DSM-5-TR prolonged grief disorder and DSM-5 posttraumatic stress disorder are related, yet distinct: confirmatory factor analyses in traumatically bereaved people

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DSM-5-TR prolonged grief disorder and DSM-5 posttraumatic stress disorder are related, yet distinct: confirmatory factor analyses in traumatically bereaved people

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ABSTRACT

Background: Prolonged grief disorder (PGD) is newly included in the text revision of the DSM-5 (DSM-5-TR). So far, it is unknown if DSM-5-TR PGD is distinguishable from bereavement-related posttraumatic stress disorder (PTSD). Prior research examining the distinctiveness of PTSD and pathological grief focused on non-traumatic loss samples, used outdated conceptualizations of grief disorders, and has provided mixed results.

Objective: In a large sample of traumatically bereaved people, we first evaluated the factor structure of PTSD and PGD separately and then evaluated the factor structure when combining PTSD and PGD symptoms to examine the distinctiveness between the two syndromes.

Methods: Self-reported data were used from 468 people bereaved due to the MH17 plane disaster ($N = 200$) or a traffic accident ($N = 268$). The 10 DSM-5-TR PGD symptoms were assessed with the Traumatic Grief Inventory-Self Report Plus (TGI-SR+). The 20-item Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) was used to tap PTSD symptoms. Confirmatory factor analyses were conducted.

Results: For PTSD, a seven factor, so-called 'Hybrid' model yielded the best fit. For PGD, a univariate factor model fits the data well. A combined model with PGD items loading on one factor and PTSD items on seven factors (associations between PGD and PTSD subscales $r \geq .50$ and $\leq .71$), plus a higher-order factor (i.e. PTSD factors on a higher-order PTSD factor) (association between higher-order PTSD factor and PGD factor $r = .82$) exhibited a better fit than a model with all PGD and PTSD symptom loading on a single factor or two factors (i.e. one for PGD and one for PTSD).

Conclusions: This is the first study examining the factor structure of DSM-5-TR PGD and DSM-5 PTSD in people confronted with a traumatic loss. The findings provide support that PGD constitutes a syndrome distinguishable from, yet related with, PTSD.

HIGHLIGHTS
- This is the first factor analytic study on PGD and PTSD after traumatic loss.
- PTSD and PGD factors are related, but distinguishable.
- DSM-5-TR PGD is distinct from DSM-5 PTSD.

El trastorno de duelo prolongado del DSM-5-TR y el trastorno de estrés postraumático del DSM-5 están relacionados, pero son distintos: análisis factoriales confirmatorios en personas con duelo traumático

Antecedentes: El trastorno de duelo prolongado (PGD en su sigla en inglés) se incluyó recientemente en la revisión del texto del DSM-5 (DSM-5-TR). Hasta ahora, se desconoce si el PGD del DSM-5-TR se puede distinguir del trastorno de estrés postraumático (TEPT) relacionado con el duelo. Investigaciones anteriores que examinaron el carácter distintivo del trastorno de estrés postraumático y el duelo patológico se centraron en muestras con pérdidas no traumáticas, utilizaron conceptualizaciones obsoletas de los trastornos del duelo y arrojaron resultados mixtos.

Objetivo: En una muestra grande de personas en duelo traumático, primero evaluamos la estructura factorial de TEPT y PGD por separado y luego evaluamos la estructura factorial al combinar los síntomas de TEPT y PGD para examinar la distinción entre los dos síndromes.

Métodos: Se utilizaron datos autoreportados de 468 personas en duelo debido al desastre del avión MH17 ($N = 200$) o un accidente de tráfico ($N = 268$). Los 10 síntomas de PGD del DSM-5-TR se evaluaron con el Inventario de Autoreporte de Duelo Traumático Plus (TGI-SR +). Se utilizó la lista de chequeo de 20 ítems para el trastorno de estrés postraumático para el DSM-5 (PCL-5) para examinar los síntomas del TEPT. Se realizaron análisis factoriales confirmatorios.

Resultados: Para el TEPT, un modelo de siete factores, llamado modelo 'híbrido', produjo el mejor ajuste. Para el PGD, un modelo de factor univariado se ajusta bien a los datos. Un modelo

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🔾 Supplemental data for this article can be accessed here.

combinado con elementos de PGD que cargan en un factor y elementos de TEPT en siete factores (asociaciones entre las subescalas de PGD y TEPT r ≥ 50 y ≤ .71), más un factor de orden superior (es decir, factores de TEPT en un factor de TEPT de orden superior)) (asociación entre el factor TEPT de orden superior y el factor PGD r = .82) mostró un mejor ajuste que un modelo con toda la carga de síntomas de PGD y TEPT en un solo factor o dos factores (es decir, uno para PGD y otro para TEPT).
Conclusiones: Este es el primer estudio que examina la estructura factorial del PGD según DSM-5-TR y el TEPT según DSM-5 en personas que enfrentan una pérdida traumática. Los hallazgos respaldan que el PGD constituye un síndrome que se distingue del TEPT, pero que está relacionado con él.

DSM-5-TR 延长哀伤障碍和 DSM-5 创伤后应激障碍相关但又不同:创伤性丧亲者中的验证性因素分析

背景: 延长哀伤障碍 (PGD) 被新纳入 DSM-5 (DSM-5-TR) 的文本修订版。到目前为止, 尚不清楚 DSM-5-TR PGD 是否可与丧亲相关的创伤后应激障碍 (PTSD) 区分开来。先前考查PTSD 和病理性哀伤区别的研究侧重于非创伤性丧亲样本, 使用了过时的哀伤障碍概念, 并提供了混杂的结果。

目的: 在一个创伤性丧亲者群体的大样本中, 我们首先分别评估了 PTSD 和 PGD 的因子结构, 然后在结合 PTSD 和 PGD 症状时评估了因子结构, 以考查两种综合征之间的差异性。

方法: 使用 468 名因 MH17 空难 (N = 200) 或交通事故 (N = 268) 而丧亲的人的自我报告数据。使用创伤性哀伤清单 - 自我报告 Plus (TGI-SR+) 评估10 个 DSM-5-TR PGD 症状。20 条目的DSM-5创伤后应激障碍检查表(PCL-5)用于考查PTSD 症状。进行了验证性因素分析。

结果: 对于 PTSD, 七因素, 即所谓的'混合'模型为最佳拟合。对于 PGD, 单变量因子模型可以很好地拟合数据。一个PGD 条目载荷于一个因素, PTSD 项目载荷于七个因素 (PGD 和 PTSD分量表之间的关联 r≥ .50 并 ≤ .71), 加上一个高阶因素 (即PTSD 因子们之上的高阶 PTSD 因子) (高阶 PTSD 因子和 PGD 因素之间的关联 r= .82) 的混合模型, 表现出比所有 PGD 和 PTSD 症状加载到单个因子或两个因子 (即, 一个PGD和一个PTSD) 的模型更好的拟合。

结论: 这是第一项在面临创伤性丧失的人中考查 DSM-5-TR PGD 和 DSM-5 PTSD因素结构的研究。研究结果支持 PGD 构成一种可与 PTSD 区分开来但与 PTSD 相关的综合征。

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 minority develop grief symptoms that are severely disabling and remain for a prolonged period of time (Bonanno & Malgaroli, 2020; Lenferink, Nickerson, de Keijser, Smid, & Boelen, 2020c; Nielsen, Carlsen, Neergaard, Bidstrup, & Guldin, 2019; Sveen, Bergh Johannesson, Cernvall, & Arnberg, 2018). Many researchers proposed definitions for establishing pathological grief as a disorder (Lenferink, Boelen, Smid, & Paap, 2021). Proposals include 'traumatic grief' (Prigerson et al., 1999), 'complicated grief' (Shear et al., 2011), 'prolonged grief' (Prigerson et al., 2009), and 'persistent complex bereavement disorder' (American Psychiatric Association [APA], 2013).

The forthcoming text revision of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR) (APA, 2020) and the 11th edition of the International Classification of Diseases (ICD-11) (World Health Organization [WHO], 2018) both include prolonged grief disorder (PGD). While they carry the same name, they differ with respect to the time criterion; PGD can be diagnosed in adults 12 months after loss in terms of DSM-5-TR and 6 months after loss using ICD-11 criteria. Furthermore, they differ in number (10 symptoms in DSM-5-TR and 12 in ICD-11) and nature of symptoms (e.g. 'intense loneliness' is a symptom of DSM-5-TR PGD and not ICD-11 PGD, while 'an inability to experience positive mood' is a symptom of ICD-11

PGD and not DSM-TR-PGD). Despite these differences, both criteria sets have shown to yield similar prevalence rates and comparable concurrent and known-groups validity (Boelen & Lenferink, 2020; Rosner, Comtesse, Vogel, & Doering, 2021). In a representative bereaved sample, PGD lifetime prevalence rates of 3–4% were found (Rosner et al., 2021). A meta-analysis indicated that these rates are much higher in people bereaved by unnatural or traumatic causes; a pooled prevalence rate of 49% was found (Djelantik, Smid, Mroz, Kleber, & Boelen, 2020). Experiencing a traumatic loss is therefore an important risk factor for PGD.

PGD as defined in DSM-5-TR and ICD-11, as well as criteria sets proposed earlier, have sparked the debate about the distinctiveness between the proposed diagnostic criteria-sets of pathological grief (Boelen & Lenferink, 2020; Boelen, Lenferink, Nickerson, & Smid, 2018; Boelen, Spuij & Lenferink, 2019; Lenferink & Eisma, 2018; Maciejewski, Maercker, Boelen, & Prigerson, 2016). Some have also questioned whether PGD is distinct from Posttraumatic Stress Disorder (PTSD; Ehlers, 2006; Golden & Dalgleish, 2010; Maercker & Znoj, 2010; O'Connor, Lasgaard, Shevlin, & Guldin, 2010; Simon, 2012). The debate regarding the distinctiveness of PGD from PTSD stems from the fact that both disorders are associated with a psychopathological reaction to a potential traumatic event (Barnes, Dickstein, Maguen, Neria, & Litz, 2012). In DSM-5-TR, both disorders include the death of a significant other under criterion A, with the specification for PTSD that in case of a death

of a family member or friend, the event must have been violent or accidental. Furthermore, PGD and PTSD share characteristics such as: intrusive thoughts, feeling numbed or detached, emotional and behavioural avoidance and experiencing intense emotions that cause functional impairments (APA, 2013, 2020). Therefore, it is not surprising that substantial comorbidity between PGD and PTSD has been documented in prior research (Lenferink, de Keijser, Smid, Djelantik, & Boelen, 2017; Maercker & Znoj, 2010; Simon et al., 2007). The comorbidity of PGD and PTSD is particularly prevalent among bereaved individuals who experienced an unexpected or violent loss, also called a 'traumatic loss' (Djelantik, Smid, Kleber, & Boelen, 2017).

One way of examining the distinctiveness vs. overlap between PGD and PTSD is by using factor analysis. Factor analysis uses mathematical procedures to regroup a set of variables into a limited set of underlying (hypothesized) factors, based on shared variance (Yong & Pearce, 2013). Many studies employed factor analyses to investigate the latent structure of PTSD (for reviews see Armour, Műllerová, & Elhai, 2016; Elhai & Palmieri, 2011). The DSM-5 (APA, 2013) implies a four-factor structure of PTSD by organizing the 20 symptoms into four clusters: (i) re-experiencing, (ii) avoidance, (iii) negative alterations in cognition and mood, and (iv) hyperarousal. Studies examining the factor structure of PTSD found the DSM-5 model to have a poor though acceptable fit, while several alternative models have demonstrated better fit (Ashbaugh, Houle-Johnson, Herbert, El-Hage, & Brunet, 2016; Blevins, Weathers, Davis, Witte, & Domino, 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 into two different clusters distinguishing anxious arousal from 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 (i) an externalizing behaviour cluster, in addition to (ii) an anxious arousal, and (iii) a dysphoric arousal cluster. 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 S1 in the Supplementary Materials shows an overview of these PTSD models. Comparing these alternate models, results seem to favour the fit of the Anhedonia (Blevins et al., 2015; Specker, Liddell, Byrow, Bryant, & Nickerson, 2018) and the Hybrid model (Ashbaugh et al., 2016; Lee et al., 2019) over the Externalization model and DSM-5 four-factor model (Ashbaugh et al., 2016; Blevins et al., 2015; Bovin et al., 2016; Lee et al., 2019; Specker et al., 2018).

In contrast to the numerous studies on the factor structure of PTSD, studies evaluating the latent structure of DSM-5-TR PGD are sparse. DSM-5-TR PGD includes two clusters, a first 'separation distress' cluster with two symptoms (yearning and preoccupation) and a second cluster including eight additional symptoms. To the best of our knowledge, only two prior studies evaluated the factor structure of DSM-5-TR PGD. A confirmatory factor analysis (CFA) showed an adequate fit for the one-factor PGD DSM-5-TR model (the fit of the two-factor model was not tested; Boelen & Lenferink, 2020). A principal component analysis found that PGD DSM-5-TR symptoms were best represented as a unidimensional construct (Prigerson, Boelen, Xu, Smith, & Maciejewski, 2021). Factor analytic studies on ICD-11 PGD also found support for a one-factor model (Boelen, Djelantik, de Keijser, Lenferink, & Smid, 2018; Boelen & Lenferink, 2020; Boelen, Lenferink, & Smid, 2019; Boelen & Smid, 2017; Killikelly et al., 2020), while one study found support for a two-factor ICD-11 PGD model (Boelen, Lenferink et al., 2018).

Factor analytic research examining the overlap between PTSD and various conceptualizations of pathological grief (other than DSM-5-TR PGD) showed that these syndromes were distinguishable. In a sample of elderly bereaved people, a model with all PTSD and pathological grief items loading on one factor did not fit well. A higher-order factor model, which differentiated PTSD and pathological grief as separate, but correlated, factors provided the best fit (O'Connor et al., 2010). In two samples confronted with various losses, a model in which DSM-IV PTSD, PGD, and depression items loaded on one factor did not fit the data well, while hierarchical models that clustered the symptoms of the three aforementioned disorders separately yielded acceptable fit (Boelen, van de Schoot, van den Hout, de Keijser, & van den Bout, 2010).

These latter two studies enhance our understanding of the overlap between PTSD and pathological grief. However, both studies used samples of people bereaved by various causes. To date, no factor analytic study has examined the distinctiveness between PTSD and pathological grief after traumatic loss. This is important given that PGD and comorbid PTSD are more prevalent after traumatic than after natural losses (Djelantik et al., 2020; Lundorff, Holmgren, Zachariae, Farver-Vestergaard, & O'Connor, 2017; Nakajima, Masaya, Akemi, & Takako, 2012). Furthermore, none of the aforementioned studies used the new PGD criteria as defined in DSM-5-TR.

Assessing the distinctiveness of PGD and PTSD is essential for establishing the validity of PGD. There is growing evidence that grief-specific treatments yield the largest effects for PGD (Boelen, Lenferink, & Spuij, 2021; Shear, Frank, Houck, & Reynolds, 2005; Shear et al., 2016), while trauma-specific treatment, such as Eye Movement and Desensitization and Reprocessing (EMDR) therapy for bereaved people showed mixed

results (Lenferink, de Keijser, Smid, & Boelen, 2020b; van Denderen, de Keijser, Stewart, & Boelen, 2018). Inadequate diagnoses can lead to under- or overdiagnosis, which may refrain people who are in need of care to receive adequate treatment. It is thus important to examine to what extent PGD is distinct from PTSD in order to improve indications for the right care.

Accordingly, the first aim of this study was to examine for the first time the factor structure of DSM-5 PTSD in a traumatically bereaved sample. In doing so, we compared the fit of alternative models as described earlier. For PTSD, we hypothesized that the four-factor DSM-5 model (APA, 2013) would fit the data moderately well and that the Anhedonia model (Liu et al., 2014) and Hybrid model (Armour et al., 2015) would yield superior fit (Ashbaugh et al., 2016; Blevins et al., 2015; Bovin et al., 2016; Lee et al., 2019; Specker et al., 2018). Our second aim was to examine the factor structure of PGD DSM-5-TR. The fit of two models were examined. Model 1 is a unidimensional model. Model 2 is a two-factor model with two symptoms (i.e. preoccupation with and longing for the deceased) representing factor 1 and the eight additional symptoms representing factor 2. We hypothesized that the one-factor model would yield the best statistical fit (Boelen & Lenferink, 2020; Prigerson et al., 2021).

Our third aim was to evaluate factor models when combining PGD and PTSD symptoms. The first combined model was a one-factor model in which all PGD and PTSD symptoms loaded onto one factor. The second combined model had PGD and PTSD symptoms loading onto two different factors. In a third combined model, we evaluated a model whereby the PTSD factors (derived from the previous steps) loaded onto a second-order PTSD factor and PGD items loaded on a single factor. Following prior research (Boelen et al., 2010; O'Connor et al., 2010), we expected the third combined model to yield superior fit.

1. Method

1.1. Participants and procedure

Data were collected in the context of two ongoing Dutch studies. The first study examined distress over time in adults who suffered losses in the MH17 plane disaster in Ukraine in 2014 (Lenferink et al., 2017, 2020c; Lenferink, Nickerson, de Keijser, Smid, & Boelen, 2019). Data were used from people completing online measures in February or March 2020 (N = 200). These data have not been included in earlier studies. Participants were recruited along different (not mutually exclusive) pathways: 102 (51.0%) were recruited via participation in prior research (Lenferink et al., 2020c), 71 (35.5%) via the MH17 Disaster Foundation, and 38 (19.0%) via invitation letter sent by the Dutch police, and 19 (9.5%) via other ways.

The second sample included 268 participants, who were recruited in the TrafVic-project examining psychological consequences of losing loved ones in traffic accidents (Boelen et al., 2021; Lenferink, de Keijser, Eisma, Smid, & Boelen, 2020a). Online survey data were collected between December 2018 and December 2019. In total, 219 participants (81.7%) were recruited via Victim Support, 21 (7.8%) via referral by an acquaintance, 21 (7.8%) through social media (e.g. Facebook), and seven participants via other ways (2.6%). The local ethics committee from the University of Groningen approved the studies. All participants provided informed consent.

1.2. Measures

Symptom-levels of DSM-5 PTSD were assessed with the 20-item PTSD Checklist for DSM-5 (PCL-5; Blevins et al., 2015; Van Praag, Fardzadeh, Covic, Maas, & von Steinbüchel, 2020). 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) (e.g. 'In the past month, how much were you bothered by repeated, disturbing, and unwanted memories of the death of your loved due to a traffic accident?'). People meet PTSD criteria when the total score is ≥3 (Bovin et al., 2016) or when they score at least 'Quite a bit' (≥3) on at least one cluster B symptom (item 1–5), one cluster C symptom (item 6–7), two cluster D symptoms (items 8–14), and two cluster E symptoms (items 15–20) (APA, 2013). Item scores were summed to represent a total PTSD score; higher scores indicate higher PTSD levels. Psychometric properties of the PCL-5 are adequate (Blevins et al., 2015; Van Praag et al., 2020). Cronbach's alpha in the current study was .95 for sample 1 and .93 for sample 2.

The items representing the 10 PGD symptoms were assessed with the 22-item Traumatic Grief Inventory-Self Report Plus (TGI-SR+; Lenferink, Eisma, Smid, de Keijser, & Boelen, 2022; see Table S1 in Supplementary Materials). This measure is an extension of the 18-item TGI-SR (Boelen et al., 2018; Boelen & Smid, 2017). Four items were added to the TGI-SR to match recent updates of DSM-5 and ICD-11. 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). People meet diagnostic criteria for PGD when scoring at least 'Often' (≥4) on at least one criterion 1 B symptom (items 1 and 3) and three criterion C symptoms (items, 6, 9–11, 18–19, 21, and the highest answer option on item 2 and 8). The highest answer option for item 2 ('I experienced intense feelings of emotional pain, sadness, or pangs of grief') and 8 ('I felt bitter or angry about the loss') was selected to represent the symptom 'Intense emotional pain (e.g. anger, bitterness, sorrow) related to the death'. Scores on the B and C criterion symptoms were summed to represent total PGD score. Higher total

scores represent higher PGD levels. The TGI-SR+ showed adequate psychometric properties (Lenferink et al., 2022). Cronbach's alpha in the current study was .93 for sample 1 and .92 for sample 2.

1.3. Statistical analyses

To examine differences between the two samples in terms of age (in years), time since loss (in months), mean total score on the PCL-5, and mean score for PGD DSM-5-TR items on the TGI-SR+, independent t-tests were conducted. 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 = deceased is a child or spouse, 1 = other), Chi-square tests were conducted using SPSS.

A series of CFAs was conducted using Mplus (version 8.0, Muthén & Muthén, 1998–2017) to evaluate the dimensionality of DSM-5 PTSD and DSM-5-TR PGD. Table S1 in Supplementary Materials shows the item mapping for the factor models. To increase statistical power, we combined data from the two samples in order to be able to run the combined model including both PGD and PTSD symptoms. Before merging the data of the two samples, we tested the measurement invariance (MI) of the factor structure of the two PGD models and the four PTSD models across the two samples using van de Schoot, Lugtig, and Hox's (2012) guidelines for multigroup CFAs. Testing MI consists of comparing the fit of one model with a more constrained model, using the CONFIGURAL METRIC SCALAR COMMAND in Mplus. First configural invariance was tested (equivalence of factor structure), followed by metric invariance (equivalence of factor loadings), and scalar invariance (equivalence of factor loadings and intercepts). Following prior research (Chen, 2007; Gloster et al., 2021; Putnick & Bornstein, 2016), a difference in CFI value of ≤0.02 and a non-significant χ^2 value ($p > .05$) demonstrated invariance for the more constrained model. However, concerns have been raised about the Chi-square difference test being too strict in favouring less constrained models (van de Schoot et al., 2012). We therefore relied on the difference in CFI values for testing MI.

On the condition that MI was demonstrated, different CFA models were tested, evaluating the distinctiveness of PTSD and PGD in the combined data from both samples. To evaluate model fit, Kline's (2011) recommendations were used. This included evaluating the Comparative Fit Index (CFI) and Tucker Lewis Index (TLI), with values above 0.90 indicating acceptable model fit and values above 0.95 excellent fit. Additionally, root-mean-square error of approximation (RMSEA) with 90% confidence intervals (90% CI) and standardized root-mean-square residual (SRMR) were reported, with values below 0.10 indicating acceptable fit and values below 0.05 excellent

fit. To compare the fit of nested models, the Satorra-Bentler scales Chi-Square test was used, which is recommended (Muthén & Muthén, 2021). Lastly, Akaike, Bayesian, and Sample-Size adjusted Bayesian information criteria (AIC, BIC, and SS-BIC) were compared between models, with lower values indicating better fit. A maximum likelihood restricted estimation method was used. Less than 5% of the data was missing per item. Missing data were accounted for using full information maximum likelihood estimation. Six people from Sample 1 had missing data on all PTSD items; these people were not included in estimating PTSD models including Sample 1 (which is the default option in Mplus).

2. Results

2.1. Participant characteristics

Table 1 shows the characteristics of both samples in terms of gender, age, education, time since loss, kinship to the deceased, and mean scores on summed DSM-5-TR PGD items and DSM-5 PTSD. In Sample 1, most participants lost one ($n = 84$; 42.0%) or two ($n = 58$; 29.0%) loved ones after the plane disaster; 57 participants (28.5%) lost three or more loved ones. One participant did not answer this question. Sixty-six participants (32.8%) lost a sibling, 55 (27.4%) a child, 21 (10.4%) a parent, 9 (4.5%) a spouse, and 49 (24.4%) someone else (e.g. friend or other family member).

In Sample 2, most participants lost one ($n = 247$; 92.2%) or two ($n = 16$; 6.0%) loved ones after a traffic accident; 5 participants (1.8%) lost three or more loved ones. Of all participants, 104 (38.8%) lost a child, 57 (21.3%) a spouse, 37 (13.8%) a parent, 45 (16.8%) a sibling, and 25 (9.3%) another close loved one.

Table 1 displays outcomes of tests of differences between Sample 1 and Sample 2 in terms of gender, age, education, time since loss, kinship to the deceased and mean scores of DSM-5-TR PGD and DSM-5 PTSD. Sample 1 included significantly less women compared to Sample 2. Participants in Sample 1 had a significantly higher level of education. Furthermore, participants in Sample 1 were more likely to be distantly related to the deceased and the loss occurred longer ago than those in Sample 2. Lastly, participants in Sample 1 displayed a significantly lower severity of PGD and PTSD symptoms.

Mean symptom-levels of DSM-5-TR PGD and DSM-5 PTSD fell within subclinical ranges. When applying the diagnostic scoring rule for DSM-5 PTSD, 15 people (7.5%) were identified as probable PTSD cases in Sample 1 and 22 (8.2%) in Sample 2. For PGD, 56 people (28.0%) met probable PGD caseness, using the diagnostic scoring rule as defined by DSM-5-TR (APA, 2020) in Sample 1 and 135 people (50.4%) in Sample 2. Please note that the impairment in daily life criterion was not

Table 1. Participant characteristics of Sample 1 and Sample 2.

Characteristic	Total Sample (N = 468)	Sample 1: Bereaved by plane disaster (N = 200)	Sample 2: Bereaved by traffic accident (N = 268)	Test of difference
Gender (Female), N (%)	325 (69.4%)	124 (61.7%)	201 (75.0%)	$\chi^2(1) = 8.69$, $p = .003$
Age, M (SD)	52.56 (14.06)	53.38 (15.43)	51.95 (12.95)	$t(377) = 1.06$, $p = .292$
Education (University), N (%)	253 (54.1%)	139 (69.2%)	114 (42.5%)	$\chi^2(1) = 34.31$, $p < .001$
Time since loss (years), M (SD)	5.14 (4.62)	5.61 (0.02)	4.79 (6.06)	$t(267) = 2.23$, $p = .027$
Kinship (Deceased is child or partner), N (%)	225 (48.1%)	64 (31.8%)	161 (60.1%)	$\chi^2(1) = 36.16$, $p < .001$
DSM–5-TR PGD levels, M (SD)	29.58 (9.47)	26.96 (9.56)	31.51 (8.95)	$t(466) = -5.32$, $p < .001$
PTSD levels, M (SD)	21.56 (15.89)	19.53 (16.12)	22.91 (15.60)	$t(460) = -2.26$, $p = .024$

PGD = prolonged grief disorder; PTSD = posttraumatic stress disorder.

applied when calculating PTSD and PGD DSM-5-TR caseness.

2.2. Confirmatory factor analysis

2.2.1. Aim 1: PTSD factor models

Table 2 shows the fit indices for the four PTSD models across the two samples. Both the six factor Anhedonia (Liu et al., 2014) and Externalization model (Tsai et al., 2015) demonstrated a better fit than the four factor DSM-5 model (APA, 2013) as evidenced by significant χ^2 difference tests, larger CFI and TLI, and smaller RMSEA, AIC, BIC, and SS-BIC values. Compared to both the Anhedonia (Liu et al., 2014) and the Externalization model (Tsai et al., 2015), the seven factor Hybrid model (Armour et al., 2015) yielded a significant improvement in fit as shown by significant χ^2 difference tests, larger CFI and TLI values, and smaller AIC, BIC, and SS-BIC values. The Hybrid model (Armour et al., 2015) was, therefore, retained. The multigroup CFA demonstrated configural, metric, and scalar invariance for the Hybrid model (Armour et al., 2015) across the two sample as evidenced by ≤0.01 difference in CFI. See Figure 1 for factor loadings of PTSD Hybrid model (Armour et al., 2015) when combining the data of the two samples. All factors of the Hybrid model (Armour et al., 2015) correlated significantly (rs ranged between .49 and .85; see Table S2 in Supplementary Materials).

2.2.2. Aim 2: PGD factor models

Table 2 shows the fit indices for the PGD models in both samples. Both the one-factor and the two-factor model yielded an acceptable fit in the plane disaster sample. Compared to the one-factor model, the two-factor model yielded a slight improvement in fit as evidenced by a significant χ^2 difference test and marginally larger CFI and TLI, and smaller AIC, BIC, and SS-BIC values. The factors of the two-factor model correlated strongly ($r = .88$). For the traffic accident sample, we found an acceptable fit for the one-factor model. The two-factor model did not yield a significantly better fit.

Based on the relatively high correlation between the two factors in the first sample and the lack of improvement of fit of the two-factor model in the second sample, the more parsimonious one-factor model was retained. This one-factor PGD model demonstrated configural, metric, and scalar invariance across the two samples (i.e. ΔCFI ≤ 0.02). Figure 2 shows the factor loadings of the one-factor PGD model when combining the data from the two samples.

2.2.3. Aim 3: combined PTSD and PGD factor models

Table 2 shows the fit indices for the combined models of PTSD and PGD. The 1-factor model did not yield an acceptable fit. The two-factor combined model yielded a significantly better fit than the one-factor model ($\Delta\chi^2 = 155.10$ (Δdf = 1), $p < .001$). The higher-order combined model yielded a better fit than one-factor and two-factor models, as evidenced by significant χ^2 – difference tests (higher-order vs. two-factor: $\Delta\chi^2 = 388.62$ (Δdf = 7), $p < .001$, higher-order vs. one-factor: $\Delta\chi^2 = 614.46$ (Δdf = 8), $p < .001$) larger CFI and TLI values and smaller RMSEA, AIC, BIC, and SS-BIC values. For the higher-order combined model, the CFI value was .90 and RMSEA ≤ .10, representing adequate fit. Other fit indices indicated non-acceptable fit. Table 3 shows the factor loadings of the items of the higher-order combined model. Table 4 shows the Pearson's correlations between the PTSD subscales and PGD. Figures of the three combined models are included in Supplementary Materials Figures S1–S3.

3. Discussion

This is, to the best of our knowledge, the first study evaluating the distinctiveness of PTSD (as defined in DSM-5; APA, 2013) and PGD (as defined in DSM-5-TR; APA, 2020) using CFA. Examining this issue seems particularly relevant in people exposed to a traumatic loss (vs. people exposed to a non-traumatic loss), because they are at risk to experience both PGD and PTSD (Heeke, Kampisiou, Niemeyer, & Knaevelsrud, 2019; Lenferink et al., 2017; Maercker & Znoj, 2010; Simon et al., 2007). Accordingly,

Table 2. Model fit statistics for PGD and PTSD models.

|	χ^2	df	$\Delta\chi^2$	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	SS-BIC	Nested in
PTSD											
Sample 1: Bereaved by plane disaster (N = 194*)											
1. DSM-5	368.61***	164		.890	.873	0.08 (0.07–0.09)	.06	9816.79	10032.47	9823.39	-
2. Anhedonia	283.32***	155	72.84***	.931	.915	0.07 (0.05–0.08)	.05	9721.04	9966.13	9728.54	1
3. Externalization	303.40***	155	60.38***	.920	.902	0.07 (0.06–0.08)	.05	9748.81	9993.90	9756.31	1
4. Hybrid	249.58***	149	2 vs. 4: 32.09***	.946	.931	0.06 (0.05–0.07)	.05	9689.48	9954.17	9697.58	2,3
			3 vs 4: 34.41***								
Sample 2: Bereaved by traffic accident (N = 268)											
1. DSM-5	400.79***	164		.892	.875	0.07 (0.06–0.08)	.06	14428.60	14665.61	14456.35	-
2. Anhedonia	305.03***	155	80.43***	.932	.916	0.06 (0.05–0.07)	.05	14323.90	14593.23	14355.43	1
3. Externalization	349.39***	155	45.93***	.912	.892	0.07 (0.06–0.08)	.06	14378.27	14647.59	14409.80	1
4. Hybrid	279.30***	149	2 vs. 4: 23.12***	.941	.924	0.06 (0.05–0.07)	.05	14301.83	14592.70	14335.88	2,3
			3 vs 4: 57.78***								
Measurement invariance PTSD Hybrid Model (N = 462*)											
Configural	528.14***	298		.943							
Metric	555.26***	311	27.33*	.940							
Scalar	579.44***	324	24.40*	.937							
PGD											
Sample 1: Bereaved by plane disaster (N = 200)											
1. One-factor	95.02***	35		.936	.918	0.09 (0.07–0.12)	.04	5361.94	5460.89	5365.84	-
2. Two-factor	85.38***	34	10.97***	.945	.928	0.09 (0.06–0.11)	.04	5352.35	5454.60	5356.39	1
Sample 2: bereaved by traffic accident (N = 268)											
1. One-factor	88.64***	35		.956	.944	0.08 (0.06–0.10)	.04	6953.86	7061.59	6966.47	
2. Two-factor	85.84***	34	2.78	.958	.944	0.08 (0.06–0.10)	.03	6952.03	7063.35	6965.06	1
Measurement invariance one-factor PGD model (N = 468)											
Configural	183.60***	70		.947							
Metric	198.56***	79	10.83	.945							
Scalar	242.26***	89	46.87***	.929							
Combined PTSD and PGD models (N = 468)											
1. One-factor	2249.04***	405		.754	.736	0.10 (0.10–0.10)	.07	37301.00	37674.37	37388.72	-
2. Two-factor	1789.76***	404	155.10***	.815	.801	0.09 (0.08–0.09)	.06	36750.25	37127.76	36838.95	1
3. Higher-order	1182.74***	397	614.46***	.895	.885	0.07 (0.06–0.07)	.06	36036.61	36443.16	36132.13	1,2

*Six people had missing data on all PTSD items in Sample 1 and were not included in analyses (using the default option in Mplus). AIC = Akaike's information criterion; BIC = Bayesian information criterion; CFI = Comparative Fit Index; CI = confidence interval; df = degrees of freedom; PGD = Prolonged Grief Disorder; PTSD = Post Traumatic Stress Disorder; RMSEA = root-mean-square error of approximation; SRMR = standardized root mean square residual; SS-BIC = Sample-size adjusted information criterion; TLI = Tucker Lewis Index.

we examined the factor structure of PTSD and PGD in a traumatically bereaved sample: 200 people were exposed to deaths of loved ones due to a plane disaster with flight MH17 that occurred five years earlier and 268 people were bereaved by a traffic accident that took place about five years earlier on average. We found that at least one out of four people reported clinically relevant PGD levels and one out of ten met PTSD criteria. These rates are lower compared to prior research. For instance, a meta-analysis shows that about one out of two people bereaved by traumatic loss experience PGD (Djelantik et al., 2020). Another meta-analysis indicates that 49% of people with PGD report comorbid PTSD (Komischke-Konnerup, Zachariae, Johannsen, Nielsen, & O'Connor, 2021). These relatively lower prevalence rates found in our study might be explained by our sample characteristics; our samples experienced the losses relatively long ago (i.e. five years on average) and some losses were more distantly related loved ones. A longer time since loss and losing a more distantly related loved one are associated with lower PGD levels (Djelantik et al., 2020; Heeke et al., 2019).

Our first key aim was to examine the factor structure of PTSD. In line with earlier CFA research in non-bereaved trauma samples (Armour et al., 2016; Ashbaugh et al., 2016; Bovin et al., 2016; Lee et al., 2019; Wang et al., 2017), the seven factor Hybrid model (Armour et al., 2015) had a superior fit compared with the DSM-5 model (APA, 2013), the Anhedonia model

(Liu et al., 2014), and the Externalization model (Tsai et al., 2015) across both samples. The Hybrid model (Armour et al., 2015) consisted of seven factors: a re-experiencing (five symptoms), avoidance (two symptoms), negative affect (four symptoms), anhedonia (three symptoms), externalizing behaviour (two symptoms), dysphoric arousal (two symptoms), and anxious arousal factor (two symptoms). The negative affect factor showed the strongest association with the other PTSD factors and the corresponding items had the lowest factor loadings. Other PTSD CFA studies had similar findings (Lee et al., 2019; Wang et al., 2017). Lee et al. (2019) noted the possibility that the symptoms related to the negative affect factor (e.g. negative feelings and negative beliefs) are non-specific symptoms of general distress, which are prevalent in several other disorders, which may explain the relatively high intercorrelations with other factors as well as the relatively low factor loadings. Notably, the Anhedonia model (Liu et al., 2014) also fits the data well, which is in line with prior PTSD research in non-bereaved samples (Ashbaugh et al., 2016; Blevins et al., 2015; Bovin et al., 2018). While the less parsimonious Hybrid model (Armour et al., 2015) provided the best (based on model fit parameters), questions have been raised about the utility of this model for research and practice. One way to examine this utility would be to evaluate whether these latent factors relate differently to other constructs or respond differently to interventions.
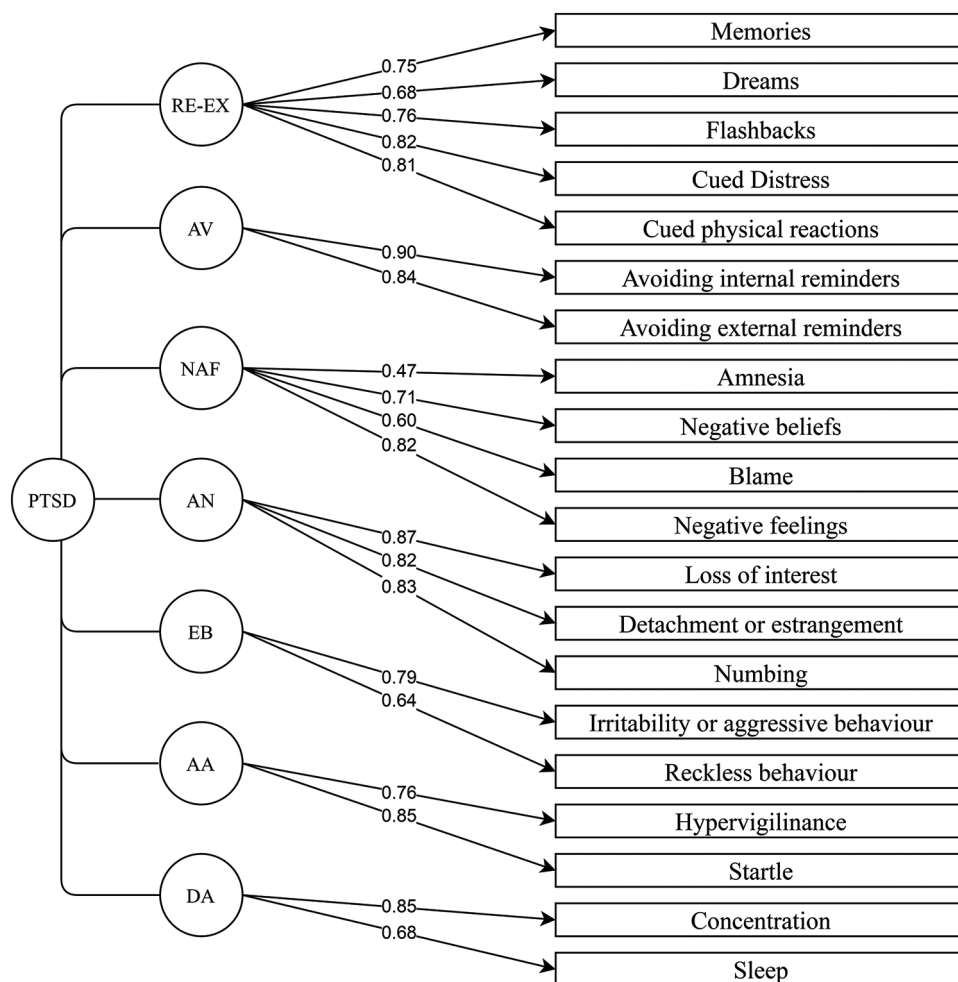
Figure 1. Factor loadings for the Hybrid PTSD model (*N* = 462*). Note: *Six people had missing data on all PTSD items in Sample 1 and were not included in analyses (using the default option in Mplus). AA = Anxious Arousal; AV = avoidance; AN = anhedonia; DA = dysphoric arousal; EB = externalizing behaviour; NAF = negative affect; PTSD = posttraumatic stress disorder; RE-EX = re-experiencing.
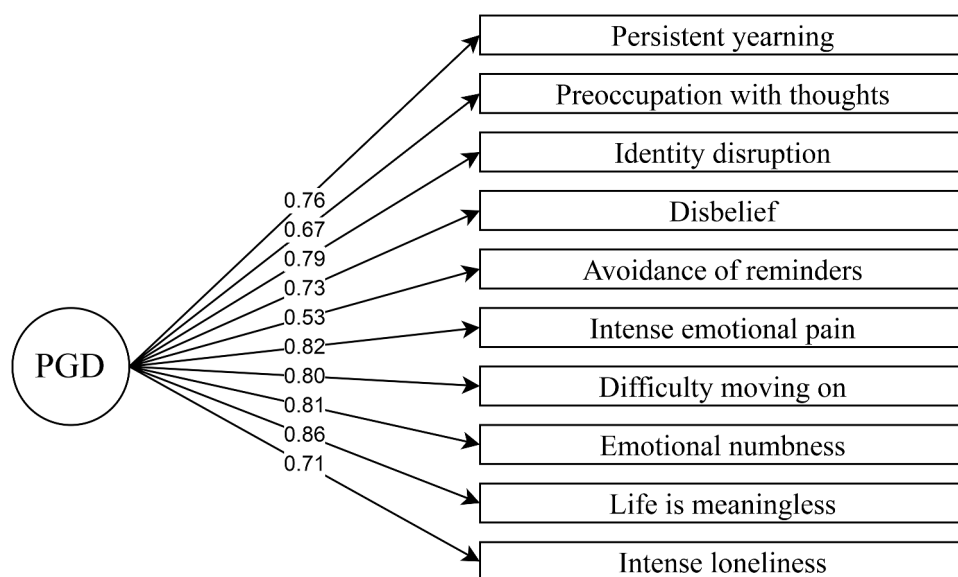
Figure 2. Factor loadings for the one-factor PGD model (*N* = 468). Note: PGD = Prolonged grief disorder.

Prior research in trauma samples has shown mixed results regarding the construct validity of the Hybrid model (Lee et al., 2019; Seligowski & Orcutt, 2016;

Silverstein, Dieujuste, Kramer, Lee, & Weathers, 2018). For instance, one study found associations between the seven PTSD factors and negative affect to vary from

Table 3. Factor loadings for the higher-order combined model (N = 468).

	PTSD RE-EX	PTSD AV	PTSD NAF	PTSD AN	PTSD EB	PTSD AA	PTSD DA	PGD
Memories	.76							
Flashbacks	.68							
Dreams	.76							
Cued distress	.82							
Cued physical reaction	.80							
Avoiding internal cues		.90						
Avoiding external cues		.84						
Dissociative amnesia			.46					
Negative beliefs			.70					
Blame			.61					
Negative feelings			.83					
Loss of interest				.87				
Detachment				.82				
Numbing				.83				
Irritability					.79			
Reckless behaviour					.64			
Hypervigilance						.76		
Startle						.85		
Concentration							.84	
Sleep							.69	
Persistent yearning								.75
Preoccupation with thoughts								.67
Identity disruption								.78
Disbelief								.72
Avoidance of reminders								.54
Intense emotional pain								.81
Difficulty moving on								.81
Emotional numbness								.81
Life is meaningless								.85
Intense loneliness								.73

AA = anxious arousal; AV = avoidance; AN = anhedonia; DA = dysphoric arousal; EB = externalizing behaviour; NAF = negative affect; PGD = prolonged grief disorder; PTSD = posttraumatic stress disorder; RE-EX = re-experiencing.

Table 4. Pearson's correlations among PTSD subscales and PGD (N = 462*).

	PTSD RE-EX	PTSD AV	PTSD NAF	PTSD AN	PTSD EB	PTSD AA	PTSD DA	PGD
PTSD RE-EX		.55	.70	.59	.53	.59	.58	.71
PTSD AV			.56	.52	.47	.39	.39	.50
PTSD NAF				.65	.59	.57	.60	.63
PTSD AN					.61	.54	.67	.70
PTSD EB						.53	.51	.54
PTSD AA							.62	.53
PTSD DA								.60
PTSD								.77

*Six people had missing data on all PTSD items in Sample 1 and were not included in analyses. AA = Anxious Arousal; AV = avoidance; AN = anhedonia; DA = dysphoric arousal; EB = externalizing behaviour; NAF = negative affect; PGD = prolonged grief disorder; PTSD = posttraumatic stress disorder; RE-EX = re-experiencing. All correlations are significant at $p < .001$.

medium to large and those for positive affect from small to medium (Seligowski & Orcutt, 2016). Another study found that some PTSD factors (i.e. externalizing behaviour, dysphoric arousal, and anxious arousal) differentiated meaningfully between indicators of personality and psychopathology, while other factors did not (Silverstein et al., 2018). The construct validity of the Hybrid model (Armour et al., 2015) remains to be studied in bereaved samples. Furthermore, the content validity of the factors of the Hybrid model (Armour et al., 2015) is questionable. Four out of seven factors are represented by two items each. It has been argued that it is unlikely that two items sufficiently capture a construct (Lee et al., 2019). Future research should therefore further examine the utility of the Hybrid, and other PTSD models, for theory, research, and practice.

Our second aim was to examine the factor structure of the newest PGD symptoms as defined in the DSM-5-TR (APA, 2020). In line with prior research (Boelen & Lenferink, 2020; Prigerson et al., 2021), the one-factor model evidenced an acceptable fit across both samples. The two-factor model, with the two separation distress items ('yearning' and 'preoccupation' representing a separate factor) yielded only a significantly better fit in the sample of people who lost loved ones after the MH17 disaster (not in the other traumatically bereaved sample). One earlier study found support for a two-factor model of PGD using slightly different criteria for ICD-11 (Boelen, Lenferink et al., 2018), while others supported a one-factor ICD-11 PGD model (Boelen & Lenferink, 2020; Boelen, Spuij, & Lenferink, 2019; Boelen & Smid, 2017; Killikelly et al., 2020). Future research should further test whether these two factors are meaningfully different or whether PGD should be considered a unidimensional construct.

Our third and final aim was to evaluate the distinctiveness between PGD and PTSD by testing models combining the two syndromes. We found that the higher-order model

combining the one-factor PGD model and the seven-factor Hybrid PTSD model (Armour et al., 2015) fit the data significantly better than a model in which PTSD and PGD loaded onto a single factor and a two-factor model with PTSD and PGD symptoms loading on correlated but distinct factors. Our finding accords with earlier CFA studies, showing that PTSD and PGD loading onto separate, yet correlated, factors had the best fit (Boelen et al., 2010; O'Connor et al., 2010). However, the aforementioned CFA studies found an acceptable fit for their models, while in the current study not all fit indices of the higher-order model were acceptable. 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, we also found that factor loadings of items that corresponded to 'dissociative amnesia' in PTSD and 'avoidance' in PGD symptoms had low factor loading (<.60), but were not removed from the analyses. It cannot be ruled out that removing these items would have improved model fit.

Consistent with earlier CFA findings (Boelen et al., 2010; Geronazzo-Alman et al., 2019; O'Connor et al., 2010), we found that PTSD and PGD factors correlated strongly (r = .82), but the items loaded onto different factors. Strong associations have also been found between disturbed grief and PTSD in other traumatically bereaved samples (for an overview see Heeke et al., 2019), for instance in homicidally bereaved people (i.e. r = .76; Boelen, van Denderen, & de Keijser, 2016), people exposed to disaster/terror attack (i.e. r = ≥ .79 ≤ .88 across four time-points; Lenferink et al., 2019; r = ≥ .57 ≤ .65 across three time-points; Glad, Stensland, Czajkowksi, Boelen, & Dyb, 2021), and internally displaced people (i.e. r = .50; Heeke, Stammel, & Knaevelsrud, 2015). These strong associations may reflect that both factors are fuelled by general factors, such as attachment styles, negative cognitions, and avoidance behaviour (Boelen, Van Den Hout, & Van Den Bout, 2006; Ehlers, 2006; Ehlers & Clark, 2000; Maccallum & Bryant, 2013). Our findings, together with findings from studies examining longitudinal latent symptom trajectories (Lenferink et al., 2020c), network structures (Djelantik, Kleber, Boelen, Smid, & Robinaugh, 2019; Malgaroli, MacCallum, & Bonanno, 2018), latent symptom-profiles (Eisma, Lenferink, Chow, Chan, & Li, 2019; Geronazzo-Alman et al., 2019; MacCallum & Bryant, 2019), and temporal precedence (Lenferink et al., 2019; O'Connor, Nickerson, Aderka, & Bryant, 2015) of disturbed grief and PTSD, indicate that these syndromes are closely related, yet distinguishable. Moreover, strong associations have also been found between other constructs in non-bereaved samples, which have also been considered to differ meaningfully, for instance between PTSD Dysphoric Arousal factor and depression levels (r = .78; Armour et al., 2012), between factors of PTSD and depression (r = ≥ .71 ≤ .87; Grant, Beck, Marques, Palyo, & Clapp, 2008; Kassam-Adams, Marsac, & Cirilli, 2010), and

between factors of major depressive disorder and general anxiety disorder (r = .78; Grant et al., 2008).

Notably, our findings align with dimensional perspectives on psychopathology, including the Hierarchical Taxonomy Of Psychopathology (HiTOP) model (Kotov et al., 2017), which conceptualizes psychopathology as signs and symptoms being organized into increasingly broader syndromes, subfactors, and spectra. Although symptoms of PGD and PTSD following traumatic loss often co-occur, these syndromes do not overlap completely. As such, some people may be predominantly plagued by separation distress and others more by traumatic distress. Accordingly, for some, grief-focused interventions may be particularly indicated and for others trauma-focused interventions may be more suitable. To the extent that traumatic and separation distress are caused by a higher order, trans-diagnostic vulnerability, interventions targeting that vulnerability may be fruitful. Indeed, some studies found evidence that PTSD symptoms are effectively targeted in bereaved people with grief-specific cognitive behavioural therapy (CBT; Na et al., 2021) or a combination of grief-specific CBT plus EMDR (van Denderen et al., 2018). However, other studies did not find support for the effectiveness of these treatment approaches in terms of reductions in PTSD levels from pre-treatment to post-treatment (Boelen et al., 2021; Lenferink et al., 2020b). More research is needed to examine the relative impact of grief-focused and trauma-focused interventions for people with combined PGD and PTSD following traumatic loss.

The current study has several limitations. A first limitation is that data were gathered through self-report measures rather than interviews. This may have biased the results such that symptom-levels may be overestimated. Secondly, data were used from samples who experienced losses because of a plane disaster or traffic accident. It is unknown to what extent our findings generalize to other traumatically bereaved samples, such as homicidally or suicidally bereaved people. A further limitation is that, with our exclusive focus on traumatically bereaved people, we cannot say anything about the factor structure of symptoms among people bereaved by other (non-traumatic) causes. Considering that elevated grief has been linked with traumatic circumstances as well as with maladaptive attachment styles (Maccallum & Bryant, 2013; Prigerson, Vanderwerker, & Maciejewski, 2008; Shear et al., 2011) one important goal for future research would be to compare the factor structure of these constructs between traumatically bereaved and insecurely attached bereaved groups. Such research may also increase knowledge about the pathogenesis of PGD. Lastly, due to our methods (i.e. CFA) and sample composition (i.e. subclinical sample) we were not able to examine the clinical utility of our findings. Research adopting a variety of statistical approaches in clinical and non-clinical samples are needed to further test the clinical utility of distinguishing between these

two syndromes (cf. Lichtenthal et al., 2018; Mauro et al., 2017; Stelzer et al., 2020).

To conclude, to our knowledge, this is the first study evaluating the factor structure of PGD and PTSD in people who experienced traumatic losses and the first focusing on PGD as defined in DSM-5-TR. Our findings indicate that DSM-5-TR PGD is strongly correlated, yet distinct from DSM-5 PTSD.

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Authors contribution

LL designed and conceptualized this study and was responsible for data collection and writing of the manuscript. LL and MvdM conducted the CFAs and wrote the first draft of the manuscript. JdK and PB read and commented on the final version of the manuscript.

Disclosure statement

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Data availability statement

The data that support the findings of this study are available from the corresponding author, [LL], upon reasonable request. The data cannot be made publicly available because of privacy reasons. Syntax/input files for analyses are available, see https://osf.io/3smdw/.

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