = Anxious Arousal, H = Hyperarousal

Table 2
Item mapping PCBD models

Item TGI-SR	PCBD Symptoms DSM-5	1-factor	2 factor	3 factor
3	B1. Yearning for the deceased	PCBD	SD	SD
2	B2. Intense sorrow	PCBD	SD	SD
1	B3. Preoccupation with the deceased	PCBD	SD	SD
14	B4. Preoccupation with the circumstances of the death	PCBD	SD	SD
5	C1 Trouble accepting the loss	PCBD	RD+SID	RD
10	C2. Disbelief	PCBD	RD+SID	RD
15	C3. Difficulty with positive reminiscing	PCBD	RD+SID	RD
8	C4. Anger	PCBD	RD+SID	RD
16	C5. Maladaptive appraisals about oneself (e.g., self-blame)	PCBD	RD+SID	RD
6	C6. Avoidance of reminders of the loss	PCBD	RD+SID	RD
17	C7. Desire to die for reunite	PCBD	RD+SID	SID
7	C8. Trouble trusting others	PCBD	RD+SID	SID

18	C9. Loneliness	PCBD	RD+SID	SID
11	C10. Life is meaningless	PCBD	RD+SID	SID
4	C11. Confusion about one's role in life	PCBD	RD+SID	SID
9	C12. Difficulty with engaging with activities	PCBD	RD+SID	SID

PCBD = Persistent Complex Bereavement Disorder; RD = Reactive Distress; SD = Separation Distress; SID = Social Identity Disruption.

Subsequently, for the combined models, the overlap between PTSD and PCBD were assessed in three models using CFA. The first model combined model consisted of all used items for both PTSD and PCBD, loading onto one factor.

For verification, a second combined model consisted of two factors representing PTSD and PCBD, without including any subfactors. For the third and final combined model, the models that were found to have the best fit for PTSD and PCBD separately were combined in a higher order CFA.

Before the series of CFAs was conducted, data on all variables was examined for univariate normality. Univariate tests revealed skewness ranging from 0.19 to 2.22, and kurtosis ranging from -1.18 to 4.46 for PCL-5 items. For TGI-SR items, skewness ranged from -0.67 to 1.26, and kurtosis ranged from -1.16 to 0.48. According to Kline (2015), this means assumption of normality is acceptable (absolute skew < 3.0 and absolute kurtosis < 10.0). Therefore, Maximum Likelihood estimation method was used.

To evaluate model fit, Kline's (2015) recommendations were used. This included assessing the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI) (with values above 0.90 indicating acceptable model fit and values above 0.95 indicating excellent fit). Additionally, root-mean-square error of approximation (RMSEA) with 90% confidence intervals (90% CI) were reported, with values below 0.10 indicating acceptable fit and values below 0.05 indicating excellent model fit. Further, standardized root mean square residual (SRMR) was used, with values below 0.10 representing acceptable fit.

To compare the fit of nested models (see table 4), Chi-square difference tests were used in addition to Akaike, Bayesian, and Sample-Size adjusted Bayesian information criteria (AIC, BIC, and SS-BIC). Lower values for these indices indicate better fit. There was less than 5% missing data on any variable. Missing data were accounted for using full maximum likelihood estimation.

Results

Participant Characteristics

Table 3 shows the characteristics of both samples in terms of age, gender, education, time since loss and mean scores on PCBD and PTSD.

In Sample 1, most participants lost one (n = 33; 32.0%) or two (n = 32; 31,1%) loved ones; 35 participants (33,9%) lost three or more loved ones. Thirty-six Participants (35.0%) lost a child, 31 (30.1%) a sibling, 2 (1.9%) a spouse and 30 (29.1%) someone other than a sibling or child (e.g., friend or parent); 4 participants did not answer this question.

In Sample 2, most participants lost one (n = 245; 92.1%) or two (n = 16; 6.0%) loved ones; 5 participants (1.9%) lost three or more loved ones. Of all participants, 101 (38.0%) lost a child, 57 (21.4%) a spouse, and 108 (40.6%) lost someone other than a spouse or child (e.g., friend, parent or sibling).

In the combined sample, most participants lost one (n = 278; 75.3%) or two (n = 48; 13.0%) loved ones; 40 participants (10.8%) lost three or more loved ones. Three participants chose not to answer this question. 103 participants (27.9%) lost their spouse, 93 (25.2%) lost a child, 74 (20.1%) lost a sibling, 47 (12.7%) a parent and 48 (13.0%) lost someone else. Four participants chose not to answer this question.

Participants in Sample 1 were significantly older than those in Sample 2 and were

more recently bereaved. Furthermore, participants in Sample 1 displayed a significantly lower severity of PCBD and PTSD symptoms than participants in Sample 2. Sample 1 consisted of significantly less women and participants in Sample 1 had a significantly higher level of education. Lastly, participants in Sample 1 were more distantly related to the deceased than those in Sample 2.

Table 3

Descriptive characteristics of Sample 1 and Sample 2

Characteristic	Total Sample (n = 369)	Sample 1: Bereaved by plane disaster (n = 103)	Sample 2: bereaved by traffic accident (n = 266)	Test of difference (significance)
Age (M, SD)	52.93 (13.431)	56.96 (13.402)	51.38 (13.142)	t_{366} = 3,624 (p < .000)
Gender (% female)	71.5%	58.3%	76.7%	$X^2(1)$ = 11.611 (p < .001)
Education (% college or university)	47.7%	62.1%	42.1%	$X^2(1)$ = 12.587 (p < .000)
Time since Loss (months)	56.20 (87.286)	42.27 (0.49)	61.61 (102.40)	$t_{264,031}$ = -3.074 (p < .050)
Kinship to the deceased (% closely related)	53.1%	36.9%	59.4%	($X^2(1)$ = 12.815 (p < .001)
Mean TGI-SR-Score	42.37 (SD = 13.18, range 16-80)	35.51 (SD = 11.25, range 16-77)	45.14 (SD = 12.83, range 16-80),	t_{365} = -6.907 (p < .000)
Mean PCL-5 Score	20.82 (SD = 14.92, range 0-74)	16.26 (SD = 12.98, range 0-74)	22.64 (SD = 15.28, range 0-63).	$t_{219,371}$ = -3.998 (p < .000)

Table 4

Model fit Statistics for PCBD and PTSD models.

	χ2	df	p	CFI	TL	RMSEA (90% CI)	SRMR	AIC	BIC	SS-BIC	Nested in
PCBD											
1. One-factor	576.26	104	< 0.01	0.86	0.84	0.11 (0.10-0.12)	0.06	15472.91	15660.63	15508.34	-
2. Two-factor	458.85	103	< 0.01	0.90	0.88	0.10 (0.09-0.11)	0.05	15357.50	15549.12	15393.67	1
3. Three-factor	403.03	101	< 0.01	0.91	0.90	0.09 (0.08-0.10)	0.05	15305.68	15505.13	15343.32	1,2
PTSD											
1. DSM-5	612.92	164	< 0.01	0.88	0.86	0.09 (0.08-0.09)	0.06	19019.50	19276.35	19066.96	-
2. Externalization	520.54	155	< 0.01	0.90	0.88	0.08 (0.07-0.09)	0.06	18945.12	19236.99	18999.05	1
3. Anhedonia	413.27	155	< 0.01	0.93	0.92	0.07 (0.06-0.08)	0.05	18837.85	19129.72	18891.78	1
4. Hybrid	376.82	149	< 0.01	0.94	0.92	0.07 (0.06-0.07)	0.04	18813.40	19128.62	18871.65	2,3
COMBINED											
1. Univariate	2877.68	594	< 0.01	0.72	0.70	0.10 (0.10-0.11)	0.07	34870.30	35292.67	34950.02	-
2. Two-factor	2525.49	593	< 0.01	0.76	0.75	0.09 (0.09-0.10)	0.07	34520.10	34946.38	34600.56	1
3. Higher-order	1831.21	583	< 0.01	0.85	0.84	0.08 (0.07-0.08)	0.06	33845.82	34311.21	33933.66	1,2

Note: Chi-square difference tests are only conducted between nested models. PCBD = Persistent complex bereavement disorder; PTSD = Post Traumatic Stress Disorder; df = degrees of freedom; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; RMSEA = root-mean-square error of approximation; SRMR = standardized root mean square residual; CI = confidence interval; AIC = Akaike's information criterion; BIC = Bayesian information criterion; SS-BIC = Sample-size adjusted information criterion.

Confirmatory Factor Analysis

Table 4 shows the fit indices for both the 4 PTSD models as well as the 3 PCBD models. With respect to PTSD, the seven factor Hybrid model seemed to fit best (Figure 1). Both six factor Anhedonia and Externalization models demonstrated better fit than the four factor DSM model as evidenced by significant $\chi 2$ -difference tests (Anhedonia: $\Delta\chi 2= 199.65$ (9), $p < .001$; Externalization: $\Delta\chi 2= 92.38$ (9), $p < .001$), larger CFI and TLI, smaller RMSEA and SRMR and smaller AIC, BIC, and SS-BIC values. Compared to both the Anhedonia and the Externalization model, the seven factor Hybrid model yielded a significant improvement in fit as evidenced by significant $\chi 2$ -difference tests (Hybrid over Anhedonia: $\Delta\chi 2= 36.45$ (6), $p < .001$; Hybrid over Externalization: $\Delta\chi 2= 143.72$ (6), $p < .001$), larger CFI and TLI, smaller RMSEA and SRMR and smaller AIC, BIC, and SS-BIC values. All factors did correlate significantly (See Table 5).

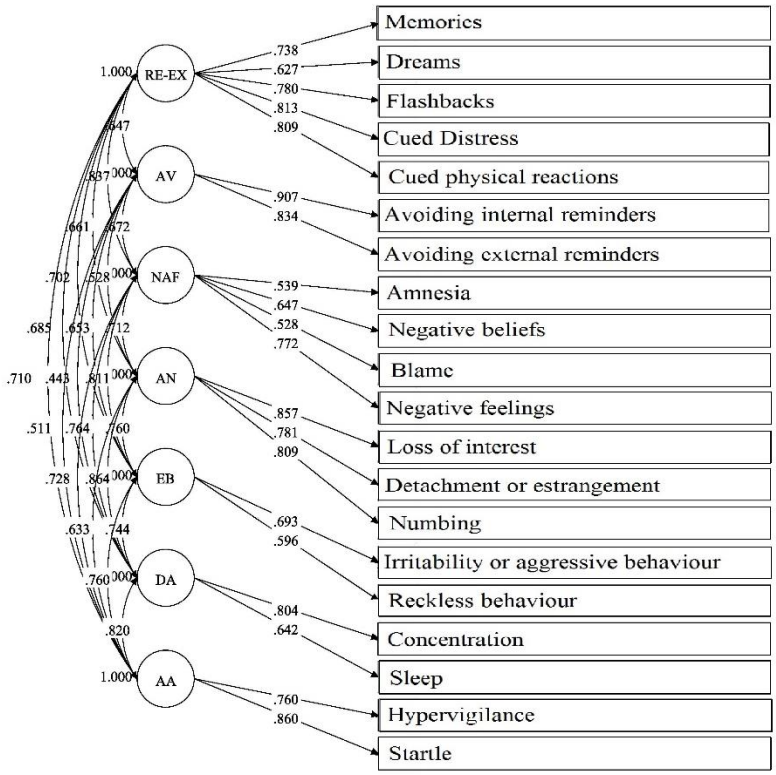

Figure 1. Factor loadings and correlations for the Hybrid PTSD model
Note: RE-EX = re-experiencing, AV = avoidance, NAF = negative affect, AN = anhedonia, EB = externalizing behaviour, DA = dysphoric arousal, AA = Anxious Arousal,

Table 5
Correlations among factors of the Hybrid PTSD model

	PTSD **RE-EX**	PTSD **AV**	PTSD **NAF**	PTSD **AN**	PTSD **EB**	PTSD **DA**	PTSD **AA**
RE-EX							
AV	0.65						
NAF	0.84	0.67					
AN	0.66	0.53	0.71				
EB	0.70	0.65	0.81	0.76			
DA	0.69	0.44	0.76	0.86	0.74		
AA	0.71	0.51	0.73	0.63	0.76	0.82	

Note: RE-EX = re-experiencing, AV = avoidance, NAF = negative affect, AN = anhedonia, EB = externalizing behaviour, DA = dysphoric arousal, AA = Anxious Arousal,

With respect to PCBD, the three factor model yielded the best fit (Figure 2). The two-factor model demonstrated a significant improvement over the one-factor model as evidenced by a significant $\chi 2$ -difference test ($\Delta\chi 2$= 117.41 (1), $p < .001$), larger CFI and TLI, smaller RMSEA and SRMR and smaller AIC, BIC, and SS-BIC values. The three-factor model however, yielded a better fit than the two factor model, as evidenced by a significant $\chi 2$ -difference test ($\Delta\chi 2$= 55.82 (2), $p < .001$), larger CFI and TLI, smaller RMSEA and SRMR

and smaller AIC, BIC, and SS-BIC values. The three factors correlated significantly (separation distress with reactive distress, r = 0.90; separation distress with social identity disruption, r = 0.794; reactive distress with social identity disruption, r = 0.922, p's < 0.001).

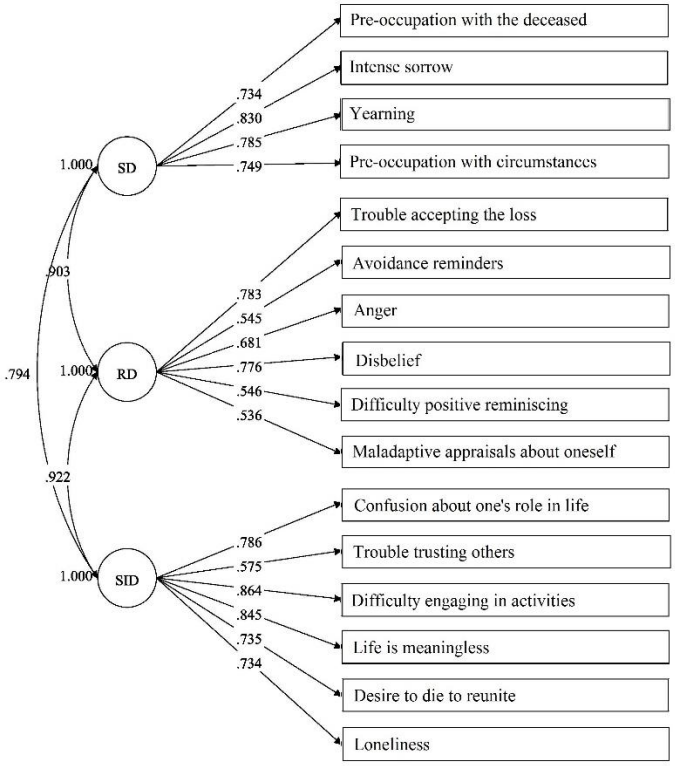

Figure 2. Factor loadings and correlations for the 3-factor PCBD model.
Note: SD = separation distress, RD = reactive distress, SID = social identity disruption.

Table 4 shows the fit indices for the combined models of PTSD and PCBD. None of the combined models yielded acceptable fit, as indicated by the low CFI and TLI. Of the three combined models, the higher order CFA (which combined both the Hybrid model for PTSD and the three-factor model for PCBD) yielded a better fit then the competing models, as evidenced by significant $\chi 2$ -difference tests (higher order over two-factor: $\Delta\chi 2 = 694.28$ (10), $p < .001$, higher order over univariate: $\Delta\chi 2 = 1046.48$ (11), $p < .001$) larger CFI and TLI, smaller RMSEA and SRMR and smaller AIC, BIC, and SS-BIC values. Table 6 shows the

factor loadings of all items in the higher-order CFA combined model, Table 7 shows the correlations between the factors. PTSD and PCBD correlated significantly (r = 0.87).

Table 6:
Factor loadings for the Higher-order CFA Combined Model

	Symptom	PTSD **REEX**	PTSD **AV**	PTSD **NAF**	PTSD **AN**	PTSD **EB**	PTSD **AA**	PTSD **DA**	PCBD **SD**	PCBD **RD**	PCBD **SID**
PCL-1	Memories	0.75									
PCL-2	Flashbacks	0.63									
PCL-3	Dreams	0.78									
PCL-4	Cued distress	0.82									
PCL-5	Cued physical reaction	0.80									
PCL-6	Avoiding internal cues		0.90								
PCL-7	Avoiding external cues		0.84								
PCL-8	Dissociative amnesia			0.51							
PCL-9	Negative beliefs			0.64							
PCL-10	Blame			0.55							
PCL-11	Negative feelings			0.79							
PCL-12	Loss of interest				0.85						
PCL-13	Detachment				0.78						
PCL-14	Numbing				0.82						
PCL-15	Irritability					0.70					
PCL-16	Reckless behaviour					0.59					
PCL-17	Hypervigilance						0.77				
PCL-18	Startle						0.85				
PCL-19	Concentration							0.76			
PCL-20	Sleep							0.68			
TGI-1	Intrusive thoughts								0.74		
TGI-2	Intense emotional pain								0.82		
TGI-3	Persistent yearning								0.78		
TGI-14	Intrusive thoughts about circumstances death								0.76		
TGI-5	Trouble accepting loss									0.76	
TGI-6	Avoidance of reminders									0.56	
TGI-8	Bitterness or anger									0.69	
TGI-10	Numbing									0.77	
TGI-15	Difficulty reminiscing									0.57	
TGI-16	Self-blame									0.55	
TGI-4	Confusion role in life										0.79
TGI-7	Difficulty trusting										0.59
TGI-9	Difficulty moving on										0.86
TGI-11	Meaninglessness of life										0.84
TGI-17	Desire to die, to be with deceased										0.74
TGI-18	Detachment										0.74

RE-EX = re-experiencing, AV = avoidance, NAF = negative affect, AN = anhedonia, EB = externalizing behaviour, DA = dysphoric arousal, AA = Anxious Arousal, SD = separation distress, RD = reactive distress, SID = social identity disruption

Table 7:
Correlations among factors of the Higher-order CFA Combined Model

	PTSD **RE-EX**	PTSD **AV**	PTSD **NAF**	PTSD **AN**	PTSD **EB**	PTSD **DA**	PTSD **AA**	PCBD **SD**	PCBD **RD**	PCBD **SID**
PTSD **RE-EX**										
PTSD **AV**	0.59									
PTSD **NAF**	0.80	0.60								
PTSD **AN**	0.73	0.55	0.75							
PTSD **EB**	0.75	0.56	0.77	0.70						
PTSD **DA**	0.78	0.59	0.80	0.73	0.75					
PTSD **AA**	0.71	0.53	0.73	0.67	0.69	0.71				
PCBD **SD**	0.67	0.50	0.68	0.62	0.64	0.66	0.61			
PCBD **RD**	0.76	0.57	0.78	0.71	0.73	0.76	0.70	0.85		
PCBD **SID**	0.73	0.55	0.75	0.68	0.70	0.73	0.67	0.82	0.93	

Note: All correlations are significant at $p < .001$. PTSD = Post Traumatic Stress Disorder, PCBD = Persistent Complex Bereavement Disorder, RE-EX = re-experiencing, AV = avoidance, NAF = negative affect, AN = anhedonia, EB = externalizing behaviour, DA = dysphoric arousal, AA = Anxious Arousal, SD = separation distress, RD = reactive distress, SID = social identity disruption.

Discussion

This study evaluated the overlap between the constructs PTSD (as defined by DSM-5, APA, 2013) and PCBD (as defined by DSM-5. APA, 2013) using CFAs. The first aim of this study was to examine the factor structure of PTSD. In line with earlier research (Armour et al., 2016; Ashbaugh et al., 2016; Bovin et al., 2018; Lee et al., 2019; Wang, 2017), CFAs showed that the seven factor Hybrid model (Armour et al., 2015) had superior fit compared with the DSM-5 model, the Anhedonia model and the Externalization model. The Hybrid model consisted of the factors: re-experiencing, avoidance, negative affect, anhedonia, externalizing behaviour, dysphoric arousal and anxious arousal. The negative affect factor showed the strongest correlation with other symptom clusters and the corresponding items had the lowest factor loadings. Other studies concerning PTSD factor structure (Lee et al., 2019; Wang, 2017) had similar findings. Lee et al. (2019) noted the possibility that the symptoms related to this factor (e.g. negative feelings and negative beliefs) are non-specific symptoms of general distress, which are prevalent in several other disorders. Notably, the Anhedonia model also fit the data well. Both the DSM-5 model and the Externalization model demonstrated poor fit.

The second aim of this study was to examine the factor structure of PCBD. As

expected, the three factor model consisting of the factors separation distress, reactive distress and social identity disruption, yielded the best fit. This is in line with the findings of Boelen et al. (2018). However, that study found the one- and two-factor models to have decent fit, while the current study found them both to fit the data poorly.

The third and final aim of this study was to assess the overlap between PCBD and PTSD by testing models combining the two constructs. We found that all combined models of PTSD and PCBD exhibited poor model fit. A higher-order model combining the three-factor PCBD model and the Hybrid PTSD model fit the data significantly better than a unidimensional model in which PTSD and PCBD loaded onto a single factor.

The models loading PTSD and PCBD onto separate factors yielding the best fit, is broadly consistent with earlier findings by Boelen et al. (2010) and O'Connor, Lasgaard, Shevlin & Guldin (2010), indicating that PTSD and PCBD might be related, but different constructs. However, the aforementioned authors found their models to yield acceptable fit, while in the current study none of the models did. It also has to be noted that the initial models tested by Boelen et al. (2010) did not fit the data either. The researchers decided to remove the PTSD "dissociative amnesia" item and the PGD "avoidance" item, which improved model fit.

In the current study, factor loadings of items that corresponded to these symptoms were among the lowest, but were not considered low enough to remove from the analysis. It cannot be ruled out that removing these items would have improved model fit.

Consistent with the findings by Boelen et al. (2010), the constructs of PTSD and PCBD strongly correlated ($r = 0.87$). The PCBD factor of reactive distress correlated with most PTSD clusters, especially with the with the cluster of negative affect ($r = 0.78$). A possible explanation is that the cluster of reactive distress contains a lot of symptoms (e.g. numbing, irritability and anger, and self-blame) which are all symptoms typical to PTSD as well. The PCBD cluster of separation distress correlated least with all PTSD clusters. This is in

conformity with the expectations of Lichtenhal, Cruess & Prigerson (2004), who anticipated separation distress to be a factor more associated with bereavement related disorders such as CG, than with PTSD.

The current study has several limitations. A first limitation is that data was gathered through self-report measures rather than interview based assessment by trained professionals. This may have affected the scores on the TGI-SR and PCL-5 items. Preferably, future research on this subject matter would use structured clinical interviews. Secondly, this study used two different samples. Thus, there could be existing differences in group scores related to characteristics of the two samples. The largest differences between the two samples were the scores on the TGI-SR and the PCL-5, both of which were higher for the TrafVic sample than the MH17 sample. The difference between the TGI-SR scores was found to exceed Cohen's (1988) convention for a large effect (d = .80), while the effect size for the analysis of the PCL-5 scores could be considered small to medium (d = 0.45). It is possible that the PCL-5 scores for the TrafVic sample were higher because participants in this sample could have been present when the accident happened and thus witness the death of their loved one. Because there were no survivors after crash of the MH-17, participants did not witness the event first-hand. A possible explanation for the difference in TGI-SR scores, is that the participants in the TrafVic sample were more closely related to the deceased than the participants in the MH-17 sample. Being closely related to the deceased loved one has been associated with higher levels of pathological grief (Hirooka et al., 2017; Holland & Neimeyer, 2011; Lenferink et al., 2020; Lobb et al., 2010). Future research could adopt measurement invariance to shed light on whether factor structure differs as a result of group characteristics (Caldas, Contractor, Koh & Wang, 2020; Chen, 2007; Hayduk & Glaser, 2000).

Concerning PCBD factor structure, the finding of this study that a three factor model yielded the best fit suggest that different mechanisms may underly these three factors that

cause these clusters of symptoms. Further research identifying these mechanisms could aid in developing clinical interventions that focus on specific elements of PCBD. It has to be noted that the factor separation distress correlated strongly with both other factors. A possible explanation is that the items of the TGI-SR to a certain degree represent one underlying dimension, as was found by Boelen et al. (2018).

Further research on PTSD factor structure could profit from a focus on practical use. Even though the Hybrid model, alongside with other more complex PTSD-models, was found to be superior in fit to the DSM-5 model, there are multiple limitations to its theoretical and clinical use. Firstly, four out of seven factors are measured by only two items each, while it is advised to have each latent variable be represented by at least three items (Kline, 2015). Furthermore, in a review by Rasmussen et al. (2019), the authors note that small factors are not reliable enough to use in diagnosing PTSD. A model consisting of seven symptom clusters may favour specificity over sensitivity, causing underdiagnoses. Shevlin et al. (2017) therefore argue that future research on PTSD factor structure should be focused on how models map onto diagnosis.

This is, to the best of my knowledge, the first study using an instrument which is specifically designed to measure all PCBD symptoms to assess the factor structure of PCBD with CFA. It is also the first study to assess the difference between DSM-5 PCBD and PTSD, using CFA, in a sample which participants who experienced traumatic loss. The findings of this study support PCBD as a distinctive diagnostic entity. However, correlations between factors suggests an overlap between PTSD and PCBD indicates that replication and further research on the subject matter is urgently needed to establish PCBD as an evidence-based diagnosis.

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