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Research paper

# Development and validation of the Aarhus PGD scale for operationalizing ICD-11 and DSM-5-TR TR Prolonged Grief Disorder

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ABSTRACT

*Background:* Prolonged Grief Disorder (PGD) is a new disorder in ICD-11 and DSM-5-TR. There is a need for self-report tools that operationalize PGD in a valid way. The aim of this study was to develop a self-report scale to operationalize ICD-11 and DSM-5-TR PGD, the Aarhus PGD scale (A-PGDs), and assess its validity.
*Method:* A-PGDs was developed collaboratively with clinicians and clients and tested in 349 bereaved adults (225 women). Two months post-loss the survey included demographics, depression, PTSD, anxiety, and PGD-symptoms. The A-PGDs was applied at follow-up three years post-loss. Test-retest was performed with a one-to-two-week interval. Exploratory structural equation modelling was used to test validity and factor structure.
*Results:* Two factors, separation distress (core-symptoms) and emotional distress (associated-symptoms), emerged in the best-fitting model for both ICD-11 and DSM-5-TR. For DSM-5-TR a third factor of antagonistic feelings (bitterness, anger) was identified. Baseline PGD-symptoms predicted core-symptoms, while depression only predicted associated-symptoms. Associated-symptoms was the only factor predicting functional impairment. Test-retest reliability was generally strong ($r \leq 0.59$; $p < .001$) on all A-PGDs items.
*Limitations:* The use of self-report data; three years post loss; a non-clinical bereaved sample.
*Conclusions:* Results indicate two PGD factors of core- and associated-symptoms. The relationship between associated-symptoms and functional impairment may indicate that the presence of these symptoms combined with core-symptoms constitutes disordered grief. Core-symptoms alone may be a part of normal grief. The findings indicate that the A-PGDs is a valid and reliable measure that can be used to operationalize both ICD 11 and DSM-5-TR PGD.

Prolonged Grief Disorder (PGD) is a psychological disorder recently recognized in both the ICD-11 ($PGD_{ICD11}$) and DSM-5-TR ($PGD_{DSM5TR}$) that constitutes a disorder of a debilitating grief reaction following the death of a significant other and persists for at least six months in PGD in ICD-11 (WHO, 2022) and at least 12 months in DSM-5-TR (APA, 2022; Prigerson et al., 2021). These two classifications of PGD include slightly different diagnostic requirements but generally capture the same phenomenon (O'Connor et al., 2019). PGD describes an intense, persistent, and impairing grief response, characterized by core symptoms of separation distress such as longing for and/or preoccupation with the deceased (Lenferink et al., 2022; WHO, 2022). These core symptoms are included in both ICD 11 and DSM-5-TR. PGD contains a second criterion of intense emotional distress but while associated symptoms of intense sadness, emotional numbness, difficulty engaging in social activities, and experiencing that a part of self has died is included in both diagnoses, ICD-11 alone includes symptoms of guilt, blame, troubles accepting the loss, and lack of positive feelings, while DSM-5-TR alone includes loneliness, avoidance, meaningless, and bitterness (APA, 2022; Lenferink et al., 2022; WHO, 2022). In both diagnoses this intense grief reaction must lead to functional impairment and clearly exceed the grief

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reaction expected given the person's social, cultural, or religious context (APA, 2022; Prigerson et al., 2021; WHO, 2022). All symptoms outlined in each diagnostic definition are presented in supplementary materials, Table 1. It is estimated that probable PGD affects approximately 7–10 % of bereaved adults (Kersting et al., 2011; Lundorff et al., 2017). There has been much attention on PGD in recent years because PGD-symptoms repeatedly has been shown to increase the risk for functional impairment, suicidality, psychiatric comorbidity, poor health behaviors, and somatic complaints (Prigerson et al., 2009).

It is pertinent to identify people with clinically relevant levels of PGD symptoms because there is now convergent evidence of evidence-based interventions for PGD (Bryant et al., 2014; Shear et al., 2005; Shear et al., 2016) and for new diagnostic categories, such as PGD, supportive diagnostic material is especially needed. The development of validated scales for operationalizing PGD is therefore wanted. During the last decades, several attempts were made to develop scales and interviews that detect PGD (Bui et al., 2015; Mauro et al., 2019; Mauro et al., 2017; Prigerson et al., 2009; Prigerson et al., 1995). These instruments mostly capture earlier definitions of PGD with acceptable accuracy (Boelen and Smid, 2017) but use somewhat varying definitions of PGD, with different, often arbitrary, recommended cut-off points. Recently, the PG-13 revised (PG13r) has been developed for the $PGD_{DSM5TR}$ (Prigerson et al., 2021) and the International Prolonged Grief Disorder Scale for the ICD-11 (IPGDS) is available for the $PGD_{ICD11}$ (Killikelly et al., 2020). Only one scale, the Traumatic Grief Inventory Self Report + (TGI-SR+), captures both diagnostic definitions (Lenferink et al., 2022). These scales are important resources that enable clinicians and researchers to screen for PGD, but have slightly different foci. The PG13r is a relatively brief scale and captures $PGD_{DSM5TR}$ only (Prigerson et al., 2021). The PG-13 was revised into PG-13-r based on advanced analysis of three large samples but is not yet validated in its present form in a new sample (Prigerson et al., 2021; Vang et al., 2022). The IPGDS is a validated scale that includes a focus on cultural differences in PGD, but captures $PGD_{ICD11}$ only (Killikelly et al., 2020). The TGI-SR+ is validated in its revised form and although it is missing an item for estimating if the grief reaction is clearly exceeding expected social, cultural or religious norms is it a promising scale as it is developed with a background in $PGD_{DSM5TR}$ but is also able to capture $PGD_{ICD11}$ (Lenferink et al., 2022). All three scales are based on items and scoring formats either from the original Inventory of Complicated Grief (Prigerson et al., 1995) or subsequently adapted versions of this scale. As such, these scales are still based on a top-down approach that is informed by high-level planning and

**Table 1**
Items included in the Aarhus Prolonged Grief Disorder Self-Report Scale for ICD 11 and DSM 5 Tr PGD (The Aarhus PGD-scale).

| | |
|---|---|
| Think of the name of the person you lost on the blank lines in the questions below (_____) and answer the questions in relation to your loss.<br>Each item is scored according to the following scale:<br>1) Not at all, 2) A little, 3) To some extent, 4) Very much, 5) Overwhelmingly) | |
| Item no. | Item formulation |
| 1. | Have you longed for _____ during the past month? |
| 2. | Have you during the past month found yourself preoccupied with thoughts of _____ even when you did not want to be thinking about them? |
| 3. | Have you had feelings of sadness or sorrow during the past month? |
| 4. | Have you felt guilty during the past month? |
| 5. | Have you felt angry during the past month? |
| 6. | During the past month, has it been hard for you to believe that _____ is dead? |
| 7. | Have you blamed yourself for your loss during the past month? |
| 8. | During the past month, have you had trouble accepting that _____ is dead? |
| 9. | During the past month, have you felt that you have lost a part of yourself? (e.g. feeling as though a part of you has died) |
| 10. | During the past month, have you been unable to experience positive emotions? |
| 11. | During the past month, have you felt emotionally numb? (e.g. having difficulties with feeling emotions as you used to do, being emotionally stunned) |
| 12. | Have you had difficulty engaging in social or other activities during the past month? |
| **13.** | Have you felt loneliness during the past month? |
| **14.** | During the past month, have you tried to avoid reminders that _____ is dead? (e.g. avoiding certain thoughts, feelings, places, music, conversation topics, etc. or keeping yourself constantly going) |
| **15.** | During the past month, have you felt that life is meaningless since _____ has died? |
| **16.** | Have you felt bitterness during the past month? |
| 17. | Overall, have these difficulties led to a decline in your level of functioning? (i.e,. your ability to function in everyday life) |
| If you answered "A little / (2)" or higher to question 17, have you then experienced this every day or almost every day? Yes/no<br><br>17a. Does this apply in relation to your work/study/daily tasks? Yes/No<br>17b. Does this apply to your social life? Yes/No<br>17c. Does this apply to your family life/domestic obligations? Yes/No<br>17d. Does this apply to other areas than those mentioned? Yes/No | |
| 18) Have any of your acquaintances expressed concern about your grief reaction? (e.g., that they feel that it exceeds what they consider normal in relation to your social, cultural or religious norms). Yes/no | |
| 19) Are you worried about your own grief reaction, including that it is more severe or intense than you expected? (e.g., compared to the people you surround yourself with or what you think is normal). Yes/no | |
| 20) Would you say that you felt this way during the last 6 months? (Pleaser answer this question in relation to your total response to the questions above). Yes/no | |

Grey: only ICD-11. Bold: only DSM-5-TR. No marking: symptoms included in both ICD-11 and DSM-5-TR.

decision-making by experts in the field and based on measures for PGD as defined before the release of ICD-11 and DSM-5-TR. Only one of the studies aimed at evaluating the potential temporal stability of PGD (Lenferink et al., 2022). However, there was a 6-month time span between the two tests. As grief symptoms are likely to fluctuate over time, this time span may challenge the validity of this re-test. Taken together, validated scales for $PGD_{ICD11}$ and $PGD_{DSM5TR}$ are available, but there is a need for scales than operationalize all ICD-11 and DSM-5-TR PGD symptoms that are based on a bottom-up approach which includes detailed experience by bereaved people and clinicians in the scale development process rather than item formulations from scales used for previous definitions of PGD.

Both $PGD_{ICD11}$ and $PGD_{DSM5TR}$ assume a division of PGD into core symptoms (separation distress) and associated symptoms (emotional distress) which translates into an assumption of a two-dimensional factor structure. Most previous studies rely on exploratory factor analysis (EFA) and generally support a unidimensional structure of PGD (Boelen et al., 2019; Killikelly et al., 2020; Lenferink et al., 2022). Studies on $PGD_{DSM5TR}$ mostly relied on EFA but frequently identified two or three-factor models of $PGD_{DSM5TR}$ that corresponded in a meaningful way to PGD core symptoms of separation distress and associated symptoms of emotional distress (Boelen and Lenferink, 2021; Boelen et al., 2019; Lenferink et al., 2022). The factor structure of PGD needs to be more fully investigated in the development of scales for PGD that assess both ICD-11 and DSM-5-TR definitions.

The aim of the current study was to develop a self-report scale for operationalizing both $PGD_{ICD11}$ and $PGD_{DSM5TR}$, The Aarhus PGD scale (A-PGDs) and to assess the validity and reliability of this new scale.

## 1. Method

The development of a psychometric scale should ideally follow certain steps to ensure high reliability, as well as high internal and external validity (Boateng et al., 2018; Pedhazur and Schmelkin, 1991). First, the domains of the test should initially be identified and the items formulated (Boateng et al., 2018). It is important to include qualitative data from the target population and clinicians to ensure the content validity of the final scale (Patrick et al., 2011). Content validity can be ensured by testing the new scale against an existing measure of the phenomenon in question (Holland et al., 2009; Ito et al., 2012). The scale scores should then be evaluated for their psychometric properties, with a sufficient-sized sample. For scale validation studies using factor analysis on clinical samples a sample size of 250–350 participants is recommended, and at least 300 participants are recommended for general samples but the design and complexity of the scale must be taken into consideration here (White, 2022).

We in the present study we aimed at following these steps to create a brief, simply-worded measure for PGD focusing only on the symptoms included in $PGD_{ICD11}$ and $PGD_{DSM5TR}$ and that employs straightforward diagnostic rules for probable PGD, as well as a continuous measure of PGD-symptom severity. To ensure high clinical utility and avoid unwanted spill-over from previous scales and item formulations, we aimed to construct this scale with a bottom-up approach that was based on the formulations of symptoms in the two current diagnostic manuals and included qualitative input from focus groups of clinicians and bereaved people with experience with PGD symptoms.

The development of the A-PGDs included the following steps:

The A-PGDs is developed in close collaboration between scientists, clinicians, and bereaved participants at the Traumatic Stress Clinic in Sydney (last author) and Unit for Bereavement Research, Denmark (first author). First, an initial set of items were developed based on the description of the PGD symptoms in the ICD-11 and DSM-5-TR, a review of the items of previous PGD scales (Ito et al., 2012; Prigerson et al., 2009), as well as a series of discussions between the first and last author of this paper on potential formulations for all 16 symptoms in ICD 11 and DSM 5-TR PGD. This work was used for a beta draft of the Aarhus PGD-scale with one item for each of the 16 PGD symptoms and a Likert-scale scoring format with two alternatives; One anchored in symptom intensity (participant rated their response as; *Not at all*, *A little*, *To some extent*, *Very much*, *Overwhelmingly*) and one with a frequency–based response format (*Never*, *At least once*, *At least once a week*, *At least once a day*, *Several times a day*).

To ensure clinical applicability we then had a panel consisting of six clinicians with considerable experience treating PGD from the Traumatic Stress Clinic (Sydney) rate the items, evaluate item formulations, and assess the proposed response formats in an open discussion format. This evaluation was performed in two rounds and the scale was adopted accordingly after both rounds. Based on these discussions that converged on the conclusion that intensity was a more clinically relevant dimension than frequency, we chose to use a 5-point Likert scale item scoring based on intensity rather than frequency. These descriptors also correspond to the scoring strategy of the WHO disorders specifically associated with stress that focus on intensity/how much respondents are bothered by symptoms in place of how frequently symptoms occur (WHO, 2022).

To ensure that the wording was meaningful and accessible to bereaved adults we then tested the comprehensibility and correct interpretation of each proposed item of the scale in a focus group of bereaved adults with symptoms of PGD from Unit for Bereavement Research in Denmark using an open discussion format. The focus group was recruited through a clinical PGD study (Johannsen et al., 2022) and consisted of five adults who had experienced spousal bereavement and had clinically relevant levels of PGD-symptoms (i.e., clinical cut-off-point on PG-13 $\geq$ 25). The group included three women and two men (age 58–72 years; mean = 65.5 years), who had lived together with their partners for 19–55 years (mean = 41.1 years) before the loss. Their PG-13 total score ranged between 27 and 42 (mean = 34). We used a back translated Danish version of the A-PGDs. Item wording of the A-PGDs was slightly adjusted based on feedback from the open discussions in the focus group. The group preferred items that referred directly to the name of the deceased instead of a general reference to 'the deceased' as seen in previous scales. We therefore included a blank line for the name of the deceased where relevant. We then adjusted the wording of the items for maximal clinical utility in a panel of Danish psychiatric researchers and clinicians, also in two rounds of open discussion. Finally, we used all the information we had gathered to optimize and finalize a total of 20 A-PGDs items for a simple and comprehensible wording. The A-PGDs was developed and tested in Danish. An English back translation of the A-PGDs is presented in Table 1.

A novel aspect of this study is the use of exploratory structural equation models (ESEM). Previous research has documented high factor-correlations between core- and associated dimensions of PGD (e.g., $r = 0.87$) and cross-factor loadings of non-trivial size (ranging from 0.32 to 0.43) (Vang et al., 2022). The presence of non-trivial cross-factor loadings might bias estimates of model fit using CFA (Marsh et al., 2014) and the restrictive assumptions of items loading solely on one factor in CFA may artificially inflate factor correlations to account for correlated residual variance in observed items. Hence, in this study ESEM was used which is an analytical technique that combines the strengths of exploratory (multiple factor loadings) and confirmatory (model falsification) approaches (Marsh et al., 2014) by including covariates in estimating the dimensionality of the construct in question.

The A-PGDs was included in an ongoing survey of grief reactions in a representative population study, The Aarhus Bereavement Study (e.g., Harris et al., 2021). These data were used to test of the operationalization of the most optimal factor structure of PGD for both $PGD_{ICD11}$ and $PGD_{DSM5TR}$ using the A-PGDs. To assess content validity, the A-PGDs was compared against another established measure of PGD, the PG13r (Prigerson et al., 2021). Concurrent validity was established in relation to other types of complicated grief reactions such as depression, PTSD, and generalized anxiety as measured at T6. In recognition of the documented fluctuations in grief symptoms (Stroebe and Schut, 2010), test-

retest data was established through repeated testing relatively shortly after the first response (one-to-two weeks) (Boateng et al., 2018). This time-point was chosen in an attempt to balance out the risk of potential memory bias from the first response to the second against the fluctuating nature of grief reactions over time. Finally, we tested the latent structure of $PGD_{ICD11}$ and $PGD_{DSM5TR}$. In line with the most recent research using similar methods (Vang et al., 2022), we expected that two factor models of PGD including one factor of core symptoms of separation anxiety and another consisting of associated symptoms of emotional distress would provide a good fit for the data, but as existing research is both sparse and equivocal, we tested competing models for this group of symptoms.

### 1.1. Scale validation

We recruited participants from The Aarhus Bereavement Study (TAB Study) which used extractions from the Danish Civil Registration System containing information on all individuals aged 18 or older, who lost a spouse and lived in the metropolitan area of the city of Aarhus in Denmark (Harris et al., 2021). Potential participants received a condolence letter one month post-loss, followed by a phone interview two months after bereavement in which they were invited to participate in the study. The adult children of the bereaved spouses were also invited to participate (Lenferink and O'Connor, 2023). All participants provided written informed consent and received questionnaires either via postal or online mail at several time-points after the bereavement starting in 2018. Data on the A-PGDs was introduced in the sixth data-wave approximately three years post-loss. In total, 349 participants (response rate 93 % of those invited, 20 cases deleted due to >50 % numbers of missing values) completed the Aarhus PGD-scale. At retest 264 of these completed the A-PGDs. In the included responses at both time points the frequency of missing values was very low (<2 %). No action was taken to replace these as exploratory structural equation models (ESEM) used for testing the A-PGDs account for missing values. Missing values in the remaining dataset were handled with expectation maximation algorithms as described in earlier publications on the TABstudy data (Harris et al., 2021; Vang et al., 2022). Demographic and mental health information were collected at baseline (two months after loss). To estimate concurrent validity we used the PCL-5 for PTSD (Ashbaugh et al., 2016), for depression CES-D (Björgvinsson et al., 2013), and for generalized anxiety the GAD-7 (Spitzer, 2007). For content validity we used another measure of PGD, here the PG-13r (Prigerson et al., 2021).

### 1.2. Data analyses

The dimensional structure and construct validity of the Aarhus PGD-scale was analyzed using ESEM for both $PGD_{ICD11}$ and $PGD_{DSM5TR}$. Competing models of the dimensional structure of PGD were tested based on theoretical models supported in existing literature. Model 1 was a unidimensional model of PGD previously supported as an adequate representation the latent structure using other measures of PGD (Pohlkamp et al., 2018; Prigerson et al., 2009). Model 2 was a two-factor model representing a distinction between core- and associated PGD symptomatology as proposed in the ICD-11 and DSM-5-TR. This model has previously been supported in a study of the dimensional structure of PG-13 using confirmatory factor analysis (CFA) (Vang et al., 2022). Model 3 was a three-factor model based on previous research that supported a division of symptomatology into factors representing separation distress, traumatic distress, and reorientation/identity among a traumatically bereaved sample (Sveen et al., 2020). Finally, model 4 represented a four-dimensional model as an explorative model that allowed for the integration of models 2 and 3. Fig. 1 in the supplementary materials illustrates the principle for model tests.

For the current study, demographics including age, gender, educational attainment, and relation to the deceased, were included as predictors of the latent variables of PGD in the ESEM. To test content validity, we included scores on depression, anxiety, PTSD, and prolonged grief as correlates of A-PGDs scores all measured at wave six (three years post-loss). These are all well-established risk factors for PGD (Wittouck et al., 2011) and therefore can be used for concurrent validity estimates (Boateng et al., 2018). Here, the factor of core-symptoms of present PGD is expected to correlate particularly with core symptoms of a previous measure of PGD whereas associated symptoms of present PGD are expected to correlate higher with previous depression, anxiety, and PTSD. Functional impairment was included in the ESEM as an outcome of the latent variables.

The model-fit of ESEM-models was evaluated using the same principles as CFA. First, appropriateness of the model was assessed, in which the dimensional structure is a meaningful representation of the theoretical construct purportedly measured, and second, statistical fit that can be used to reject models based on inadequate fit to the sample data (Byrne, 2016). A standard range of model fit indices were used to assess fit in stage 1 and stage 2 including incremental, absolute and parsimony-corrected fit-statistics. The Comparative Fit Index (CFI, Bentler, 1990) and Tucker-Lewis Index (TLI, Tucker and Lewis, 1973) were used as incremental fit indices to estimate the proportionate improvement in fit of a hypothesized model compared to a restricted baseline model. Values $\geq$0.90 and $\geq$0.95 reflect acceptable and excellent model fit, respectively. Absolute fit indices included the chi-square test ($\chi^2$), Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR, Jöreskog and Sörbom, 1993).

Models with a Root Mean Square Error of Approximation (RMSEA, Jöreskog and Sörbom, 1993) values below $\leq$0.08 and $\leq$0.05 reflect acceptable and excellent model fit, respectively. Previously, differences in RMSEA values of 0.015 have been taken to reflect meaningful differences between models (Chen, 2007). SRMR values below $\leq$0.05 reflect a well-fitting model (Byrne, 2016). Finally, the Bayesian Information Criterion (BIC, Schwarz, 1978) was the absolute fit index used to compare the relative fit of the models. Previous research found that a difference of 10 or more points lower on the BIC indicating superior model fit (Raftery, 1995). Both RMSEA and BIC-indices award more parsimonious models as they include a score-penalty that increases as number of parameters increase. Models were estimated using robust maximum likelihood in Mplus version 8.1 (Yuan and Bentler, 2000). Due to the a priori uncertainty of the structure of the scale, test-retest reliability was assessed at item-level using Pearson's *r*.

## 2. Results

The sample characteristics are reported in Table 2.

Table 3 displays mean scores and standard deviations for the A-PGDs items and test-retest stability coefficients. The highest mean scores were reported for the core-symptoms of intense longing and preoccupation. Cronbach's alpha for $PGD_{ICD11}$ was 0.88 and Cronbach's alpha for DSM-5-TR PGD was 0.90. In the re-test 264 of the sample (76 %) responded to the A-PGDs. Evidence for test-retest reliability was generally strong ($p <$ .001) with large correlations between items across test and retest ($r \geq$ 0.59). There was a tendency for test-retest stability was to be higher for items loading onto the core-symptom cluster of ICD-11 PDG (apart from self-blame) and DSM-5 PGD ($r \geq$ 0.72) compared to the associated symptom clusters ($r \geq$ 0.59).

### 2.1. Factor structure and validity of A-PGDs for operationalizing $PGD_{ICD11}$

Table 4 displays the fit statistics for competing models of $PGD_{ICD11}$.

Overall, incremental and absolute fit-statistics indicated a continuous improvement in model fit as number of latent dimensions increased. While model 1 displayed overall unacceptable fit statistics, model 2 to 4 all displayed acceptable levels of error with SRMR and RMSEA-values <0.08. Only model 4 displayed acceptable fit according to both the CFI and TLI, however, the BIC indicated that the increased

**Table 2**
Demographic information of the sample.

| | | Full sample ($N$ = 349) |
|---|---|---|
| Gender, *n* (%)* | Men | 62.51 (14.04) |
| | Women | 122 (35) |
| Age, mean (*SD*) | | 225 (64.5) |
| Highest level of education, *n* (%) | Primary school | 50 (14.3) |
| | High school or vocational training | 11 (3.3) |
| | Vocational training | 89 (25.5) |
| | Continuing education | 38 (10.9) |
| | University | 147 (42.1) |
| | *Missing* | *14 (4)* |
| The primary source of income, *n* (%) | Salary | 138 (39.5) |
| | Pension | 184 (52.7) |
| | Support from the government (e.g., unemployment benefits, sickness benefits, social security, state education grant) | 8 (2.3) |
| | Other | 9 (2.6) |
| | *Missing* | *10 (2.9)* |
| Relationship to deceased | Partner to deceased | 237 (67.9) |
| | Child of deceased | 110 (31.5) |
| | *Missing* | *2 (0.6)* |
| Anxiety (T1/T6) | | 4.50 (4.55)/ 2.51 (3.29) |
| Depression (T1/T6) | | 9.03 (5.82)/ 6.40 (4.70) |
| PTSD (T1/T6) | | 13.28 (11.90)/ 7.65 (8.44) |
| PGD (T1/T6) | | 24.38 (8.61)/ 15.33 (5.75) |

* Two cases were missing gender information.

precision did not outweigh the disadvantages of increasing complexity (Δ14.2). The lowest BIC-value was found for model 3 that generally outperformed model 2 in terms of fit statistics (BIC Δ-12.6) whereas model 2 displayed acceptable fit across all indicators apart from the CFI and TLI that was bordering on acceptable. Differences in RMSEA values were as small as to suggest equivalence between the models (Δ0.010) and hence, models 2 and 3 were selected for further inspection.

Table 5 displays factor loadings for ICD-11 of models 2 and 3. Factor 1 was comprised of core-symptoms of grief (PGD1 (longing) and PGD2 (preoccupation)) displaying the strongest loadings on the factor, that was also characterized by specific symptoms of emotional distress including disbelief (PGD6), difficulty accepting the loss (PGD8), self-blame (PGD7), lost part of self (PGD9) and sadness (PGD3). More severe grief-symptomatology and PTSD-symptomatology at T1 predicted variability in factor 1. As detailed in Table 5, the second factor was primarily characterized by symptoms of apathy/numbness (PGD11), anhedonia (PGD10), associability (PGD12), and sadness (PGD3). Factor 2 was predicted by PTSD and anxiety at baseline, and only factor 2 was related to functional impairment (see supplementary materials for details). The factors were correlated at $r = 0.49$, $p < .001$ in the two-factor model, and $r = 0.46$, $p < .001$ in the three-factor model.

Table 5 also shows that the pattern and magnitude of factor loadings was maintained in the three-factor model that also included a third factor characterized by disbelief, self-blame, and difficulty accepting the loss. Factor 3 was uncorrelated with factor 1 and moderately correlated with factor 2 ($r = 0.39$, $p = .021$), and uncorrelated to all predictor variables apart from educational attainment. Factor 2 remained the only factor predictive of functional impairment in the three-factor model. As the division into core- and associated symptomatology presupposes an association between the clusters, the two-factor model provided the most parsimonious and most theoretically meanings full model for

**Table 3**
Mean scores, standard deviations and stability of The Aarhus PGD-scale items.

| Item | | Test | | Retest | | |
|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | r |
| Pgd1 | Longing | 2.81 | 1.06 | 2.59 | 1.07 | 0.79*** |
| Pgd2 | Preoccupation | 2.38 | 1.05 | 2.04 | 0.98 | 0.72*** |
| Pgd3 | Sad | 2.10 | 0.91 | 1.86 | 0.88 | 0.66*** |
| Pgd4 | Guilt | 1.44 | 0.69 | 1.29 | 0.60 | 0.59*** |
| Pgd5 | Anger | 1.42 | 0.65 | 1.35 | 0.59 | 0.61*** |
| Pgd6 | Disbelief | 1.84 | 1.02 | 1.56 | 0.88 | 0.78*** |
| Pgd7 | Self-blame | 1.25 | 0.57 | 1.20 | 0.52 | 0.60*** |
| Pgd8 | Difficulty accepting | 1.72 | 0.97 | 1.59 | 0.87 | 0.75*** |
| Pgd9 | Lost part of myself | 1.66 | 0.92 | 1.54 | 0.85 | 0.76*** |
| Pgd10 | Anhedonia | 1.55 | 0.85 | 1.39 | 0.73 | 0.60*** |
| Pgd11 | Apathy/numb | 1.47 | 0.77 | 1.31 | 0.63 | 0.68*** |
| Pgd12 | Asocial | 1.75 | 1.03 | 1.50 | 0.81 | 0.63*** |
| **Pgd13** | Loneliness | 2.08 | 1.08 | 1.91 | 0.95 | 0.73*** |
| **Pgd14** | Avoidance | 1.31 | 0.67 | 1.19 | 0.51 | 0.68*** |
| **Pgd15** | Meaningless | 1.41 | 0.78 | 1.36 | 0.71 | 0.82*** |
| **Pgd16** | Bitterness | 1.27 | 0.54 | 1.24 | 0.53 | 0.64*** |

Note: Range: 1–5. Grey: only ICD-11. Bold: only DSM-5-TR. No marking: symptoms included in both ICD-11 and DSM-5-TR.

**Table 4**
Fit statistics for ESEM analyses of The Aarhus PGD-scale.

| Model | $Chi^2$ (df) | *p* | CFI | TLI | RMSEA (90 % CI) | SRMR | BIC |
|---|---|---|---|---|---|---|---|
| ICD-11 PGD | | | | | | | |
| Model 1 | 622.09 (161) | <.001 | 0.754 | 0.722 | 0.092 (0.085–0.100) | 0.078 | 9318.13 |
| Model 2 | 369.74 (141) | <.001 | 0.878 | 0.843 | 0.069 (0.061–0.078) | 0.054 | 9124.83 |
| Model 3 | 264.88 (122) | <.001 | 0.924 | 0.886 | 0.059 (0.049–0.069) | 0.046 | **9112.19** |
| Model 4 | 182.11 (104) | <.001 | 0.958 | 0.927 | 0.047 (0.036–0.059) | 0.029 | 9126.39 |
| DSM-5-TR | | | | | | | |
| Model 1 | 535.05 (161) | <.001 | 0.802 | 0.776 | 0.083 (0.075–0.091) | 0.072 | 9091.50 |
| Model 2 | 324.14 (141) | <.001 | 0.903 | 0.875 | 0.062 (0.053–0.071) | 0.049 | 8948.15 |
| Model 3 | 214.52 (122) | <.001 | 0.951 | 0.927 | 0.048 (0.037–0.058) | 0.038 | **8921.69** |
| Model 4 | 132.79 (104) | .030 | 0.985 | 0.973 | 0.029 (0.010–0.042) | 0.024 | 8932.59 |

Note: Model 1 is the 1-factor ESEM model. Model 2 is the two factor ESEM-model. Model 3 is the three factor ESEM model. Model 4 is the four factor ESEM model. The BIC values marked in bold refers to the best fitting model for the data

**Table 5**
Factor loadings and structural relationships of the two- and three-factor ESEM-model of ICD-11 PGD.

| Item loadings | | Model 2 | | | | Model 3 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | F1 | | F2 | | F1 | | F2 | | F3 | |
| | | λ | p | Λ | p | λ | p | λ | P | λ | p |
| 1 | Longing | **0.82** | <.001 | -0.01 | .678 | **0.87** | <.001 | 0.01 | .586 | -0.08 | .347 |
| 2 | Preoccupation | **0.84** | <.001 | -0.08 | .228 | **0.84** | <.001 | -.05 | .384 | -0.01 | .753 |
| 3 | Sad | **0.21** | .007 | **0.60** | <.001 | **0.22** | .007 | **0.64** | <.001 | -0.11 | .406 |
| 4 | Guilt | 0.12 | .336 | **0.43** | .001 | 0.08 | .559 | **0.40** | .002 | 0.17 | .377 |
| 5 | Anger | -0.09 | .469 | **0.49** | <.001 | -0.11 | .444 | **0.46** | <.001 | 0.12 | .493 |
| 6 | Disbelief | **0.74** | <.001 | 0.07 | .662 | **0.71** | <.001 | -.02 | .699 | **0.40** | <.001 |
| 7 | Self-blame | **0.35** | .001 | 0.14 | .343 | **0.29** | .038 | 0.06 | .612 | **0.41** | .001 |
| 8 | Difficulty accepting | **0.72** | <.001 | 0.10 | .527 | **0.68** | <.001 | 0.01 | .751 | **0.43** | <.001 |
| 9 | Lost part of myself | **0.47** | <.001 | **0.34** | <.001 | **0.45** | <.001 | **0.35** | <.001 | 0.04 | .752 |
| 10 | Anhedonia | -0.02 | .788 | **0.73** | <.001 | -0.03 | .582 | **0.74** | <.001 | 0.00 | .999 |
| 11 | Apathy/numb | 0.01 | .894 | **0.81** | <.001 | -0.02 | .591 | **0.81** | <.001 | 0.07 | .510 |
| 12 | Asocial | -0.01 | .941 | **0.67** | <.001 | 0.01 | .658 | **0.76** | <.001 | -0.28 | .049 |
| **Structural relations** | | F1 | | F2 | | F1 | | F2 | | F3 | |
| | | β | p | β | p | β | p | β | P | β | p |
| **Predictors** | | | | | | | | | | | |
| Gender | | 0.03 | .585 | -0.08 | .164 | 0.05 | .336 | -.07 | .162 | -0.09 | .289 |
| Age | | 0.15 | .091 | 0.08 | .441 | **0.17** | .042 | 0.08 | .438 | -0.08 | .553 |
| Education | | -0.13 | .029 | -0.04 | .490 | -0.09 | .097 | -.05 | .435 | **-0.18** | .035 |
| Relation | | -0.15 | .052 | -0.06 | .552 | -0.14 | .072 | -.06 | .527 | -0.02 | .882 |
| Depres. | | 0.08 | .095 | 0.09 | .107 | **0.11** | .033 | 0.08 | .126 | -0.11 | .215 |
| Anxiety | | 0.07 | .434 | **0.25** | .007 | 0.10 | .289 | **0.24** | .009 | -0.09 | .560 |
| PTSD | | **0.25** | .011 | **0.22** | .041 | **0.19** | .023 | **0.23** | .036 | 0.27 | .092 |
| Grief | | **0.23** | .001 | 0.09 | .244 | **0.25** | <.001 | 0.09 | .245 | -0.05 | .721 |
| **Outcome** | | | | | | | | | | | |
| Funct. Imp. | | -0.02 | .853 | **0.69** | <.001 | -0.01 | .992 | **0.75** | <.001 | -0.18 | .247 |

Note: Significant loadings at $p \geq .05$ is highlighted in bold. Highest factor loading per items is highlighted by a grey slot. λ = standardized factor loading. β = standardized beta value. Model 2: Factors are correlated at r = 0.49, $p < .001$. Free parameters = 67
Model 3: Factor are correlated at F1 with F2 = 0.46, $p < .001$, F1 with F3 = 0.11, $p < .618$, F2 with F3 = 0.39, $p = .021$. Free parameters = 86.

$PGD_{ICD11}$ and was retained over the three-factor model as the additional factor was unrelated to core-symptomatology of grief (factor 1) and other mental health outcomes at baseline.

### 2.2. Factor structure and validity of the Aarhus PGD-scale for operationalizing $PGD_{DSM5TR}$

Table 4 also displays the fit statistics for competing models of $PGD_{DSM5TR}$. Overall, incremental- and absolute fit-statistics indicated a continuous improvement in model fit as number of latent dimensions increased. Like the ICD-11 models, model 1 displayed overall unacceptable fit statistics, whereas models 2 to 4 all displayed acceptable levels of error with SRMR and RMSEA-values < 0.08. Only models 3 and 4 displayed acceptable fit according to both the CFI and TLI. The BIC indicated that the increased precision gained in model 4 was on the verge of outweighing the disadvantages of increasing complexity (ΔBIC 10.9) whereas ΔRMSEA = −0.019 indicated a significant improvement in the four-factor model along with all other fit statistics, so both models 3 and 4 were inspected further. Upon inspection, the four-factor model presented with similar problems as observed for the three-factor ICD-11 model. Specifically, the additional fourth factor was uncorrelated with all other factors, and the more parsimonious three-factor model was therefore chosen as the final model. Factor loadings and multivariate relationships to predictors and outcomes for the four-factor model is displayed in the supplementary materials.

Table 6 displays factor loadings of DSM-5-TR. Factor 1 was

comprised of core-symptoms of grief (PGD1 and PGD2) and was also characterized by disbelief (PGD6), feeling like having lost part of oneself (PGD9) and meaningless (PGD15). Furthermore, factor 1 was predicted by higher age, and scores were lower among those who had lost a partner (see supplementary materials for details). Only grief symptomatology at T1 predicted variability in this factor out of the mental health outcomes. Factor 2 was primarily characterized by associability (PGD12), sadness (PGD3), apathy/numbness (PGD11), loneliness (PGD13), avoidance (PGD14), and secondarily by feeling like having lost part of oneself (PGD9), and meaninglessness (PGD15, see Table 6). Overall, this factor was only predicted by anxiety and depression at T1, and was the only factor to predict functional impairment. Finally, factor 3 was primarily characterized by bitterness (PGD16) and anger (PGD5) and was scored higher among men and lower educational attainment.

## 3. Discussion

The aim of this study was to develop the Aarhus PGD scale and to operationalize the factor structure of $PGD_{ICD11}$ and $PGD_{DSM5TR}$. Overall, tests of the dimensionality of the A-PGDs aligned with both ICD-11 and DSM-5-TR for a division of PGD into core- and associated symptomatology. For $PGD_{ICD11}$ a two-factor structure that corresponded to a first factor resembling the core requirements of separation distress (longing for and/or preoccupation with the deceased) and a second factor of associated symptoms of emotional distress (including numbness, anhedonia, lack of sociability, sadness, anger, and feelings of guilt and loosing part of oneself) was the best fit for the data. Factor 1 was predicted by grief levels at baseline (two months post loss), but this was not the case for factor 2. Factor 2 alone was predicted by anxiety at baseline. Functional impairment was predicted by factor 2 alone. Both factors were predicted by PTSD at baseline. This may be explained by the fact that the PTSD-scale was answered referring to the loss and therefore closer related to (normal) grief, than anxiety and depression. Comparably, other internalizing disorders such as anxiety and depression were not directly related to the core requirement of symptoms of separation distress, but rather to a more general state of distress as seen in factor 2.

For $PGD_{DSM5TR,}$ a three-factor model was the best fit. The first factor included the core symptoms of grief (longing and preoccupation). The second factor of associated symptoms was characterized by emotional distress as exemplified by sadness, feeling like having lost part of oneself, apathy/numbness, lack of sociability, loneliness, avoidance, and meaninglessness. Overall, only factor 2 was predicted by depression which underlines the concurrent validity of the scale. Finally, a third factor emerged that was characterized by antagonistic feelings such as also anger and bitterness. This factor was predicted by male gender and lower educational attainment. Antagonistic feelings such as bitterness and anger are common in relation to grief and trauma (Boelen et al., 2016; Speckens et al., 2007) but has received little attention in recent bereavement research. Bitterness is only included in $PGD_{DSM5TR}$. Embitterment can be defined as a chronic and pervasive state of intense resentment, and may be one of the most destructive and toxic of human emotions (Znoj, 2011). It is hypothesized that long-term mismanagement anger can lead to bitterness (Brodbeck et al., 2019). Therefore, the two symptoms of PGD, anger and bitterness, may be closely related as seen in factor 3 in $PGD_{DSM5TR}$. Being the target of anger and bitterness is often experienced as very unpleasant. This may lead to that other people avoid contact with the 'embittered bereaved'. Isolation and loneliness in a time of separation distress and need for a sense of security may therefore be a true risk for the 'embittered bereaved'. The identification of this antagonistic symptom-factor in PGD leads to the suggestion that there may be subtypes of PGD still not discovered in present literature. Future studies should test these potential suggestions.

For both $PGD_{ICD11}$ and $PGD_{DSM5TR}$ only factor 2, characterized by associated symptoms of emotional distress, predicted functional impairment while factor 1 including core symptoms of separation distress did not. The results indicate that core symptoms of separation distress are common and central for PGD as well as for normal grief reactions. This makes sense as separation distress is often painful but still can be considered a part of normal grief and do not necessarily contribute to impairment (Bowlby, 1980). That is, the findings indicate that grief as exemplified in high scores on the separations distress factor may not in itself be impairing. It is only when symptoms of emotional distress in factor 2 are involved, that grief become disordered, with functional impairment and predicted by other internalizing mental disorders such as depression. This accords with results from network analyses that suggest associated symptoms of emotional distress to be a central factor of PGD that drives other symptoms (Robinaugh et al., 2016).

Finally, evidence for the test-retest reliability for symptoms of grief was generally strong with large correlations between items across time especially in regards to core symptoms. As grief fluctuates, also when it is disordered, some variation in PGD is expected, even over a course of 1–2 weeks. However, the results indicated a tendency towards greater stability for symptoms of separation distress (core-symptoms) regardless of whether operationalized using ICD-11 or DSM-5-TR requirements and less so for associated symptoms. Hence, while associated symptomatology was still considered relatively stable, these findings may indicate a tendency towards more fluctuation over time in associated symptoms. Factor 2 including associated symptoms is also the factor most strongly related to functional impairment, and therefore encourage optimism regarding the opportunity to target these symptoms with relevant interventions.

**Table 6**
Factor loadings and structural relationships of the three-factor ESEM-model of DSM-5-TR PGD.

| Item loadings | | Model 3 | | | | | |
|---|---|---|---|---|---|---|---|
| | | F1 | | F2 | | F3 | |
| | | Λ | p | λ | p | λ | p |
| 1 | Longing | **0.77** | <.001 | 0.13 | .212 | -0.02 | .469 |
| 2 | Preoccupation | **0.83** | <.001 | -0.00 | .993 | 0.01 | .850 |
| 3 | Sad | 0.17 | .099 | **0.67** | <.001 | -0.02 | .727 |
| 5 | Anger | -0.14 | .183 | 0.22 | .115 | **0.45** | <.001 |
| 6 | Disbelief | **0.60** | <.001 | -0.01 | .826 | **0.33** | <.001 |
| 9 | Lost part of myself | **0.37** | <.001 | **0.38** | <.001 | 0.14 | .188 |
| 11 | Apathy/numb | -0.01 | .636 | **0.66** | <.001 | 0.19 | .145 |
| 12 | Asocial | -0.07 | .570 | **0.78** | <.001 | -0.04 | .622 |
| 13 | Loneliness | 0.15 | .147 | **0.65** | <.001 | 0.03 | .636 |
| 14 | Avoidance | 0.13 | .084 | **0.34** | .002 | 0.21 | .079 |
| 15 | Meaningless | **0.31** | .001 | **0.32** | .003 | **0.28** | .005 |
| 16 | Bitterness | 0.01 | .572 | 0.00 | .992 | **0.93** | <.001 |
| **Structural relations** | | F1 | | F2 | | F3 | |
| | | β | p | β | p | β | p |
| **Predictors** | | | | | | | |
| Gender | | 0.06 | .257 | -0.04 | .513 | -0.16 | .003 |
| Age | | 0.18 | .039 | 0.10 | .324 | -0.10 | .328 |
| Education | | -0.11 | .076 | 0.04 | .483 | -0.17 | .003 |
| Relation | | -0.17 | .037 | -0.10 | .269 | -0.06 | .526 |
| Depression | | 0.10 | .053 | 0.12 | .046 | -0.01 | .886 |
| Anxiety | | 0.07 | .428 | 0.26 | .006 | 0.10 | .321 |
| PTSD | | 0.17 | .051 | 0.17 | .127 | 0.36 | .010 |
| Grief | | 0.26 | <.001 | 0.13 | .075 | -0.03 | .781 |
| **Outcome** | | | | | | | |
| Funct. Imp. | | -0.08 | .476 | 0.71 | <.001 | 0.07 | .496 |

Note: Significant loadings at $p \geq .05$ is highlighted in bold. Highest factor loading per items is highlighted by a grey slot. λ = Standardized factor loading. β = Standardized beta value. Model 5: Factor are correlated at F1 with F2 = 0.39, $p = .001$, F1 with F3 = 0.26, $p = .001$, F2 with F3 = 0.46, $p < .001$.

### 3.1. Strengths and limitations

This study profited from a rigorous, bottom-up approach in the development of the scale including both qualitative and quantitative methods, a sufficiently large sample with longitudinal data points

including relevant long-term predictors, test-retest data within a close time-frame, and the test of concurrent validity trough association with known psycho-pathological correlates. The use of exploratory structural equation modelling allowed us to detect multiple sources of multi-dimensionality relevant to the construct in question. Notably, we did as well as relying on fit information when determining the best fitting model, we also inspected factor loadings, factor correlations, and overall factor structure that was in line with existing theory and diagnostic entities for PGD. This study also had several limitations. Firstly, this study relied on self-report data from a non-clinical sample of adults who experienced spousal or parental loss. Self-report data may result in over-reporting of PGD symptoms. The A-PGDs should ideally be tested in clinical samples with more diverse types of loss and be compared to data from structured clinical interviews for PGD. Similarly, replication studies in larger samples are warranted. Secondly, although several established predictors were assessed longitudinally in this study, it is likely that there were other relevant predictors which were not included. Future research should address these issues. Finally, the data on A-PGDs is a part of a large ongoing longitudinal study and was restricted to responses collected two months and three years post loss. While this design allows for investigating predictors for PGD longitudinally, studies on the A-PGDs including larger variations in time since loss, especially data-points closer to the death than three years, may be relevant considering the six and twelve-month time requirement in ICD-11 and DSM-5-TR accordingly.

## 4. Conclusion

The results of the present study indicate a structure of PGD that supports the division of PGD into core- and associated symptoms as seen in both ICD-11 and DSM-5-TR. This finding is in line with the diagnostic constructs of PGD and recent research results. However, the results indicated that a 'simple' factor structure of both ICD-11 and DSM-5-TR PGD was not realistic as some items loaded on more than one factor. Methods such as ESEM are necessary to capture such complex relationships between items included in the identified factors. The relationship between associated symptoms of emotional distress and functional impairment may indicate that the presence of these symptoms in combination with core symptoms of separation distress are what constitute disordered grief. The results indicate that core symptoms alone may be a part of normal grief. Taken together the findings indicate that the Aarhus PGD Scale is a valid and reliable measure that can be used to operationalize ICD 11 and DSM-5-TR PGD.

## Preregistration

This study is a part of a larger study (The TABstudy) and was not preregistered individually.

## CRediT authorship contribution statement

Maja O'Connor (MOC), Maria Louison Vang (MV), Mark Shevlin (MS), Ask Elklit (AE), Katrine B. Komischke-Konnerup (KK), Marie Lundorff (ML), and Richard Bryant (RB).

MOC was responsible for the organization and coordination of the trial. MOC and RAB were the chief investigators and MV was responsible for the data analysis. MOC, MV, and RAB developed the trial design. All authors contributed to the writing of the final manuscript and contributed to the management or administration of the trial.

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## Declaration of competing interest

All authors declare that there are no conflicts of interest in relation to the submitted paper.

## Data availability

Due to restrictions on data sharing stipulated by The General Data Protection Regulation (GDPR) the EU organization that has tightened the data protection rules. To protect participant privacy according to The General Data Protection Regulation these data can therefore unfortunately not be made available.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jad.2023.09.022.

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