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A systematic review and meta-analysis of correlates of prolonged grief disorder in adults exposed to violent loss

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ABSTRACT

Background: Violent loss (i.e. loss through homicide, suicide, or accident) is associated with high levels of prolonged grief disorder (PGD).
Objective: The current meta-analysis aims at identifying correlates of PGD in adults exposed to violent loss.
Method: We conducted a systematic literature search in PsycINFO, PsycARTICLES, PubMed, Web of Science, and Scopus. We used the Pearson correlation coefficient r as an effect size measure and a random effects model was applied to calculate effect sizes.
Results: Thirty-seven eligible studies published between 2003 and 2017 ($N = 5911$) revealed 29 potential correlates. Most studies used a cross-sectional design. Analyses revealed large significant effect sizes for comorbid psychopathology ($r = .50$–$.59$), suicidality ($r = .41$, 95% confidence interval [CI] [.30; .52]), and rumination ($r = .42$, 95% CI [.31; .52]), while medium effect sizes were found for exposure to traumatic events and factors concerning the relationship to the deceased. Small effect sizes emerged for sociodemographic characteristics, multiple loss, physical symptoms, and religious beliefs. Ten variables did not show a significant association with PGD. Heterogeneity and a small number of studies assessing certain correlates were observed.
Conclusions: The associations with psychological disorders may indicate shared mechanisms of psychopathology. Moreover, we recommend that clinicians carefully assess suicidal ideation among individuals with PGD who have been exposed to violent loss. Further research is warranted using longitudinal study designs with large sample sizes to understand the relevance of these factors for the development of PGD.

Una revisión sistemática y metanálisis de los correlatos de duelo prolongado en adultos expuestos a pérdidas violentas

Antecedentes y objetivos: La pérdida violenta (ej. pérdida por homicidio, suicidio, accidente) está asociada con niveles elevados de trastorno por duelo prolongado (PGD, por sus siglas en inglés). El objetivo del metanálisis actual es identificar los correlatos del PGD en adultos expuestos a pérdidas violentas.
Método: Condujimos una búsqueda sistemática de literatura en PsycINFO, PsycARTICLES, PubMed, Web of Science y Scopus. Usamos el coeficiente r de correlación de Pearson como medición del tamaño del efecto de la muestra y se aplicó el modelo de efectos aleatorios (REM) para calcular los tamaños del efecto.
Resultados: Treinta y siete estudios elegibles publicados entre el año 2003 y 2017 (N=5911) revelaron 29 correlatos potenciales. La mayoría de los estudios usaron un diseño transversal. Los análisis revelaron tamaños del efecto significativamente grandes para comorbilidad psicopatológica (r= .50-.59), suicidalidad (r=. 41, 95% IC[.30; .52]) y rumiación (r=.42, [.31; .52]), mientras que los tamaños del efecto medianos fueron encontrados para exposición a eventos traumáticos y factores concernientes a la relación del deceso. Los tamaños del efecto pequeños emergieron en las características sociodemográficas, pérdidas múltiples, síntomas físicos y creencias religiosas. Díez variables no mostraron una asociación significativa con PGD. Se observó heterogeneidad y un número pequeño de estudios que evalúan ciertos correlatos.
Conclusiones: Las asociaciones con trastornos psicológicos podrían indicar mecanismos compartidos de psicopatología. Además, recomendamos que los clínicos evalúen cuidadosamente la ideación suicida entre los individuos con PGD que han estado expuestos a pérdidas violentas. Son necesarias investigaciones futuras usando diseños de estudio longitudinales con muestras de tamaño grandes para comprender la relevancia de estos factores para el desarrollo del PGD.

HIGHLIGHTS
• The first systematic review of correlates of PGD in survivors of violent loss.
• The systematic literature search identified 37 studies and revealed 29 correlates.
• Large effect sizes were found for comorbid psychopathology, suicidality and rumination.
• Results are relevant in the light of the inclusion of PGD in the forthcoming ICD-11.

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关于经历暴力丧亲的成人中延长哀伤障碍的相关变量的系统综述和元分析

背景与目的：暴力（即，通过杀人、自杀、意外）丧亲与严重的延长哀伤（PGD）有关。本元分析旨在确定经历暴力丧亲的成年人中PGD的相关变量。

方法：我们在PsycINFO，PsycARTICLES，PubMed，Web of Science和Scopus进行了系统的文献检索。我们使用Pearson相关系数r作为效应大小测量，并且应用随机效应模型（REM）来计算效应大小。

结果：2003年至2017年期间发表的37项符合条件的研究（N = 5911）显示了29项潜在的相关变量。大多数研究使用横截面设计。分析显示共病精神病（r = .50 - .59），自杀（r = .41,95％CI [.30; .52]）和反刍（r = .42, [.31; .52]）有显著的大效应量，同时发现暴露于创伤事件和与死者关系的因素有中等效应量。社会人口学特征，多次丧亲，身体症状和宗教信仰出现了小的效应量。十个变量没有显示出与PGD的显著相关。我们还发现研究的异质性和只被少数研关注的某些变量。

结论：PGD与心理障碍的关联可能表明共同的精神病理学机制。此外，我们建议临床医生仔细评估暴露于暴力丧亲的PGD患者的自杀意念。需要进行大样本的纵向研究来进一步了解这些因素和PGD症状发展的相关性。

1. Introduction

Violent loss has been defined as the loss of a significant other through homicide, suicide, or accident, and also includes deaths due to natural disasters, terrorism, or warfare (Rynearson, 2006). Violent death is often perceived as preventable, and may impede the survivors' search for reasons and meaning, or induce them to assign blame to others or themselves (Rynearson, 2006). Individuals exposed to violent loss often perceive lack of recognition or stigmatizing social attitudes, which may aggravate the process of adjustment (Feigelman, Gorman, & Jordan, 2009). Grieving a violent death may therefore be different from grieving a non-violent death, and evidence indicates that losing someone by violent means is associated with a greater risk of developing adverse mental health outcomes, in particular prolonged grief disorder (PGD) (Burke & Neimeyer, 2013; Schaal, Jacob, Dusingizemungu, & Elbert, 2010).

PGD has been defined as a maladaptive reaction to the loss of a significant other. It is marked by persistent separation distress and is combined with cognitive, emotional and behavioural symptoms (e.g. difficulty accepting death, sadness, guilt) resulting in functional impairment for at least 6 months following loss (Prigerson et al., 2009; WHO, 2018). PGD was not included as distinct clinical entity in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). Instead, it was included as 'persistent complex bereavement disorder', as a condition for further study (American Psychiatric Association, 2013). The International Classification of Diseases, 11th revision (ICD-11), on the other hand, included PGD as clinical disorder in June 2018 (Maercker et al., 2013; WHO, 2018). A recent meta-analysis including 14 population-based studies found a PGD prevalence rate of 9.8% among adults exposed to non-violent bereavement (Lundorff, Holmgren, Zachariae, Farver-Vestergaard, & O'Connor, 2017). Evidence suggests higher PGD prevalence rates among those exposed to violent loss compared to those exposed to non-violent loss (Currier, Holland, Coleman, & Neimeyer, 2008; Schaal et al., 2010), yet no meta-analysis exists that measures this rate.

Two previous non-systematic literature reviews provide an overview of potentially relevant factors associated with PGD among adults exposed to violent loss (Hibberd, Elwood, & Galovski, 2010; Kristensen, Weisaeth, & Heir, 2012). The authors identified female gender, a close relationship to the deceased, multiple loss, self-blame, social support, and waiting for death confirmation as risk factors and correlates for PGD.

1.1. Previous research on risk factors and correlates of PGD

Based on the literature among survivors of violent loss, we will give an overview of potentially relevant risk factors and correlates for PGD. Findings on the association of gender with PGD have been mixed: while some studies found women to be at higher risk of PGD (Morina, Rudari, Bleichhardt, & Prigerson, 2010; Neria et al., 2007), others did not find an association when other trauma- and loss-related variables were statistically controlled for (Schaal et al., 2010; Stammel et al., 2013). Some studies showed that a higher educational level was associated with lower PGD severity (Dyregrov, Nordanger, & Dyregrov, 2003; Neria et al., 2007).

Several studies in survivors of violent loss indicate that grief symptoms decrease as time goes by (Heeke, Stammel, & Knaevelsrud, 2015; Schaal et al., 2010). Loss of a closely related family member was associated with more severe grief reactions than the loss of a distantly related family member, indicating that the emergence of PGD is associated with the relationship to the person lost (Neria et al., 2007; Stammel et al., 2013). Multiple loss is frequent in contexts of war, terrorism, or accidents, and has been linked to more

severe grief in some studies (Mercer & Evans, 2006; Stammel et al., 2013).

Violent death may evoke visual images of the deceased's final minutes, and cognitions about what he or she must have gone through (Baddeley et al., 2015; Smid et al., 2015). Survivors may subsequently engage in avoidance of these intrusive images. Several authors report high comorbidities with post-traumatic stress disorder (PTSD) (Morina, von Lersner, & Prigerson, 2011; Schaal, Dusingizemungu, Jacob, Neuner, & Elbert, 2012). Depression and anxiety have likewise been considered as comorbid with PGD (Morina, 2011; Neria et al., 2007).

In line with cognitive theories of grief, several studies investigated the impact of cognitive interpretations of the loss on PGD outcomes and found global negative beliefs and negative assumptive worldviews to be associated with PGD (Boelen, de Keijser, & Smid, 2015; Mancini, Prati, & Black, 2011). This suggests that the subjective interpretation of the loss may play a role in the development of PGD. Rumination has been defined as repetitive thinking about negative emotions and a focus on their causes, meanings, and consequences (Nolen-Hoeksema, 1991). Anecdotal evidence from grief-related case studies indicates that survivors of violent loss may be more likely to engage in ruminative thoughts about the deceased's death or what the survivor could have done to prevent this from happening (Higson-Smith, 2014; Smid et al., 2015; Wagner, Knaevelsrud, & Maercker, 2005). Morina (2011) furthermore reported an association between rumination and PGD.

Research suggests that a greater extent of social support may function as a protective factor against the development of PGD (Burke, Neimeyer, & McDevitt-Murphy, 2010; Hibberd et al., 2010). However, survivors also report stigma and insensitive reactions pointing to a potentially harmful social environment (Feigelman et al., 2009; Peters, Cunningham, Murphy, & Jackson, 2016).

1.2. Objectives

To date, researchers and clinicians have relied on individual study findings to describe the association of a variable with PGD. To obtain an overview of the diverse studies published in the field, a synthesis of the evidence has an advantage over interpreting single-study results owing to increased statistical power and precision (Borenstein, Hedges, Higgins, & Rothstein, 2009). Meta-analyses have been referred to as the 'gold standard' for synthesizing and summarizing individual study results (Head, Holman, Lanfear, Kahn, & Jennions, 2015).

The primary aim of the present study is to identify potential correlates for PGD after violent loss through a systematic review. Secondly, we aim to quantify the magnitude of the relationship between potential correlates and PGD through a meta-analysis. Thirdly, we evaluate the quality of included studies.

2. Method

The systematic review and meta-analysis were conducted in accordance with recommendations from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberati, Tetzlaff, Altman, & The Prisma Group, 2009). The protocol was pre-registered in PROSPERO in November 2016 (registration no. CRD42016050470).

2.1. Inclusion criteria

We included quantitative studies that investigate correlates for PGD in adults (≥ 18 years) who had lost a significant other to violent death. From studies that included both violent and non-violent loss, only those in which at least 70% of the participants had lost a significant other to violent loss were included. Correlates were defined as any variable that contributed to variability in prolonged grief in terms of symptom severity or diagnostic status. We focused our analysis on validated instruments that specifically assessed complicated or prolonged grief reactions, rather than general extent of grief (Tomita & Kitamura, 2002). We provide a list of included and excluded PGD instruments in Appendix A. Except for standard sociodemographic data, we excluded those factors from our analysis that were only assessed with qualitative interviews, non-validated questionnaires, or single-item questions. We excluded articles if they met any of the following criteria:

- studies focusing on conditions other than PGD [e.g. bereavement-related depression, major depressive disorder (MDD), PTSD]
- single-case and intervention studies
- studies with professionals (e.g. nurses, firemen) or patient samples
- studies that recruited participants on the basis of a specific comorbid psychiatric disorder (e.g. MDD, PTSD) or physical condition (e.g. HIV/ AIDS, Alzheimer's disease)
- studies that included non-adult participants (< 18 years) or unfitting types of loss (job loss, pet loss) in the same comparison group as adults who experienced violent loss
- studies that did not provide sufficient data to calculate effect sizes.

Since PGD instruments apply diverse time criteria (e.g. 2, 6, and 14 months) (Bui et al., 2015; Horowitz et al., 1997; Prigerson et al., 2009, 1999), we did not specify exclusion criteria for time since loss. However, owing to the importance of the 6 month time criterion for the PGD conceptualization in ICD-11, we carried out sensitivity analyses which included only those studies that apply the 6 month criterion to measure the robustness of the effect sizes. Results can be accessed in Appendix B.

2.2. Identification and selection of studies

Journal articles, books, book chapters, and dissertations, published and unpublished, in the English or German language between 1980 and 31 December 2017 were considered for inclusion. We originally searched databases until August 2016, but repeated the search in December 2017 to look for new articles that had been published in the meantime. The following databases were searched: PsycINFO, PsycARTICLES, PubMed, Web of Science, and Scopus. Search terms for the databases were: *prolonged grief, traumatic grief, complicated grief, pathological grief, persistent complex bereavement disorder* OR (*grief* AND (*risk* OR *predict** OR *predisposition*)). In addition, a snowball search system was employed to identify relevant studies by manually searching reference lists of initially included articles (Lipsey & Wilson, 2001). Our search strategy resembles the PICOS (population, intervention/exposure, comparator, outcome, study design) approach (World Health Organization, 2014) and is therefore presented in Appendix C in terms of the PICOS system as well.

2.3. Screening procedure

Two authors (CH, CKa) decided on the inclusion or exclusion of each study. In case of disagreement, consensus was reached by discussion. We screened 25% of the full texts independently, chosen based on computerized randomization. Interrater reliability was calculated using Cohen's kappa for categorical variables (Orwin, 1994).

2.4. Coding and data extraction

Manuscripts reporting analyses from the same data set were included if they reported effect size estimates for different correlates. If a correlate was repeatedly reported in different studies on the basis of the same or an overlapping data set, we used the article with the largest sample size or the most comprehensive article (Borenstein et al., 2009). If estimates of subscales and the whole scale were reported, only the association of the overall score with PGD was used. Meta-analyses were conducted for those correlates that were measured in at least two studies. Where a study reported both continuous (symptom severity) and categorical (diagnosis) estimates of a correlate, we used the effect size for PGD symptom severity because of the statistical advantages of continuously measured variables (Borenstein et al., 2009). In case of longitudinal data, we used the data that were closest to the 6 month criterion for PGD.

2.5. Effect size calculation

Pearson's correlation coefficient r was used as a measure of effect size (Borenstein et al., 2009). Effect sizes of $.1 \geq r < .25$ are considered as small, $.25 \geq r < .4$ as medium, and $r \geq .4$ as large (Cohen, 1988).

2.6. Meta-analytical procedure

A random effects model (REM) was used to calculate effect sizes. The assumption for the REM is that the true effects differ between sample groups in different studies, and differences in effect size may not only be attributed to random error inherent in each study (Borenstein et al., 2009). To identify and quantify this heterogeneity, we used the Q-statistic and the I^2 index (Borenstein et al., 2009; Crombie and Davies, 2009). Q determines the conformity to the normal distribution of effect sizes. A significant value ($p < .05$) indicates heterogeneity. I^2 is an estimate of the ratio of true heterogeneity in the observed variation, with a score ≤ 25 indicating low heterogeneity, 50 moderate heterogeneity, and ≥ 75 high heterogeneity (Borenstein et al., 2009; Higgins & Thompson, 2002). Moderate to high levels of heterogeneity may lead to difficulties in the interpretation of the mean effect size, and possible moderators contributing to the heterogeneity should be examined (Borenstein et al., 2009; Higgins & Green, 2011). In cases of heterogeneity, subgroup analyses were performed. At least 10 studies should be available for each subgroup analysis (Higgins & Green, 2011). All subgroup analyses were conducted using mixed effects analysis. Subgroups were based on the quality of the study, the type of loss studied, and the means of data assessment (interview or questionnaire).

2.7. Quality assessment/risk of bias

Quality assessment was performed using an adjusted list based on Standards for Reporting of Diagnostic Accuracy Studies (STARD) (Bossuyt et al., 2015). To increase the applicability of the tool to all types of studies, items on the STARD list were selected on the basis of recommendations from a review on tools for quality assessment (Shamliyan, Kane, & Dickinson, 2010). Items were rated as 'high risk of bias' (score = 0), 'low risk of bias' (score = 2), or 'unclear' (score = 1) (Higgins et al. (2011). An overall score of

< 10 indicated low quality, a score of ≥ 10 and < 13 indicated medium quality, and a score of ≥ 13 indicated high quality. The individual item-based ratings can be found in Appendix D. Two authors (CH, CKa) independently rated the studies. In case of disagreement, consensus was reached by discussion. The interrater reliability was calculated using Cohen's kappa for categorical variables (Orwin, 1994).

2.8. Publication bias

Publication bias is defined as the selective publication of studies with significant or positive results (Rothstein, Sutton, & Borenstein, 2005). It can lead to an overestimation of effects, because non-significant findings are less likely to be published. The presence of publication bias was measured using Egger's regression test (Egger, Smith, Schneider, & Minder, 1997). A significant finding would indicate publication bias. Duval and Tweedie's (2000) trim-and-fill procedure computes the number of presumably missing studies and produces an effect size estimate that is corrected for bias. At least six studies per correlate and a homogeneous data set are required to measure publication bias (Sterne & Egger, 2005). The difference between original and corrected effect size was tested for significance by examining whether the original fell within the confidence limits of the bias-corrected effect size estimate (Niemeyer, Musch, & Pietrowsky, 2013).

All analyses were performed using the Comprehensive Meta-Analysis software (Biostat, 2011).

3. Results

3.1. Description of the studies

Figure 1 displays the selection process and reasons for study exclusion. Interrater reliability for the full-text screening was substantial (κ = .76) (Landis & Koch, 1977). Thirty-seven studies fulfilled the inclusion criteria. Twelve publications were based on overlapping data sets associated with five individual studies. The systematic review therefore comprised 30 original studies. The 12 publications based on overlapping data sets were still included because they reported effect size estimates for different correlates. The 30 original data sets comprise a total sample size of N = 5911 people (excluding control groups).

From the 30 original studies, n = 13 studies (43.3%; n = 2245, 38.0% of total study participants) referred to an individual homicide, suicide, or accident, whereas 17 studies (56.7%; n = 3666, 62% of total study participants) were conducted with participants who had lost a significant other mainly due to collective violence (war, terrorism, natural disaster, collective accidents). Two studies only provided estimates for correlates, which were not examined in any other study (Kristensen, Tonnessen, Weisaeth, & Heir, 2012; Neimeyer & Burke, 2011); hence, these studies were not included in the quantitative synthesis. Characteristics of the studies included in the meta-analysis are displayed in Table 1.

3.2. Quality assessment

Out of 37 studies, nine studies (24.3%) showed low quality, 15 (40.5%) showed medium quality, and 13 (35.1%) showed high quality (Table 1). The majority of all studies stated research questions, eligibility criteria, source of the recruited sample, basic sociodemographic/clinical characteristics, and study limitations. However, several of the low- and medium-quality studies did not clearly state the setting of data assessment, did not specify how missing data were handled, or did not perform a power calculation. Only seven studies used random sampling or approached the entire population. The individual item-based ratings are presented in Appendix D. The interrater reliability was high (κ = .84) (Landis and Koch (1977).

3.3. Correlate effect size estimates

The main results of the meta-analyses for each correlate are displayed in Table 2. Twenty-nine correlates were examined by at least two studies across the 37 studies published between 2003 and 2017. Only five correlates (17.2%) were examined in more than 10 studies, demonstrating that only a limited number of variables is routinely assessed. Altogether, 19 correlates showed significant associations with PGD. Four sociodemographic variables showed a small association with PGD (gender, education, employment, having another child born after a loss, or having remaining children). Four sociodemographic variables did not show an association with PGD (marital status, ethnicity, age, and income). Heterogeneity was a minor problem among sociodemographic characteristics and age was the only correlate to display significant heterogeneity.

Among factors associated with the death and the deceased, only the relationship to the deceased showed a significant association with PGD (r = .38; 95% confidence interval [CI] [.23; .53]): having lost a closely related person (partner, parent, child, or sibling) was associated with more severe PGD compared to having lost a distantly related person. For time since loss, the combined effect size of seven studies did not reach significance (r = −.15; 95% CI [−.30; .01]). The studies showed considerable heterogeneity. However, the small number of studies did not allow for subgroup analyses.

All health-related characteristics were significantly associated with PGD. Physical/somatic symptoms showed a medium-sized association with PGD
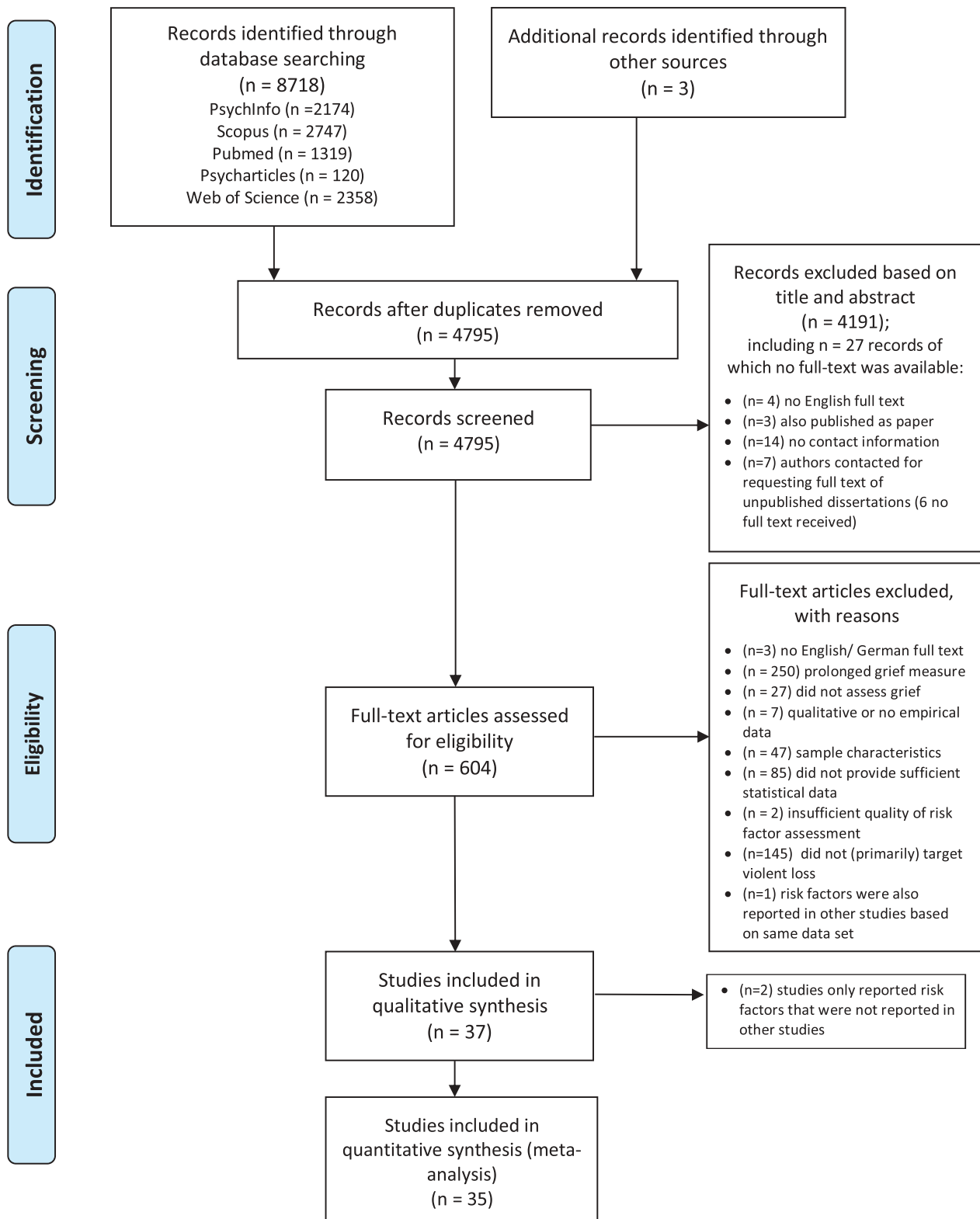
Figure 1. Flowchart of study identification and selection. [PRISMA 2009 flow diagram (Moher et al., 2009).]

(r = .23, 95% CI [.12; .34]) based on three studies. All other health-related characteristics (e.g. depression or PTSD) showed high associations with PGD (r > .40).

Three factors concerning how bereaved individuals relate to others were identified in the included studies: attachment anxiety, attachment avoidance, and social support. Only attachment anxiety was significantly related to PGD (r = .33, 95% CI [.15; .50]).

Regarding cognitive characteristics, only rumination was measured more than once across the included studies, and showed a large association with PGD (r = .42, 95% CI [.31; .52]).

Multiple loss and the presence of religious beliefs showed small positive associations with PGD (r = .11, 95% CI [.04; .18]; r = .12, 95% CI [.01; .23], respectively). Based on five studies, the exposure to

Table 1. Characteristics of studies included in the systematic review.

Study	Location of data assessment	Loss type	Sample type	N	PG measure	Age (years), mean or range	% Female	Time since loss (years or months), mean or range	Overall quality
Anderson (2010)	USA	Suicide	Individual	201	ICG	48.89	90.5	5.51 (6–484 m)	H
Aronson et al. (2017)	USA	Suicide 24.3%; accidents 27.1%; combat 48.6%	Individual	70	ICG-R	52.90	100.0	4.00 y	M
Burke et al. (2010)[1]	USA	Homicide	Individual	54	ICG-R	48.61	88.9	1.75 y	M
Capitano (2013)	USA	Suicide	Individual	219	ICG	31–40 y: 3.7%; 41–50 y: 32.4%; 51–60 y: 44.7%; 61–70 y: 12.8%; ≥ 71 y: 5.9%	91.3	6–12 m: 6.4%; 13–36 m: 34.7%; 37–60 m: 20.1%; 61–120 m or longer: 8.7%; missing: 30.1%	H
Craig et al. (2008)	USA (with Bosnian refugees)	Primarily war-related atrocities; some by natural disaster[c]	War-related loss/collective	126	ICG	42.00	56.0	Data collection 10 y post-war	M
Currier et al. (2015)	USA	Accidents 58.9%; homicide 18.8%; suicide 22.3%	Individual	195	ICG-R	21.00	80.0	Max. 2 y post-loss	L
Dyregrov et al. (2015)[2]	Norway	Utøya terror attack	Terrorism/collective	67	ICG	39–78	55.0	1.5 y	M
Dyregrov et al. (2003)[a]	Norway	Suicide 65.3%; accident 34.7%	Individual	196	ICG	NR	59.9	6–23 m	M
Feigelman et al. (2008)	USA	Suicide 86%; accidents 8%; natural death 4%; homicide 0.8%; other 0.9%	Individual	540	CG-Assessment	NR	85.0	NR	L
Field et al. (2014)[b]	Cambodia	50% died in stampede	Collective accident/collective	159	PG-13	49.29	100.0	6 m (for stampede group)	M
Harris (2016)	USA	Suicide	Individual	94	ICG	49.97	100.0	NR	H
Heeke et al. (2015)	Colombia	Survivors of armed conflict	War-related loss/collective	222	PG-13	48.70	59.0	12.12 y	M
Hu et al. (2015)	China	Wenchuan earthquake	Natural disaster/collective	271	ICG	44.87	54.6	Data collection 18 m after earthquake	M
Huh et al. (2017)	South Korea	Sewol ferry accident	Collective accident/collective	84	ICG	47.40	57.0	1.5 y	M
Kristensen et al. (2010)[3]	Norway	Tsunami in Southeast Asia	Natural disaster/collective	130	ICG	45.70	51.5	2.2 y	H
Kristensen et al. (2012)[3]	Norway	Tsunami in Southeast Asia	Natural disaster/collective	130	ICG	45.70	51.5	2.2 y	H
McDevitt-Murphy et al. (2012)[1]	USA	Homicide	Individual	54	ICG-R	48.61	88.9	1.74 (29 days – 58.30 m)	M
Mitchell et al. (2017)[4]	USA	Suicide	Individual	60	ICG	43.30	72.0	1 m	L
Mitchell et al. (2004)[4]	USA	Suicide	Individual	60	ICG	43.30	72.0	1 m	L
Moore (2013)	USA	Suicide	Individual	154	PG-13	NR	90.1	Max. 2 y	H
Morina (2011)	Kosovo	War-related killings	War-related loss/collective	100	Prolonged Grief Disorder interview	50.10	100.0	Data collection 10 y post-war	M
Morina et al. (2010)	Kosovo	War-related killings	War-related loss/collective	60	ICG-R	40.60	33.3	7–8 y	L
Morina et al. (2011)	Kosovo	War-related killings	War-related loss/collective	179	PG-13	20.30	58.1	Data collection 10 y post-war	H
Mutabaruka et al. (2012)	Rwanda	War-related killings	War-related loss/collective	102	Inventory of Traumatic Grief	45.00	68.6	Data collection 13 y post-genocide	L
Neimeyer and Burke (2011)[1]	USA	Homicide	Civilian/individual	46	ICG-R	50.23	89.1	1.63 y (1.1–58.3 y) (m)	L
Neria et al. (2007)	USA	9/11 terror attacks	Terrorism/collective	704	CG-Assessment	45.13	79.0	2.5–3.5 y	M
Rheingold and Williams (2015)	USA	Homicide	Individual	47	ICG	50.84	78.7	2.08 y	M
Schaal et al. (2012)[5]	Rwanda	Genocide 62%; illness 27.5%; accident 3%; other (mainly poisoning) 7.5%	War-related loss/collective	400	PG-13	37.18	87.7	11.50 y (1–38 y)	H
Schaal et al. (2009)	Rwanda	War-related killings	War-related loss/collective	40	PG-13	49.93	100.0	Data collection 13 y post-genocide	M
Schaal et al. (2010)[5]	Rwanda	Genocide 62%; illness 27.5%; accident 3%; other (mainly poisoning) 7.5%	War-related loss/collective	400	PG-13	37.18	87.7	11.50 y (1–38 y)	H

(Continued)

Table 1. (Continued).

Study	Location of data assessment	Loss type	Sample type	N	PG measure	Age (years), mean or range	% Female	Time since loss (years or months), mean or range	Overall quality
Stammel et al. (2013)	Cambodia	War-related killings	War-related loss/collective	775	CG-Assessment	56.70	64.3	Data collection 30 y post-genocide	H
Tolstikova et al. (2005)	Canada/USA	Motor vehicle accident 86%	Individual	84	ICG	49.70	86.0	6.20 y (6 m – 38 y)	L
van Denderen et al. (2014)	Netherlands	Homicide	Individual	331	ICG	52.60	65.9	6.90 y	H
Wagø et al. (2017)[2]	Norway	Utøya terror attack	Terrorism/collective	67	ICG	39–78	55.0	1.5 y	H
Weder et al. (2010)	Palestine (West Bank)	War-related killings	War-related loss/collective	21	PG-13	44.87	52.4	15.00 y	L
Williams et al. (2012)[1]	USA	Homicide	Individual	47	ICG-R	49.66	89.4	1.74 y	M
Xu et al. (2014)	China	Sichuan earthquake	Natural disaster/collective	226	ICG	27–45	100.0	2.41–2.83 y	H

[a] The 'sudden infant death syndrome' group in this study was excluded from this meta-analysis. [b] Repeated communication with study authors could not unequivocally clarify whether participants in the control group were bereaved by violent loss, but all had experienced the Khmer Rouge regime (1975–1979). Sensitivity analysis without this study can be accessed in Appendix E. [c] Personal communication with author. [1,2,3,4,5] Data stem from the same study, respectively, but provided different risk factor estimates. Overall study quality rating: L, low quality; M, medium quality; H, high quality.
PG, prolonged grief; ICG, Inventory of Complicated Grief; ICG-R, Inventory of Complicated Grief – Revised; CG, complicated grief; y, years; m, months; NR, not reported.

traumatic events had a medium-sized association with PGD ($r = .27$, 95% CI [.06; .45]).

Significant heterogeneity was observed in 12 correlates (age, traumatic events, relationship to the deceased, time since loss, depression, PTSD, anxiety, global psychopathology, avoidance, social support, attachment avoidance, and counselling experience). Thus, at least some of the variance was due to true differences between the study effects (Bienvenu et al., 2004; Costa, Terracciano, & McCrae, 2001; Craske, 2003). To determine potential moderators of heterogeneity, we subsequently performed subgroup analyses.

3.4. Subgroup analyses

Subgroups were based on quality of study, type of loss (individual or collective incident), and, if available, means of data assessment (interview or questionnaire). Subgroup analyses were performed for the three correlates that were examined by at least 10 studies and which had a heterogeneous data set (age, depression, and PTSD).

Subgroup analyses for age revealed that among people who had lost a significant other to an individual incident (homicide, suicide, or accident), age emerged as a significant correlate, with younger age being associated with less PGD ($r = -.28$, 95% CI [−43; −.11]). By contrast, age was not a significant correlate among people bereaved by collective violence ($r = -.02$, 95% CI [−.07; .11]). In both subgroups, heterogeneity was high. For the remaining correlates, PTSD and depression, the interview measure, the type of loss, and the quality of the studies did not have an impact on effect sizes or heterogeneity. Results of the subgroup analyses are displayed in Table 3.

3.5. Publication bias

Publication bias analyses were applicable for four correlates (gender, education, employment, and marital status) (Table 2). Egger's regression test was not significant for any of the data sets and did therefore not indicate publication bias. The trim-and-fill procedure imputed one study each into the subgroups according to gender and education, but corrected effect sizes did not significantly differ from original effect sizes (Table 2).

4. Discussion

This study aimed at identifying correlates for PGD among adults who had experienced violent loss. We furthermore aimed to quantify the magnitude of the relationship between correlates and PGD in a meta-analysis. Sociodemographic characteristics (female gender, low educational level, no employment, and

Table 2. Meta-analyses of individual correlates.

	k	N	r	95% CI of r Lower limit	95% CI of r Upper limit	p-value	r_{pb} [95% CI]	Q	p-value (Q)	I^2
Sociodemographic characteristics										
Female gender	14	2885	.20	.14	.25	< .001	.18 [.12; .23]	16.66	.06	40.61
Age	14	2971	−.10	−.20	.01	.07		85.44	< .001	84.79
Education	12	2769	−.10	−.14	−.06	< .001	−.11 [−.15; −.07]	8.47	.67	0.00
Employment: being employed	7	1127	−.14	−.21	−.08	< .001	−.14 [−.21; −.08]	4.68	.70	0.00
Marital status: being in a relationship or married	7	1479	−.05	−.11	.01	.09	−.05 [−.11; .01]	6.72	.35	10.69
Income	4	821	−.09	−.21	.03	.15		4.87	.18	38.36
Race/ethnicity: being white	2	740	−.05	−.13	.03	.24		0.001	.97	0.00
Having another child/other children left	5	602	−.23	−.36	−.10	< .001		8.50	.08	52.96
Characteristics associated with death and the deceased										
Relationship to the deceased: closely related (vs distantly related)	4	1701	.39	.23	.53	< .001		33.00	< .001	90.91
Time since loss	7	913	−.15	−.30	.01	.07		29.52	< .001	79.68
Mode of death: suicide (vs accident)	3	716	−.00	−.10	.09	.94		2.64	.27	24.36
Age of deceased person	3		−.10	−.24	.04	.17		3.75	.15	46.71
Health-related characteristics										
Depression	15	3139	.59	.52	.65	< .001		83.33	< .001	83.20
Post-traumatic stress disorder	13	3259	.59	.50	.67	< .001		113.02	< .001	89.38
Anxiety	8	2457	.52	.44	.59	< .001		29.27	< .001	76.08
Health conditions (physical/somatic symptoms)	3	496	.23	.12	.34	< .001		3.02	.22	33.77
Global psychopathology	3	327	.50	.28	.67	< .001		8.25	< .01	76.62
Suicidality	3	923	.41	.30	.52	< .001		2.50	.27	24.27
Avoidance	2	137	.54	.24	.74	< .001		4.46	< .05	77.57
Intrusion	2	137	.62	.43	.76	< .001		2.68	.10	62.66
Anger	2	278	.47	.36	.58	< .001		1.29	.26	22.53
Interpersonal characteristics										
Social support	5	495	−.02	−.38	.34	.92		60.93	< .001	93.44
Personality characteristics										
Attachment avoidance	2	396	.08	−.09	.24	.38		2.86	.09	65.08
Attachment anxiety	2	396	.33	.15	.50	.001		4.01	< .05	75.09
Cognitive characteristics										
Rumination	2	252	.42	.31	.52	< .001		0.64	.43	0.00
Other										
Multiple loss	5	1440	.11	.04	.18	< .01		6.00	.20	33.32
Traumatic events	5	1327	.27	.06	.45	.01		43.56	< .001	90.82
Counselling experience	2	975	.00	−.27	.27	.99		14.01	< .001	92.86
Religiosity: having religious beliefs	2	292	.12	.01	.23	< .05		0.29	.59	0.00

k, number of studies; N, sample size per risk factor estimate; r, Pearson's r; r_{pb}, Pearson's r corrected for publication bias; Q, Q-statistic for heterogeneity; I^2, ratio of true heterogeneity in the observed variation; CI, confidence interval.

Table 3. Subgroup analyses based on assessment type, type of loss and study quality.

Correlate	Subgroup		k	r [95% CI][a]	Q, significance of Q, I^2	Comparison (p-value)[b]
Depression	Assessment	Questionnaire	12	.60 [.52; .66]***	Q = 59.18, p < .001, I^2 = 81.41	p = .99
		Interview	3	.59 [.19; .82]***	Q = 21.20, p < .001, I^2 = 90.57	
	Type of loss	Individual	4	.69 [.53; .81]***	Q = 12.75, p < .001, I^2 = 76.46	p = .12
		Collective	11	.55 [.49; .62]***	Q = 53.50, p < .01, I^2 = 81.31	
	Quality	Low	3	.50 [.15; .74]***	Q = 16.92, p < .001, I^2 = 88.18	p = .74
		Medium	8	.60 [.51; .68]***	Q = 26.27, p < .001, I^2 = 73.36	
		High	4	.62 [.47; .73]***	Q = 34.59, p < .001, I^2 = 91.33	
PTSD	Assessment	Questionnaire	12	.62 [.54; .68]***	Q = 81.50, p < .001, I^2 = 86.50	NA
		Interview	1	.24 [.07; .39]**	NA	
	Type of loss	Individual	3	.64 [.44; .78]***	Q = 9.66, p < .01, I^2 = 79.29	p = .52
		Collective	10	.58 [.47; .66]***	Q = 95.53, p < .001, I^2 = 90.58	
	Quality	Low	2	.42 [−.04; .74]	Q = 8.00, p < .001, I^2 = 87.50	p = .59
		Medium	7	.62 [.50; .72]***	Q = 44.40, p < .001, I^2 = 86.49	
		High	4	.59 [.43; .72]***	Q = 55.20, p < .001, I^2 = 94.57	
Age	Type of loss	Individual	6	−.28 [−.43; −.11]**	Q = 21.16, p < .01, I^2 = 76.36	p < .01
		Collective	8	.02 [−.07; .11]	Q = 28.49, p < .001, I^2 = 75.43	
	Quality	Low	1	.00 [−.25; .25]	NA	p = .42
		Medium	9	−.04 [−.15; .07]	Q = 34.23, p < .001, I^2 = 76.63	
		High	4	−.19 [−.50; .17]	Q = 48.86, p < .001, I^2 = 93.86	

[a] Analyses based on random effects model. [b] Analyses based on mixed effects analyses. **p < .01, ***p < .001.
k, number of studies; r, Pearson's r; Q, Q-statistic for heterogeneity; I^2, ratio of true heterogeneity in the observed variation; PTSD, post-traumatic stress disorder; NA, not applicable.

having no other child after the loss of a child) showed small associations with PGD, while large associations were found for comorbid psychopathology and rumination. We found small associations for multiple loss, religious beliefs, and somatic/physical symptoms. Three correlates (traumatic events, attachment

anxiety, and relationship to the deceased) showed medium-sized associations. Twelve correlates displayed significant heterogeneity, which limits the interpretability of mean effect sizes. It was not possible to identify moderators that may have caused heterogeneity. The analysis did not indicate publication bias.

We evaluated the study quality. Fifteen studies were classified as being of medium quality, while nine studies were of low quality and 13 showed high quality. The most common flaws were non-randomized selection of participants and imprecise reporting of data analyses.

4.1. Sociodemographic characteristics

The meta-analysis showed a small positive association of female gender with PGD. A number of factors may account for this finding. Women score higher than men on personality traits (e.g. neuroticism, openness to feelings) associated with the development of adverse mental health outcomes. They are more likely to respond to stressful life events with anxiety and avoidant behaviour (Bienvenu et al., 2004; Costa et al., 2001; Craske, 2003). As such, women are at greater risk than men of developing mental health problems (Olff, Langeland, Draijer, & Gersons, 2007; Tolin & Foa, 2006). However, the proportion of females in the included studies was high. This may lead to an overrepresentation of symptoms that are more likely to be endorsed by women. Moreover, female participants already far outnumbered males in the development of the assessment instruments (Bui et al., 2015; Prigerson et al., 1995, 2009), which may have led to a greater attribution of relevance to symptoms occurring in women in the scale development. As social norms of masculinity discourage emotional expression in men, they may grieve differently from women (Creighton, Oliffe, Butterwick, & Saewyc, 2013), and this aspect clearly needs further research. The overrepresentation of women in the included studies and during the scale development may have the consequence that the identified correlates and respective associations with PGD are more likely to be representative of women.

The meta-analysis further showed that age was largely unrelated to PGD. However, the subgroup analyses revealed that in studies conducted with people exposed to an individual death (homicide, suicide, or accident), age was significantly negatively related to PGD, whereas it was not among those who had lost a significant other to collective violence. This is somewhat in contrast to previous studies of non-violent loss that reported a positive association of age and PGD (Kersting, Braehler, Glaesmer, & Wagner, 2011; Lundorff et al., 2017). This issue warrants further research taking into account the specific role of the type of loss (individual vs collective).

The small effect of education and PGD is in line with previous research, which demonstrated that a higher educational level is associated with lower levels of psychopathology (Ross & Mirowsky, 2006). Education facilitates reappraisal strategies and the pursuit of fundamental goals, including emotional well-being (Ross & Mirowsky, 2006). Education has an impact on multiple outcomes, such as social status, employment, and health behaviour. Hence, the small effect of employment on levels of PGD was unsurprising. We assume that having regular tasks in life and a daily structure helps in dealing with bereavement. Qualitative evidence suggests that parenting may offer a distraction from grief and provide a sense of meaning and purpose in life (Chidley, Khademi, Meany, & Doucett, 2014), which supports that having another child was negatively associated with PGD.

4.2. Characteristics associated with the death and the deceased

Time since loss was not significantly associated with PGD. Grief may not decrease in cases of violent loss as feelings of guilt, visual images of the death, or difficulties in finding meaning may contribute to persistent grief among survivors (Rynearson, 2006). However, some included studies reported data on the association of time since loss with PGD a few months after loss, while others reported data on this association several decades after loss. This may have contributed to the observed heterogeneity. High levels of heterogeneity may lead to difficulties in interpreting the mean effect size. Once more studies have addressed time since loss, future meta-analyses should clarify the role of this variable for the development of PGD.

In line with the idea that PGD is a disorder that is associated with the relationship to the lost person, a close relationship emerged as a significant correlate of PGD. This indicates that losing a member of the nuclear family is associated with higher PGD severity than losing a distantly related family member or friend. The observed heterogeneity was largely accounted for by one study (Mitchell, Kim, Prigerson, & Mortimer-Stephens, 2004), which may have overestimated the effect.

4.3. Health-related characteristics

The largest effect sizes were found for health indicators, in particular comorbid psychopathology. In line with previous results, the largest associations were found for depression and PTSD. Because other health-related factors were similarly related to PGD, we suspect a shared mechanism of psychopathology, which may be triggered by a certain risk (e.g. the loss of a significant other). The disorders share multiple

risk factors (e.g. female gender, educational level, exposure to traumatic events) as well as certain symptoms (feelings of hopelessness, intrusions), which increase the occurrence of comorbidities (Cole & Dendukuri, 2003; Xue et al., 2015). Heterogeneity was particularly present among health-related indicators, indicating a large between-study variance of the effect sizes. The heterogeneity could not be explained by moderating variables.

The high association of intrusion with PGD may be largely accounted for by the fact that intrusions are part of the PGD criteria set in the form of 'separation distress' (Horowitz et al., 1997; Prigerson et al., 2009). However, it also seems possible that a high association of intrusion with PGD is specific to violent loss survivors. Visual intrusions may be particularly disruptive in the case of violent losses, where mourners are likely to imagine the deceased's last minutes as painful. Future research should investigate whether the violent nature of someone's death is more likely to evoke intrusions.

PGD was highly associated with suicidality. This bears important clinical implications. Clinicians should therefore carefully assess suicidal ideation among their bereaved patients.

4.4. Cognitive characteristics

Rumination was the only cognitive factor that had been assessed more than once among the included studies. Some bereaved individuals may engage in continuous rumination about the deceased's death or about their own reactions to the death, thereby increasing the attention to a negative emotional state and inhibiting actions that might distract the individual (Nolen-Hoeksema, 1991).

4.5. Interpersonal characteristics

Despite the social environment's importance for psychopathology (Brewin, Andrews, & Valentine, 2000), only a few studies have investigated social support. The non-significant association between social support and PGD was mainly due to one study, which found a positive correlation (Anderson, 2010), while the other studies consistently found negative correlations (Burke et al., 2010; Kristensen, Lars, & Heir, 2010; Rheingold & Williams, 2015; Wagø, Byrkjedal, Sinnes, Hystad, & Dyregrov, 2017). It was not possible to conduct subgroup analyses, and it remains for future research to investigate the link between social support and PGD further.

4.6. Personality characteristics

Two studies analysed the relation between attachment styles and PGD. Two dimensions of attachment are proposed: attachment-related anxiety (predisposition towards anxiety and vigilance concerning rejection and abandonment) and attachment-related avoidance (discomfort with closeness and dependency or a reluctance to be intimate with others) (Sibley, Fischer, & Liu, 2005). We found attachment-related avoidance to be unrelated to PGD and attachment-related anxiety to be positively associated with PGD. This is in line with prior theoretical conceptualizations (Fraley & Bonanno, 2004).

4.7. Other factors

Traumatic events may heighten the vulnerability not only to depression and PTSD (Steel et al., 2009), but also to PGD, as evidenced by a medium-sized association. Moreover, we found a small effect for multiple loss, indicating that having lost more than one significant other was associated with higher PGD severity.

Religious beliefs showed a small positive association with PGD, suggesting that the presence of religious beliefs was associated with higher PGD severity. Schaal et al. (2010) found the opposite effect but did not report bivariate associations. Their effect size was therefore not included in the meta-analysis. Neimeyer and Burke (2011) examined the association between religious coping and PGD among survivors of violent loss and reported a significant positive association between negative religious coping ('punishing God reappraisals') and PGD severity, but found no effect for positive religious coping ('a secure relationship with God'). Further analyses are needed to understand the role of religiosity and religious coping for PGD.

4.8. Limitations

Despite the various strengths of the meta-analysis, several limitations should be considered when interpreting the results. The included studies were mainly based on non-randomly selected samples; most data relied on self-report measures. These studies are prone to sampling bias. Our stringent inclusion criteria may have resulted in the exclusion of some relevant articles. This strategy, however, increased the comparability between included studies. The agreement during the full-text screening was only substantial. The cross-sectional design of most studies does not allow us to draw conclusions about causal relationships. Some of the examined risk factors are invariant factors (gender, age of deceased and bereaved person, ethnicity, mode of death, relationship to the deceased, and time since loss) and causal relations can be assumed. For the remaining variables, it remains unclear whether the factors identified as correlates are a cause or an effect of low or high prolonged grief symptom severity. Meta-

analyses based on longitudinal studies would therefore be a desirable approach for future research to clarify the relationship between these variables and PGD. Our meta-analysis was limited by the heterogeneity of examined correlates. It was not possible to identify moderators that caused heterogeneity. Several variables included in this meta-analysis were only measured twice, which significantly limits conclusions that can be drawn about these correlates. Finally, in six of the studies, the majority of the sample experienced violent loss, but not all. We decided to include these studies if more than 70% of the sample experienced violent loss, but we are aware that the studies including mixed natures of death do not capture as precisely the specific nature of violent loss as studies including participants with violent loss only.

5. Conclusions

This is the first systematic review and meta-analysis to report on correlates for PGD among adults exposed to the violent loss of a significant other. As a result of the systematic literature research based on precise inclusion criteria and the respective effect calculations, the meta-analysis extends the knowledge beyond conclusions from narrative reviews. Altogether, 19 correlates showed significant associations with PGD. Sociodemographic characteristics showed small associations with PGD, while comorbid psychopathology and rumination showed large associations. Some of the sociodemographic and health-related characteristics were investigated in several studies and these effect calculations therefore have a valid empirical basis.

The results demonstrate that the relevant correlates stemmed from a wide range of domains, including factors a person is equipped with (gender, age), biographical factors (multiple loss, traumatic events), intrapsychological factors (rumination, attachment style), and factors concerning the relationship to the person lost, to name a few. This points to a complex interplay of factors that potentially contribute to the development of the disorder. It seems likely that – comparable to established vulnerability–stress models for other disorders – a set of diverse factors facilitates the development of PGD (Ingram & Luxton, 2005; Maccallum & Bryant, 2013). Some of these factors may uniquely contribute to PGD (e.g. relationship to the person lost), while others (e.g. gender, education) may be shared contributors to general psychopathology (Brewin et al., 2000; Cole & Dendukuri, 2003). Further research using longitudinal study designs is required to establish the causal link between these factors and PGD.

Furthermore, there is cumulative evidence that several of the identified correlates are important not only among violent loss survivors but also among people exposed to non-violent loss. Future meta-analyses focusing on correlates and risk factors among non-violently bereaved individuals may clarify the specificity of certain variables according to the type of loss. Future research could also focus on examining whether it is the kinship relationship with the deceased, or rather the interpersonal quality of the relationship (emotional closeness, depth, conflict), which influences grief reactions. The present meta-analysis highlights the need for further investigation of specific grief-related risk factors. Some correlates with preliminary evidence may turn out to be important in the future.

In the light of the inclusion of PGD in the ICD-11, it is important for clinicians to identify bereaved adults at risk for PGD, particularly in subgroups of survivors of violent loss, which have been shown to be more likely to be affected by PGD. Suicidality may be prevalent among individuals with PGD and clinicians should therefore carefully assess suicidal tendencies among their bereaved patients.

Disclosure statement

No potential conflict of interest was reported by the authors.

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*References marked with an asterisk indicate studies included in the meta-analysis.

Appendix A. Identified and selected grief assessment instruments.

Instrument	Authors	Year	Subscales	No. of items	Focus
Bereavement Experience Questionnaire – Revised	Guarnaccia & Hayslip	1998	3: Existential loss/emotional needs; guilt/blame/anger; preoccupation with thoughts of deceased	24	General extent of grief
Bereavement Phenomenology Questionnaire	Byrne & Raphael	1994		22	General extent of grief: focus on male grief experience
Bereavement Risk Index	Parkes	1993		8	Asks for general risk factors, such as demographic information, some psychological symptoms (anger, social contacts)
Brief Grief Questionnaire	Shear, Jackson, Essock, Donahue, & Felton	2006		5	Screening for complicated grief
Complicated Grief Assessment Self Report[a]	Prigerson	2001		10	Complicated grief
Complicated Grief Module[a]	Langner & Maercker	2005		7	Complicated grief
Core Bereavement Items	Burnett, Middleton, Raphael, & Martinek	1997	Images and thoughts; acute separation; grief	17	General extent of bereavement-induced phenomena
Expanded Texas Inventory of Grief	Zisook & DeVaul	1984	2	58	General extent of grief
Grief Avoidance and Deliberate Grief Avoidance	Bonnano & Zhang	2005		13	General extent of grief
Grief Experience Inventory	Sanders, Mauger, & Strong	1979	16	135	General extent of grief
Grief Experience Questionnaire	Barrett & Scott	1989		55	Extent of suicide-induced grief
Grief Measurement Scales	Jacobs	1987	4: Sadness, loneliness and crying; numbness and disbelief; perceptual set and search; distressful yearning	38	General extent of unresolved grief
Grief Reaction Index	Lennon, Martin, & Dean	1990		12	General grief
Grief Reaction Measure	Vargas, Loya, & Hodde-Vargas	1989	4: Depressive symptoms; preservation of lost object; suicidal ideation; decedent-directed anger	20	General grief reactions to loss induced by sudden death
Grief Resolution Index	Remondet & Hansson	1987		7	General extent of grief of husband loss
Grief Screening Scale	Layne, Pynoos, Savjak, & Steinberg	1998		10	General extent of grief: intrusive or unpleasant thoughts, yearning, difficulties carrying on daily activities
Grief Symptoms Measure	Casarett	2001		14	General extent of grief
Hogan Grief Reaction Checklist	Hogan, Greenfield, & Schmidt	2001		61	General extent of grief
ICD-11 Prolonged Grief Disorder Scale	Xiu, Maercker, Woynar, Geirhofer, Yang, & Jia	2016		23	Prolonged grief according to ICD-11 (not validated)
Inventory of Complicated Grief[a]	Prigerson, Frank, Kasl, Reynolds, Anderson, Zubenko, … Kupfer	1995		19	Complicated grief
Inventory of Complicated Grief – Revised[a]	Prigerson	1999		34	Complicated grief
Inventory of Traumatic Grief[a]	Prigerson, Shear, Jacobs, Reynolds, Maciejewski, Davidson, … Zisook	1999		19	Complicated grief
PG-13[a]	Prigerson, Horowitz, Jacobs, Parkes, Aslan, Goodkin … Maciejewski	2009		13	Prolonged grief
Present Feeling about Loss	Singh & Raphael	1981			General extent of unresolved grief

(Continued)

Appendix A. (Continued).

Instrument	Authors	Year	Subscales	No. of items	Focus
Prolonged Grief Disorder Scale	Boelen	2012		11	Short version of Inventory of Complicated Grief (not validated)
Reactions to Loss Scale	Cooley, Toray, & Roscoe	2010	3	65	Assessment of grief in college students including non-death losses
Response to Loss Instrument	Deutsch	1982		37	General extent of grief
Structured Clinical Interview for Complicated Grief[a]	Bui, Mauro, Robinaugh, Skritskaya., Wang, Gribbin, … Shear	2015	5	31	Complicated grief
Structured Grief Symptom Interview[a]	Bonanno, Keltner, Holen, & Horowitz	1995		30	Complicated grief: intrusive experiences, behaviours that delay or minimize the finality of the loss, difficulties adapting to the loss
Texas Inventory of Grief	Faschingbauer	1977		13	General extent of grief
Texas Revised Inventory of Grief	Faschingbauer	1987	2: Past behaviour; present emotional feelings	21	General extent of grief
The Grief Reaction Assessment Form	Ho, Chow, Chan, & Tsui	2002		16	A Chinese measure to indicate grief reactions. The graph can discriminate between the grief reaction of people experiencing anticipated and those experiencing unanticipated death
Tübingen Grief Scale	Stroebe, Abakoumkin, Stroebe, & Schut	2012		13	General extent of grief
Widowhood Questionnaire	Zisook & Shuchter	1985		19	General extent of grief in widowhood

[a] Shaded instruments were included.

Appendix B. Meta-analyses of individual correlates including only studies measuring prolonged grief disorder at least 6 months post-loss.

	k	r	95% CI of r		p-value	Q	p-value (Q)	I²
			Lower limit	Upper limit				
Sociodemographic characteristics								
Female gender	12	.20	.13	.25	< .001	21.21	.03	48.13
Age	11	−.03	−.12	.08	.57	50.15	< .001	80.06
Education	10	−.10	−.14	−.06	< .001	7.98	.53	0.00
Employment: being employed	6	−.15	−.21	−.08	< .001	3.61	.60	0.00
Marital status: being in a relationship or married	4	−.05	−.11	.01	.09	2.65	.45	0.00
Having another child/other children left	5	−.23	−.36	−.10	< .001	8.50	.08	52.96
Characteristics associated with death and the deceased								
Relationship to the deceased: closely related (vs distantly related)	3	.31	.18	.43	< .001	15.06	< .001	86.72
Time since loss	5	−.12	−.30	.07	.22	28.89	< .001	86.16
Mode of death: suicide (vs accident)	3	−.08	−.20	.05	.24	0.25	.62	0.00
Age of deceased person	3	−.10	−.24	.04	.17	3.75	.15	46.71
Health-related characteristics								
Depression	12	.57	.50	.63	< .001	57.91	< .001	81.01
PTSD	11	.59	.50	.67	< .001	105.74	< .001	90.54
Anxiety	7	.52	.44	.59	< .001	29.26	< .001	79.50
Health conditions (physical/somatic symptoms)	2	.23	.08	.38	< .001	3.01	.08	66.78
Global psychopathology	2	.46	.16	.69	< .001	7.86	< .01	87.29
Suicidality	3	.41	.30	.52	< .001	2.50	.27	24.27
Anger	2	.47	.36	.58	< .001	1.29	.26	22.53
Interpersonal characteristics								
Social support	3	−.05	−.46	.54	.92	52.45	< .001	96.19
Other								
Multiple loss	5	.11	.04	.18	< .01	6.00	.20	33.32
Traumatic events	5	.27	.06	.45	.01	43.56	< .001	90.82
Counselling experience	2	.00	−.27	.27	.99	14.01	< .001	92.86

k, number of studies; N, sample size per risk factor estimate; r, Pearson's r; r_{pb}, Pearson's r corrected for publication bias; Q, Q-statistic for heterogeneity; I², ratio of true heterogeneity in the observed variation; CI, confidence interval; PTSD, post-traumatic stress disorder.

Appendix C. PICOS approach for guiding the research question.

Population	Adults (≥ 18 years) who had lost a significant other to violent death
Intervention/ exposure	Presence of the correlate/risk factor
Comparator	Absence of the correlate/risk factor
Outcomes	We focused our analysis on validated instruments that specifically assessed complicated or prolonged grief reactions rather than general extent of grief. Pearson's correlation coefficient r was used as a measure of effect size (Borenstein et al., 2009)
Study design(s)	• We included quantitative studies that investigated correlates for PGD. Correlates were defined as any variable that contributed to variability in prolonged grief in terms of symptom severity or diagnostic status • We excluded qualitative, single-case, and intervention studies

Appendix D. Individual item-based rating of the quality of included studies.

Study	Study objectives and hypotheses	Eligibility criteria	Recruitment	Setting	Representative sample	Missing data	Power calculation	Demographic and clinical characteristics	Study limitations	Quality (sum)	Quality rating
Anderson (2010)	Reported	Reported	Reported	Unclear	Unclear	Reported	Reported	Reported	Reported	16.00	High
Aronson, Kyler, Morgan, Perkins, and Love (2017)	Unclear	Reported	Reported	Unclear	Unclear	Not reported	Not reported	Reported	Reported	11.00	Medium
Burke et al. (2010)	Reported	Reported	Reported	Unclear	Not reported	Not reported	Not reported	Reported	Reported	11.00	Medium
Capitano (2013)	Reported	Reported	Reported	Unclear	Not reported	Not reported	Reported	Reported	Reported	13.00	High
Craig, Sossou, Schnak, and Essex (2008)	Reported	Not reported	Unclear	Reported	Not reported	Reported	Not reported	Not reported	Reported	11.00	Medium
Currier, Irish, Neimeyer, and Foster (2015)	Reported	Reported	Unclear	Not reported	Not reported	Not reported	Not reported	Reported	Reported	9.00	Low
Dyregrov, Dyregrov, and Kristensen (2015)	Unclear	Reported	Reported	Unclear	Unclear	Not reported	Not reported	Reported	Reported	11.00	Medium
Dyregrov et al. (2003)	Unclear	Not reported	Reported	Reported	Reported	Not reported	Not reported	Reported	Reported	11.00	Medium
Feigelman, Jordan, and Gorman (2008)	Reported	Reported	Reported	Not reported	Not reported	Not reported	Not reported	Reported	Reported	9.00	Low
Field et al. (2014)	Reported	Unclear	Unclear	Unclear	Reported	Not reported	Not reported	Reported	Reported	12.00	Medium
Harris (2016)	Reported	Unclear	Reported	Reported	Not reported	Reported	Reported	Reported	Reported	15.00	High
Heeke et al. (2015)	Reported	Unclear	Reported	Reported	Not reported	Not reported	Not reported	Reported	Reported	11.00	Medium
Hu, Li, Dou, and Li (2015)	Reported	Reported	Reported	Reported	Not reported	Not reported	Not reported	Reported	Reported	12.00	Medium
Huh, Huh, Lee, and Chae (2017)	Unclear	Not reported	Reported	Unclear	Unclear	Reported	Not reported	Reported	Reported	11.00	Medium
Kristensen et al. (2010)	Unclear	Reported	Reported	Reported	Reported	Not reported	Not reported	Reported	Reported	13.00	High
Kristensen et al. (2012)	Unclear	Reported	Reported	Reported	Reported	Not reported	Not reported	Reported	Reported	13.00	High
McDevitt-Murphy, Neimeyer, Burke, Williams, and Lawson (2012)	Unclear	Unclear	Reported	Not reported	Not reported	Reported	Not reported	Reported	Reported	10.00	Medium
Mitchell et al. (2017)	Reported	Reported	Unclear	Not reported	Not reported	Not reported	Not reported	Reported	Reported	9.00	Low
Mitchell et al. (2004)	Unclear	Not reported	Reported	Not reported	Not reported	Not reported	Not reported	Reported	Unclear	6.00	Low
Moore (2013)	Reported	Reported	Reported	Reported	Not reported	Reported	Reported	Reported	Reported	16.00	High
Morina (2011)	Reported	Reported	Reported	Reported	Not reported	Not reported	Not reported	Reported	Reported	12.00	Medium
Morina et al. (2010)	Reported	Not reported	Reported	Not reported	Unclear	Not reported	Not reported	Reported	Reported	9.00	Low
Morina et al. (2011)	Reported	Reported	Reported	Reported	Unclear	Unclear	Not reported	Reported	Reported	14.00	High
Mutabaruka, Séjourné, Bui, Birmes, and Chabrol (2012)	Reported	Reported	Not reported	Unclear	Not reported	Not reported	Not reported	Reported	Reported	9.00	Low
Neimeyer and Burke (2011)	Reported	Not reported	Reported	Unclear	Not reported	Not reported	Not reported	Reported	Reported	9.00	Low
Neria et al. (2007)	Unclear	Reported	Reported	Reported	Not reported	Not reported	Not reported	Reported	Reported	11.00	Medium
Rheingold and Williams (2015)	Unclear	Reported	Reported	Unclear	Unclear	Unclear	Not reported	Reported	Reported	12.00	Medium
Schaal et al. (2012)	Reported	Reported	Reported	Reported	Reported	Not reported	Not reported	Reported	Reported	14.00	High
Schaal et al. (2009)	Reported	Reported	Reported	Reported	Not reported	Not reported	Not reported	Reported	Reported	12.00	Medium
Schaal et al. (2010)	Unclear	Reported	Reported	Reported	Reported	Not reported	Not reported	Reported	Reported	13.00	High
Stammel et al. (2013)	Reported	Reported	Reported	Reported	Not reported	Reported	Not reported	Reported	Reported	14.00	High
Tolstikova, Fleming, and Chartier (2005)	Reported	Reported	Reported	Unclear	Not reported	Not reported	Not reported	Reported	Not reported	9.00	Low
van Denderen, de Keijser, Gerlsma, Huisman, and Boelen (2014)	Reported	Reported	Reported	Reported	Not reported	Reported	Not reported	Reported	Reported	14.00	High
Wagø et al. (2017)[2]	Reported	Unclear	Reported	Reported	Reported	Not reported	Not reported	Reported	Reported	13.00	High
Weder, Garcia-Nieto, and Canneti-Nisim (2010)	Reported	Unclear	Reported	Reported	Not reported	Not reported	Not reported	Unclear	Not reported	8.00	Low
Williams, Burke, McDevitt-Murphy, and Neimeyer (2012)	Reported	Reported	Reported	Unclear	Not reported	Not reported	Not reported	Reported	Reported	11.00	Medium
Xu, Herman, Bentley, Tsutsumi, and Fisher (2014)	Unclear	Reported	Reported	Reported	Unclear	Not reported	Reported	Reported	Reported	14.00	High

Appendix E. Sensitivity analyses excluding Field et al. (2014).

	k	N	r	95% CI of r		p-value	r_pb 95% CI	Q	p-value (Q)	I²
				Lower limit	Upper limit					
Health-related characteristics										
Depression	14	2980	.59	.55	.66	< .001		82.74	< .001	84.29
PTSD	13	3100	.57	.48	.65	< .001		100.53	< .001	89.06
Anxiety	7	2298	.52	.43	.60	< .001		28.92	< .001	79.25

k, number of studies; N, sample size per risk factor estimate; r, Pearson's r; r_{pb}, Pearson's r corrected for publication bias; Q, Q-statistic for heterogeneity; I^2, ratio of true heterogeneity in the observed variation; CI, confidence interval; PTSD, post-traumatic stress disorder.