Title

"Do early symptoms of prolonged grief disorder lead to symptoms of posttraumatic stress disorder and depression? A longitudinal register-based study of the two first years of bereavement"

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Abstract

Introduction: Symptoms of prolonged grief disorder (PGD), depression, and posttraumatic stress disorder (PTSD) often emerge concurrently in bereavement. The understanding of temporal relationships between these syndromes in a general bereaved population is limited. This study aims to investigate temporal relationships between these syndromes from 2 months post-loss throughout the 2 first years of bereavement.

Method: Data was derived from a registry-based cohort study with 1224 adult participants, who lost a spouse or parent. Participants completed self-report measures of PGD, depression, and PTSD at 2, 6, 11, 18, and 26 months post-loss. Random-intercept cross-lagged panel analyses examined the temporal relationships between PGD, PTSD, and depression.

Results: In spousal and parental bereavement, high levels of grief symptoms at 2 months post-loss predicted subsequent high symptoms of PTSD and depression at 6 months post-loss, not vice versa. PGD, PTSD, and depression showed strong intertwined relationships over the 2 first years of bereavement. Between-person differences explained an increasingly large amount of variance in symptoms of PGD, PTSD, and depression over time. Losing a spouse and younger age was associated with higher symptoms of PGD, PTSD, and depression compared to losing a parent and older age.

Conclusion: In the early years of bereavement, large differences exist between bereaved individuals in general levels of PGD, PTSD, and depression. Within bereaved individuals, the temporal relationships between these syndromes become increasingly complex and intertwined over time. Findings should be interpreted with respect to the non-clinical sample and self-report data used.

Keywords: Bereavement; Prolonged grief; Depression; Posttraumatic stress disorder; temporal relationships

General Scientific Summary: This study suggests that high levels of early grief symptoms evolve into symptoms of PTSD and depression within bereaved individuals. Furthermore, symptoms of PGD, PTSD, and depression become increasingly intertwined through the first years of spousal and parental bereavement.

Introduction

Losing a loved one is a stressful life event that may trigger the onset of a range of mental illnesses and intensify pre-existing vulnerabilities (Guldin et al., 2017; Stroebe et al., 2007). Commonly experienced types of bereavement-related distress are symptoms of prolonged grief disorder (PGD), posttraumatic stress disorder (PTSD), and depression, which together can be labeled *'complicated grief reactions'* (Komischke-Konnerup et al., 2021; Rando, 2013). Approximately 10 % of bereaved adults are expected to develop PGD symptoms (Lundorff et al., 2017), and 12-16 % of bereaved adults exhibit PTSD symptoms (O'Connor, 2010; Onrust & Cuijpers, 2006). Additionally, 19 % of bereaved individuals are estimated to meet the full diagnostic criteria for depression (Kristiansen et al., 2019). PGD, PTSD, and depression are distinct syndromes with different core symptoms (Boelen & Prigerson, 2007; Bonanno et al., 2007). PGD is characterized by intense yearning/longing for and persistent preoccupation with the deceased in an atypically long period following the loss, which is defined as more than 6 months in the 11th revision of the International Classification of Diseases (ICD-11; World Health Organization, 2023) and more than 12 months in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (Prigerson et al., 2021). Although different diagnostic criteria set for PGD exist, they include the same core symptoms (e.g., yearning) but with some variations in associated symptoms (Eisma et al., 2022). The present study focuses on the ICD-11 conceptualization of PGD, which consists of core symptoms and associated emotional pain related to the loss (e.g., guilt, anger) (World Health Organization, 2023). In contrast to PGD, PTSD is concerned with the avoidance of trauma-related cues and negative re-experiencing of memories and thoughts related to a traumatic event, e.g., the death of a loved one and intense feelings of threat (Ehlers & Clark, 2000). Finally, depression is mainly characterized by pronounced feelings of sadness, emptiness, hopelessness, and inactivity that are not necessarily related to bereavement (Jordan & Litz, 2014; Shear & Skritskaya, 2012).

Although distinct, complicated grief reactions often co-occur and are closely related types of distress. A recent meta-analysis found that 49% of bereaved adults with clinically relevant PGD symptoms experienced co-occurring PTSD and 63% experienced co-occurring depressive symptoms (Komischke-Konnerup et al., 2021). Co-occurring symptomatology in bereaved individuals is associated with considerable functional impairment, lower quality of life, and more severe grief symptoms (Aoyama et al., 2018; Kersting et al., 2009; Simon et al., 2007). Preventive strategies and effective treatment of co-occurring symptomatology in bereavement are therefore crucial. Etiological knowledge about temporal relationships between symptoms of PGD, PTSD, and depression is essential to develop effective strategies for the prevention or amelioration of co-occurring symptomatology. Knowledge of such temporal relationships may inform the order of treating these syndromes.

Can core mechanisms of PGD affect the risk of PTSD and depression?

A cognitive-behavioral framework of PGD theorizes three core psychological mechanisms, which could explain why PGD symptoms may increase the risk of developing or intensifying symptoms of PTSD and depression. These core mechanisms are 1) maladaptive anxious and depressive avoidance coping strategies, 2) poor integration of the loss into autobiographical memory, and 3) persistent maladaptive grief cognitions (Boelen et al., 2006). Anxious avoidance strategies are driven by feelings of threat and defined as consistent attempts of avoiding internal (e.g., feelings, thoughts) or external factors (e.g., places, persons), reminding one of the irreversibility of the loss (Boelen et al., 2006). Such avoidance strategies may keep the bereaved individual from adequately processing distressing details of the death of the loved one and integrating them into the autobiographical memory. This may increase intrusive re-experiences of the death or related memories and emotions (i.e., PTSD symptoms) (Ehlers & Clark, 2000). Depressive avoidance strategies are defined as behavioral patterns of inactivity and withdrawal, where the individual

refrain from activities that were important before the loss or new activities that have the potential to increase positive feelings and adaptation (Boelen et al., 2006). This type of avoidance may keep the bereaved individual from engaging in social and meaningful activities, which then may intensify depressive symptoms such as feelings of emptiness and meaninglessness (Boelen et al., 2006). Finally, maladaptive grief cognitions (e.g., global negative cognitions about the future, oneself, others, or life, and catastrophic thoughts about one's grief) might increase feelings of meaninglessness and/or intensify feelings of threat (i.e., symptoms of depression and PTSD). In line with this cognitive-behavioral framework, PGD may increase the risk of development or worsening of PTSD and depressive symptoms due to the described underlying core psychological mechanisms.

Temporal associations between complicated grief reactions

Several studies support the hypothesis that high PGD symptom levels increase the risk of the development or worsening of PTSD and depressive symptoms. Three longitudinal studies found that PGD symptoms temporally predict or mediate later symptoms of PTSD in samples of traumatic (e.g., plane disaster) and nontraumatic bereavement (e.g., sickness, old age) to a greater extent than vice versa (Djelantik et al., 2018; Lenferink et al., 2019; O'Connor et al., 2015). Concerning temporal relationship between symptoms of PGD and depression alone, two longitudinal studies found PGD symptoms to temporally predict or mediate later depressive symptoms rather than vice versa (Lenferink et al., 2019; Tsai et al., 2020). Contrary to the majority of studies, one study of 275 bereaved trauma-exposed survivors found that PTSD symptoms at 14-15 months predicted PGD symptoms at 30-32 months post-loss (Glad et al., 2022). However, as the participants were not only coping with a loss but were directly traumatized themselves, the PTSD psychopathology might be especially pronounced in this group of bereaved individuals. Additionally, Lenferink et al. (2019) found that PTSD symptoms rather than PGD symptoms temporally predicted depression in a sample of traumatic losses due to a plane disaster, when symptoms of PGD, PTSD, and depression

were taken into account simultaneously. A recent study found similar results in a sample of bereaved families from an intensive care unit (Wen et al., 2022). These mixed findings could suggest a complex pattern of temporal relationships, but methodological limitations in previous studies challenge the generalizability of findings. First, most of the studies used convenience sampling and focused on specific death causes, e.g., deaths due to plane disasters, terror attacks, and cancer (Glad et al., 2022; Lenferink et al., 2019; Tsai et al., 2020). Secondly, the studies yielded low response rates at initial assessment and high dropout rates at follow-up assessment (Djelantik et al., 2018; Lenferink et al., 2019; O'Connor et al., 2015). Finally, most studies did not disentangle between-person and within-person effects, and cannot conclude if higher PGD symptoms at one time point lead to subsequent increase in symptoms of PTSD and depression within a bereaved individual (Orth et al., 2022). Based on previous research, there is a need for longitudinal studies that measure PGD, PTSD, and depression at numerous time points from early to later bereavement in a large, representative sample of a general bereaved population. Finally, to our knowledge, no study has investigated temporal relationships between symptoms of PGD, PTSD, and depression in subgroups of bereaved individuals based on different relationships to the deceased (e.g., losing a spouse or parent). Some evidence suggests that losing a partner is a risk factor for high levels of bereavement-related distress compared to other types of losses, e.g., losing a parent as an adult (Burke & Neimeyer, 2013). However, based on a review of empirical studies, Maccallum and Bryant (2013) proposed that it is the degree to which the bereaved individual's identity is entwined with the deceased (merged identity) that is crucial in the development of PGD. Correspondingly, recent studies found that perceived interpersonal closeness to the deceased was an important risk factor across bereaved spouses and adult children, and both subgroups show similar patterns of decreasing symptoms over time (Harris et al., 2023; Harrison et al., 2022). Thus, perceived interpersonal closeness and merged identity with the deceased may increase the risk of developing

PGD rather than the factual relationship to the deceased. Still, higher interpersonal closeness may be more frequent in bereaved elderly spouses. However, when PGD is present, regardless of whether one lost a spouse or a parent, the same core psychological mechanisms (e.g., avoidance) are proposed to be maintaining PGD symptoms (Boelen et al., 2006; Maccallum & Bryant, 2013). In the same way, relationships between complicated grief reactions would likely be similar across different types of loss, because the same core problem is present.

Aim of the study

This study primarily aimed to investigate temporal relationships between PGD, PTSD, and depression from 2 months post-loss throughout the 2 first years of bereavement in a large registry-based sample of bereaved adults. We hypothesized that high levels of PGD symptoms would lead to high levels of PTSD and depression. As a secondary aim, we examined potential differences in temporal relationships based on relationship to the deceased (spousal versus parental loss). We hypothesized similar relationships between PGD, PTSD, and depression across both types of loss, although spousal loss may be associated with higher levels of PGD. Finally, predictors of between-person differences in symptomatology were explored. The predictors were chosen based on research indicating age, gender, and relationship to the deceased as potential risk factors for bereavement-related distress (Burke & Neimeyer, 2013).

Methods

Participants in the present study were bereaved individuals who had lost a spouse or a parent. They were enrolled in a large ongoing multi-wave cohort study, entitled The Aarhus Bereavement Study (TABstudy). The TABstudy is under the surveillance of the Danish Data Protection Agency [registration number: 2015-57-0002- 62908-266], follows the General Data Protection Regulation of the European Union [2016/679], and was pre-registered at ClinicalTrials.org [NCT03049007].

Data were collected and managed using the research electronic data capture (REDCap) tool hosted at Aarhus University, Denmark (Harris et al., 2009).

Recruitment procedure and participants

All bereaved individuals (age: 25-85 years), who lost a spouse from January 2017 to March 2018, and lived in the metropolitan area of Aarhus, Denmark, were identified through extractions from the Danish Civil Registration System (DCRS). Potential participants were sent a condolence letter 1 month after their loss. Two months post-loss, potential participants were invited to participate via phone interviews. If the bereaved spouses consented to participate in the study, their adult children were also invited to participate. Of the 1464 contacted bereaved spouses, 986 agreed to participate (67.3 %). Of the 529 parentally bereaved individuals who expressed interest in participating, 400 agreed to participate in the study (75.6 %). The overall response rate of the 1993 contacted individuals was 69.5 %. All participants provided written informed consent and were sent self-report questionnaires via postal or online mail at 2, 6, 11, 18, and 26 months after the loss (i.e., T1, T2, T3, T4, and T5). A total of 1247 individuals participated at T1. There were no statistically significant differences between participating individuals and non-participating individuals in relation to gender or socioeconomic status (p = .501, p = .957), but individuals who did not participate were significantly older than those participating (p <.001). Before the data analysis, cases were excluded if they had a high degree of missing data (50% or more on case level) at each time point (at T1 this meant excluding 60 cases). The percentage of missing values in the included sample was very low (1.1-2.5%) and data were missing completely at random for all five-time points (Little, 1988; Little's Missing Completely At Random (MCAR) test = ns). The Expectation-Maximization algorithm was performed to impute missing data (Twala, 2009). This resulted in a final sample of 1224 bereaved individuals, who completed one or more of the questionnaires (n = 1187 at T1, n =1093 at T2, n = 1065 at T3, n = 915 at T4, and n = 761 at T5). 677 participants

completed all five questionnaires. See further information about design and recruitment in in the paper of Lundorff et al. (2021).

Measures

Prolonged grief disorder: Symptoms of PGD were measured using the Prolonged Grief-13 scale (PG-13; Prigerson et al., 2009), which is a 13-item scale measuring the severity and frequency of symptoms of PGD (e.g., "In the past month, how often have you had intense feelings of emotional pain, sorrow, or pangs of grief related to the lost relationship?" and "Have you had trouble accepting the loss?") on a 5-point Likert scale. PG-13 has been validated in different populations (Pohlkamp et al., 2018; Prigerson et al., 2009). A recent study on the TABstudy data found that the Danish version of PG-13 was a valid measure of PGD symptoms reflecting the ICD-11 structure of core- and associated symptoms (Vang et al., 2022). The cut-off for clinically relevant symptoms of PGD in this study was ≥ 35 as suggested by Pohlkamp et al. (2018). The Cronbach's alpha ranged between .90 to .92 across T1 to T5.

Depression: Symptoms of depression were measured using the Center for Epidemiologic Studies Depression Short Form (CES-D 10). CES-D-10 is a 10-item self-report scale (e.g., "I thought my life had been a failure") (Björgvinsson et al., 2013; Radloff, 1977). The cut-off for clinically relevant symptoms of depression was ≥ 16 (Weiss et al., 2015). Cronbach's alpha ranged between .84 to .87 across T1 to T5.

Posttraumatic stress disorder: Symptoms of bereavement-related PTSD was measured with The Posttraumatic Stress Disorder Checklist for Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition (PCL-5; Ashbaugh et al., 2016; Weathers et al., 2013). To capture bereavement-related PTSD "the death" was used instead of "the stressful experience" (e.g., "Repeated, disturbing

dreams of the death?"). The cut-off for clinically relevant PTSD was ≥ 31 (Ashbaugh et al., 2016; Weathers et al., 2013). Cronbach's alpha ranged between .91 and .93 from T1 to T5.

Data analyses

Random intercept cross-lagged panel models (RI-CLPM) were used to investigate temporal relationships between summed scores of PGD, PTSD, and depression (Hamaker et al., 2015). RI-CLPM is an extension of the original CLPM model in which a hypothesized time-invariant component is included to accurately separate between-person differences, represented by the random intercept (RI), from within-person processes, modelled by the CLPM (Hamaker et al., 2015; Usami et al., 2019). In this study, individual differences in symptomatology (RI) were separated from the hypothesized relationships between the syndromes over time (CLPM-paths). Data analysis progressed in two stages.

In stage one, two RI-CLPM models were conducted: Model 1 where the cross-lagged paths were constrained to be equal across types of loss, and Model 2 with no constraints. Model fit was evaluated and compared to determine whether complicated grief reactions were best modelled separately across the subsamples to accommodate significant differences in symptom stability or temporal relationships between parental and spousal loss (Model 2), or whether constraining the temporal relationships to be equal between the types of loss (Model 1) provided a better fit to the data. We evaluated the competing models' absolute fit indices, incremental fit indices, and parsimonious fit indices. Absolute fit indices investigate the degree of misfit in the model and are indicated by Chi-square-test, root mean square error of approximation (RMSEA), and standardized root mean squared residual (SRMR) with smaller values favored. Chi-square test should preferably be non-significant, although this is often not the case in large samples, as significance is dependent on sample size (Tanaka, 1987). SRMR and RMSEA values of ≤.05 indicate a good fit and ≤.08

indicates an acceptable fit (Byrne, 2012; Jöreskog & Sörbom, 1993). Incremental fit indices indicate the degree of improvement in model fit compared to a baseline model. Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) were used, where ≥.90 is acceptable and ≥.95 indicates a good fit (Bentler, 1990; Tucker & Lewis, 1973). Finally, Bayesian Information Criterion (BIC) compares the relative fit of the models (Schwarz, 1978) and is parsimony-corrected, thereby penalizing increasingly complex models. A difference of 10 points or more points on the BIC is found to indicate a superior model fit of the model with the lower value (Raftery, 1995).

Stage two was based on the selection of the best-fitting models and consisted of adding demographic covariates and relationship to the deceased as predictors of RI representing between-person differences. Given that the model with constraints on temporal relationships across subsamples (Model 1) provided the best fit to the data, an overall RI-CLPM was computed with age, gender, and relationships to the deceased as covariates.

Results

Characteristics of the participants

Characteristics of the participants are presented in Table 1. Two-thirds of the participants were women (66.55 %) with a mean age of 61.86 years (standard deviation, *SD* = 15.64). The majority were currently either on pension (*n* = 650, 54.76 %) or working (*n* = 450, 37.91 %). Only 2.73 % of the deaths were caused by accidents or suicides, while most deaths were caused by natural events (e.g., old age, disease). The participants' symptom levels were generally declining (see Table 2). Across time, between 62-66 % of the participants who had clinically significant PGD symptoms also endorsed clinically relevant levels of co-occurring depression or PTSD.

Participants who only completed the first questionnaire (T1) were not significantly different from the participants who answered later questionnaires in terms of gender, level of education, received

support, additional losses, sickness before the loss, cause of death, symptom level of PGD, and depressive symptoms at T1. However, participants who only completed T1 were younger compared to those who also answered later questionnaires (mean, $M = 59.48$, $SD = 16.62$ vs. $M = 63.70$, $SD = 14.67$, $p < .001$) and showed higher levels of PTSD at T1 ($M = 14.48$, $SD = 12.92$ vs. $M = 12.37$, $SD = 10.99$, $p = .003$). In terms of source of income, there was a statistically significant difference, $\chi^2(2) = 10.63$, $p = .005$, Cramer's $V = .094$. Compared to participants who only completed T1, a greater proportion of those who completed later questionnaires had a primary income of pension (59.1 % vs. 49.6 %), but a smaller proportion had a primary income of salary (34.8 % vs. 42.8 %) or received support from the government (6.1 % vs. 7.6 %).

INSERT TABLE 1

INSERT TABLE 2

RI-CLPMs of PGD, PTSD, and depression

Table 3 displays fit statistics from tests of model fit from the first stage of the analyses. Both models provided excellent fit to the data. However, differences in the BIC favored the constrained model (Model 1) (ΔBIC = 210). Taken in conjunction with the presence of negative residual variances in the measurement model of all outcomes at T5 in the unconstrained model (Model 2) and the principle of parsimony, the theoretical model assuming similar temporal relationships between complicated grief reactions across both types of loss was preferred (Model 1). This selection was supported by a chi-square difference test indicating no statistically significant differences between the models ($\chi^2_{dif}(36) = 46.34$, $p = .116$). A RI-CLPM for the full sample was therefore computed with excellent fit statistics ($\chi^2(48) = 127.39$, CFI = .996, TLI = .991, RMSEA [90% CI] = .037 [.029; .045], SRMR = .030, BIC = 87356). The RI accounted for statistically significant amounts of variance in all outcomes (factor loadings ranging from .76 to .94, $p < .001$,

see Table 4), and was strongly correlated for all outcomes: $r_{RI\text{-}PGD\ and\ RI\text{-}depression} = .83$, $p < .001$, $r_{RI\text{-}PGD\ and\ RI\text{-}PTSD} = .85$, $p < .001$, and $r_{RI\text{-}depression\ and\ RI\text{-}PTSD} = .88$, $p < .001$.

INSERT TABLE 3

All standardized correlation coefficients were positive and statistically significant but declined from large to medium from 2 to 26 months post-loss (see Table S1).

Temporal relationships

Table 4 displays standardized regression coefficients and factor loadings for the final RI-CLPM. The autoregressive effects were statistically significant and relatively stable for PGD and PTSD until 18 months post-loss, and for depression until 11 months post-loss. Over time, the autoregressive effects declined towards statistical non-significance and from medium to small according to Cohen's guidelines (Cohen, 1988).

The cross-lagged effects indicated a complex pattern (see Figure 1). From 2-6 months post-loss, PGD symptoms predicted PTSD and depressive symptoms. From 6-11 months post-loss, PTSD symptoms predicted symptoms of PGD, whereas PTSD and depressive symptoms showed bidirectional relationships. From 11-18 months post-loss, symptoms of PGD, PTSD, and depression become entangled. Unexpectedly, PTSD symptoms at 11 months post-loss were negatively associated with PGD and PTSD symptoms at 18 months post-loss. Furthermore, from 18 months post-loss, no within-person effects reached statistical significance, and large between-person differences in symptomatology were found 2 years post-loss (RI: $PGD_{T5} = .94$; $depression_{T5} = .84$; $PTSD_{T5} = .91$). The unexpected findings may be related to less remaining variance in the model at later time points (Table S2) and potential problems with multicollinearity (see strong positive correlations between syndromes in Table S3). The cross-lagged effects were small according to

Cohen's guidelines, which are common in RI-CLPMs and do not imply unimportant effects (Orth et al., 2022).

INSERT TABLE 4

INSERT FIGURE 1

Predictors of between-person differences in symptomatology

Table 5 displays standardized regression coefficients for associations between demographics, relationship to the deceased, and RI representing between-person differences in symptomatology ($\chi^2(84) = 212.53$, $p < .001$, CFI = .993, TLI = .988, RMSEA [90% CI] = .035 [.030; .041], SRMR = .033, BIC = 86939). The female gender weakly predicted higher levels of PTSD and depressive symptoms, but not symptoms of PGD. Compared to higher age, being younger was moderately associated with higher levels of PGD, PTSD, and depression. Regarding relationship to the deceased, being bereaved of a spouse was associated with higher levels of PGD, PTSD, and depression with effects ranging from moderate to large.

INSERT TABLE 5

Discussion

In line with previous research (Komischke-Konnerup et al., 2021), high levels of co-occurrence were found between PGD, PTSD, and depression in the present study. The primary aim was to examine temporal relationships between these syndromes from 2 months post-loss throughout the 2 first years of bereavement in a large representative sample of a general bereaved population. Consistent with our hypothesis, early grief symptoms (i.e., PGD symptoms at 2 months post-loss) predicted PTSD and depressive symptoms at 6 months post-loss. However, this pattern was not consistently found throughout the 2 first years of bereavement. Instead, temporal patterns between PGD, PTSD, and depression became increasingly intertwined. Regarding our secondary aim,

similar temporal patterns were evidenced across spousal and parental bereavement. This supports the hypothesis that temporal relationships between PGD, PTSD, and depression are not affected by whom you lose. Nevertheless, losing a spouse at a younger age was associated with overall higher severity of PGD, PTSD, and depression.

The impact of early grief symptoms

The present study point to the high initial levels of grief within the individual may be a risk factor for the later development or intensification of symptoms of PTSD and depression as well as full-blown PGD. This is in line with previous research indicating that bereavement and high levels of early grief are important risk factors for developing serious mental illnesses such as depression, PTSD, and PGD (Boelen & Lenferink, 2021; Cole & Dendukuri, 2003; Guldin et al., 2017; Kristiansen et al., 2019). Paradoxically, PGD cannot be diagnosed until 6 months post-loss according to ICD-11, whereas depression and PTSD can be diagnosed within this period. This points to a need for further research into the clinical utility and validity of the time criterion for PGD. While a PGD diagnosis is not appropriate at 2 months post-loss, these findings indicate that early high levels of grief may have a spillover effect on the intensification or development of PTSD and depressive symptoms rather than vice versa.

Intertwined temporal relationships

In this study, PGD was not the driving force in the development of long-term PTSD and depressive symptoms post-loss. Instead, temporal patterns between them became increasingly complex and intertwined over time. This is consistent with cross-sectional analyses that find mixed classes of PGD, PTSD, and/or depressive symptoms (Boelen, 2021; Kokou-Kpolou et al., 2021; Maccallum & Bryant, 2019) and close connections between symptoms of these syndromes (Djelantik et al., 2020; Karatzias et al., 2022). Together, this suggests that PGD, PTSD, and depression could be considered

a cluster of closely associated loss-related syndromes and that the entangled associations could reflect ramifications of a general type of bereavement-related distress, sharing core psychological mechanisms (cf. Nolen-Hoeksema & Watkins, 2011; Ruggero et al., 2019). Although the cognitive-behavioral framework of PGD suggests diagnosis-specific core mechanisms, the framework is highly influenced by cognitive-behavioral models of PTSD and depression, where avoidance strategies and maladaptive cognitions are also considered core mechanisms (Boelen et al., 2006; Ehlers & Clark, 2000). Associations between proposed core mechanisms and PGD, PTSD, and depression are evidenced in bereaved individuals (Boelen, 2021; Maccallum & Bryant, 2019; Treml et al., 2021).However, the negative associations between PTSD and PGD at 11-18 months post-loss, and non-significant associations at 18-26 months post-loss, pose a potential challenge for above interpretation. Theoretically, the change in temporal associations coincides with the anniversary of the death date, which could be an important turning point for bereaved individuals that affect the relationships between syndromes. Statistically, reduced remaining variance and strong correlations between the syndromes may disturb estimates in the model at these time points and should be interpreted with caution. Nevertheless, the strong positive correlations between the syndromes support a close and intertwined relationship.

The role of trait-like between-person differences

Differences between individuals in terms of stable levels of complicated grief reactions accounted for an increasingly large amount of variance in this study. Eighteen months post-loss, no cross-lagged or autoregressive relationships were statistically significant. Simultaneously, the influence of between-person differences on PGD, PTSD, and depressive symptoms was at its highest and strongly correlated. Together, this could suggest that bereaved individuals' general and somewhat stable level of complicated grief reactions is a stronger predictor of distress in later bereavement compared to temporary fluctuations of specific syndromes. High general distress appears to be more

detrimental than temporarily high levels of specific types of distress. This is consistent with dimensional approaches, e.g., the Hierarchical Taxonomy of Psychopathology (HiTOP) model, in which psychopathology is seen on a dimension from resilience to overall maladaptation, conceptualized as a general psychopathological factor *P*. *P* is assumed to be underlying for all mental illnesses (trait-like between-person differences) and can manifest itself in different constellations of syndromes over time (temporary within-person fluctuations) (Ruggero et al., 2019). The amount of variance explained by between-person differences may also reflect the nature of the sample as a general population sample with low symptom levels at later measurements. This is in line with research showing that most bereaved individuals show resilience, whereas only a small group experience persistent psychopathology (Bonanno et al., 2002; Mancini, 2019; Nielsen et al., 2019). However, the RI, cross-lagged effects, and autoregressive effects may change if examined in a homogenous group of clinically impaired bereaved people.

The present findings are different from previous cross-lagged studies (Djelantik et al., 2018; Lenferink et al., 2019; Wen et al., 2022). However, most studies did not disentangle between-person differences from within-person fluctuations of symptoms, which can lead to inaccurate estimates (Hamaker et al., 2015). Furthermore, temporal relationships between syndromes found within bereaved persons may be more sensitive to influence of external stressors not related to the loss (e.g., divorce, job loss, COVID-19) compared to more trait-like levels of symptomatology. The only study that also controlled for between-person differences found that differences between bereaved participants accounted for a large amount of variance in PGD and PTSD (Glad et al., 2022).

The present study examined potential predictors of the large between-person differences. The strongest predictor was relationship to the deceased, in which losing a spouse was associated with higher levels of complicated grief reactions compared to losing a parent. Bereaved spouses may have greater interpersonal closeness and merged identities increasing the risk of complicated grief

reactions, whereas parentally bereaved adults are likely to perceive themselves as independent from the deceased, e.g., living on their own (Maccallum & Bryant, 2013). Moreover, younger age was a predictor of generally high levels of complicated grief reactions. This could reflect that less experience with loss is a possible risk factor for high symptoms (Burke & Neimeyer, 2013). It is also probable that loss of an important attachment figure early in one's life would be more conflicting with one's life script, thus increasing intense feelings of shock and distress (Horowitz, 1990). Finally, being a woman was associated with higher PTSD and depressive symptoms, but not PGD. Previous studies indicated that being a woman is a potential risk factor for complicated grief reactions (Burke & Neimeyer, 2013). However, the gender effect on PGD may be neutralized in this study due to most participants being older bereaved spouses, and older men may be more dependent on their wives (higher merged identity), which increases the likelihood of PGD (Maccallum & Bryant, 2013). Future research needs to clarify the role of trait-like differences versus individual fluctuations of complicated grief reactions by using factor-analytic methods to test the potential changing role of a general trait-like factor of distress in contributing to associations between PGD, PTSD, and depression within bereaved individuals over time.

Strengths and limitations

The present study has several strengths. First, analyses are based on a large and representative sample of a general bereaved population, primarily based on probability sampling, with a reasonably high response rate (69.5 %), and a representative proportion of men included in the sample. Previous comparative analysis of the TABstudy found a non-significant gender difference between non-participants and participants (Lundorff et al., 2020). Second, to our knowledge, it is the first study of temporal relationships between PGD, PTSD, and depression that includes multiple assessments from as early as 2 months post-loss throughout the primary years of bereavement.

Finally, the present study is the first to investigate the role of the relationship to the deceased in temporal relationships between PGD, PTSD, and depression.

Several limitations should be considered. First, the study was not based on structured clinical interviews for diagnostics and some participants may not meet the event criterion of PTSD (exposure to a threatening/horrific event). Thus, the results cannot be generalized to diagnoses per se and the exclusion of the event criterion of PTSD potentially inflate correlations among syndromes. Second, the study did not include pre-loss measurements. The effect of pre-existing depression or PTSD on PGD is still unknown. Future research would profit from pre-loss measurements. Third, as the study is based on a community sample, the results may not be directly generalizable to treatment-seeking bereaved individuals. Future studies need to examine temporal associations between these syndromes in a more homogenous sample of clinically impaired individuals. Fourth, some participants were related to each other and had lost the same person (e.g., multiple adult children from the same family). Finally, it was not possible to study other types of loss, e.g., loss of a child.

Clinical implications

The present study underlines the importance of early screening for PGD, PTSD, and depression to identify bereaved individuals potentially at risk of developing these syndromes. Specifically, if high levels of grief are present in early bereavement, one should be aware that these symptoms may evolve into co-occurring depressive and PTSD symptoms in long-term bereavement. Early intervention of grief symptoms may even have preventive effects on later development of PTSD and depression. Furthermore, the closely intertwined relationships between different complicated grief reactions point to the relevance of transdiagnostic treatment. Smid et al. (2015) developed 'Brief Eclectic Psychotherapy for Traumatic Grief' for symptoms of PGD and PTSD due to traumatic deaths (e.g., accidents). A similar treatment is currently being tested for complicated grief

reactions in old age due to different loss types (see https://clinicaltrials.gov/ct2/show/NCT04694807). Both treatments focus on similar maintaining processes, i.e., inadequate integration of the loss into autobiographical memory, maladaptive cognitions, and problematic avoidance strategies.

Conclusions

The present study found that temporal relationships between PGD, PTSD, and depression were similar across parental and spousal bereavement, although bereaved spouses report higher symptom severity. Between-person differences explained most variance in symptomatology regardless of the syndromes. Additionally, high levels of early grief predicted symptoms of PGD, PTSD, and depression. Over time, PGD, PTSD, and depression became increasingly intertwined, constituting a highly connected cluster of bereavement-related distress. Future studies need to replicate the present findings in samples of clinically impaired bereaved individuals.

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Table 1. Characteristics of the participants at 2 months post-loss.

	All participants (*N*= 1187)	Spousal loss (*n*= 807; 67.99 %)	Parental loss (*n*= 380; 32.01 %)
Gender, *n* (%)			
Men	397 (33.45)	242 (29.99)	155 (40.79)
Women	790 (66.55)	565 (70.01)	225 (59.21)
Age, mean (*SD*)	61.86 (15.64)	70.17 (9.72)	44.24 (10.23)
Highest level of education, *n* (%)			
Primary school	245 (20.64)	220 (27.26)	25 (6.58)
High school	36 (3.03)	16 (1.98)	20 (5.26)
Vocational training	322 (27.13)	224 (27.76)	98 (25.79)
Continuing education	139 (11.71)	84 (10.41)	55 (14.47)
University	427 (35.97)	245 (30.36)	182 (47.89)
Missing	*18 (1.52)*	*18 (2.23)*	*0 (0.00)*
The primary source of income, *n* (%)			
Salary	450 (37.91)	128 (15.87)	322 (84.74)
Pension	650 (54.76)	637 (78.93)	13 (3.42)
Support from the government [a]	41 (3.45)	10 (1.24)	31 (8.16)
Other	36 (3.03)	23 (2.85)	13 (3.42)
Missing	*10 (0.84)*	*9 (1.12)*	*1 (0.26)*
Sickness before the loss, *n* (%)			
Yes	853 (71.86)	604 (74.85)	249 (65.53)
No	315 (26.54)	184 (22.80)	131 (34.47)
Missing	*19 (1.60)*	*19 (2.35)*	*0 (0.00)*
Cause of death [b], *n* (%)			
Cancer		461 (57.13)	
Cardiovascular disease		92 (11.40)	
Accident/suicide		22 (2.73)	
Old age		21 (2.60)	
Dementia		17 (2.11)	
Diabetes		8 (0.99)	
Other		174 (21.56)	
Missing		*12 (1.49)*	
Loss of other persons within the five past years, mean *(SD)*	1.80 (1.27)	1.89 (1.37)	1.49 (0.80)
Number of persons whom the bereaved person received support from, mean *(SD)*	3.95 (2.20)	4.20 (2.26)	3.42 (1.99)

Note. SD= Standard deviation; [a] E.g., unemployment benefits, sickness benefits, social security, state education grant. [b] Self-reported cause of death, only reported by bereaved spouses.

Table 2. Symptoms of PGD, PTSD, and depression over time.

	T1 [a] N = 1187	**T2** N = 1093	**T3** N = 1065	**T4** N = 915	**T5** N = 761
Symptoms, mean *(SD)*					
PGD	25.48 (9.05)	23.98 (8.83)	22.14 (8.47)	20.92 (7.66)	19.67 (7.04)
PTSD	13.28 (11.90)	11.79 (11.47)	10.39 (10.68)	9.24 (9.95)	8.94 (9.40)
Depression	9.03 (5.82)	8.42 (5.78)	7.68 (5.57)	7.15 (5.17)	6.98 (5.10)
Clinically relevant symptoms present, *n* (%)					
PGD	207 (31.17)	152 (13.90)	113 (10.61)	60 (6.56)	30 (3.94)
PTSD	111 (10.32)	94 (9.41)	71 (7.14)	42 (4.70)	26 (3.45)
Depression	172 (14.49)	142 (12.99)	122 (11.46)	74 (8.09)	54 (7.10)
Cases of co-occurrence, *n* (%) [b]					
PGD without co-occurrence	77 (37.20)	52 (34.21)	38 (33.63)	23 (38.33)	11 (36.67)
PGD with PTSD only	25 (12.08)	16 (10.53)	8 (7.08)	4 (6.67)	3 (10.00)
PGD with depression only	43 (20.77)	30 (19.74)	26 (23.01)	11 (18.33)	6 (20.00)
PGD with PTSD and depression	62 (29.95)	54 (35.53)	41 (36.28)	22 (36.67)	10 (33.33)

Note. SD= Standard deviation; T1= 2 months post-loss; T2= 6 months post-loss; T3= 11 months post-loss; T4=18 months post-loss; and T5= 26 months post-loss; PGD= prolonged grief disorder; PTSD= posttraumatic stress disorder.

[a] PGD measured at T1 does not represent PGD symptoms per se, because of the time criterion.

[b] Percentage of co-occurrence in individuals with clinically relevant PGD symptoms at each time point (e.g., T1: N = 207).

Table 3. Fit statistics for random intercept cross-lagged panel models.

Model	χ^2 (df)	p	CFI	TLI	RMSEA (90 % CI)	SRMR	BIC
PGD, depression, and PTSD							
Model 1	**231.79 (132)**	**<.001**	**.995**	**.991**	**.035 (.028, .043)**	**.041**	**87210**
Model 2	185.45 (96)	<.001	.995	.989	.039 (.031, .047)	.031	87420

Note. The best fitting model is indicated in bold; prolonged grief disorder (PGD); posttraumatic stress disorder (PTSD); Comparative Fit Index (CFI); Tucker-Lewis Index (TLI); Root mean square error of approximation (RMSEA); Standardized root mean squared residual (SRMR); Bayesian Information Criterion (BIC). Model 1 has constrained cross-lagged paths to be equal across types of loss. Model 2 included no constraints but had estimation problems with a negative residual variance for all outcomes at T5 in the parental loss group.

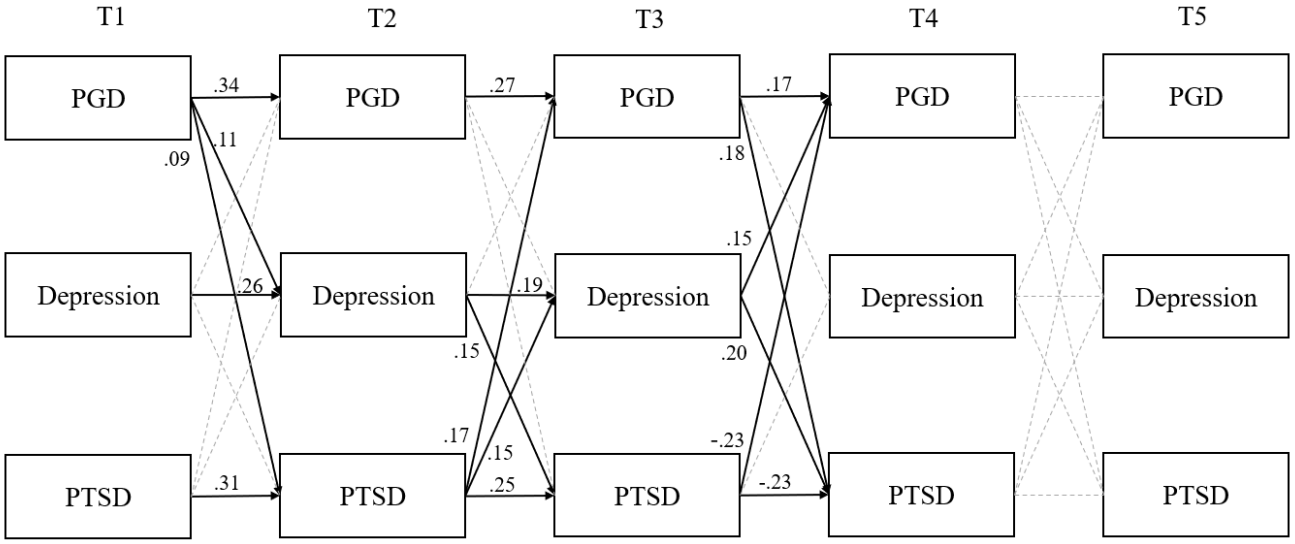
Table 4. Standardized regression coefficients and random intercept loadings from the final model.

	Std. B	*p*
Autoregressive effects		
PGD T1 → PGD T2	**.34**	<.001
PGD T2 → PGD T3	**.27**	<.001
PGD T3 → PGD T4	**.17**	.047
PGD T4 → PGD T5	-.09	.489
Depression T1 → Depression T2	**.26**	<.001
Depression T2 → Depression T3	**.19**	.001
Depression T3 → Depression T4	.13	.084
Depression T4 → Depression T5	.14	.058
PTSD T1 → PTSD T2	**.31**	<.001
PTSD T2 → PTSD T3	**.25**	<.001
PTSD T3 → PTSD T4	**-.23**	.015
PTSD T4 → PTSD T5	-.04	.741
Cross-lagged effects		
PGD T1 → Depression T2	**.11**	.026
PGD T2 → Depression T3	.05	.404
PGD T3 → Depression T4	.08	.293
PGD T4 → Depression T5	-.07	.503
PGD T1 → PTSD T2	**.09**	.046
PGD T2 → PTSD T3	-.02	.702
PGD T3 → PTSD T4	**.18**	.031
PGD T4 → PTSD T5	.07	.741
Depression T1 → PGD T2	.02	.622
Depression T2 → PGD T3	.04	.417
Depression T3 → PGD T4	**.15**	.007
Depression T4 → PGD T5	.08	.439
Depression T1 → PTSD T2	.02	.591
Depression T2 → PTSD T3	**.15**	.007
Depression T3 → PTSD T4	**.20**	.013
Depression T4 → PTSD T5	.07	.471
PTSD T1 → PGD T2	.07	.103
PTSD T2 → PGD T3	**.17**	.002
PTSD T3 → PGD T4	**-.23**	.014
PTSD T4 → PGD T5	.13	.249
PTSD T1 → Depression T2	.05	.278
PTSD T2 → Depression T3	**.15**	.007
PTSD T3 → Depression T4	-.15	.084
PTSD T4 → Depression T5	.13	.105
Random intercept loadings	λ	*p*
PGD T1	**.82**	<.001
PGD T2	**.84**	<.001
PGD T3	**.87**	<.001
PGD T4	**.93**	<.001

PGD T5	**.94**	<.001
Depression T1	**.76**	<.001
Depression T2	**.81**	<.001
Depression T3	**.83**	<.001
Depression T4	**.86**	<.001
Depression T5	**.84**	<.001
PTSD T1	**.79**	<.001
PTSD T2	**.84**	<.001
PTSD T3	**.87**	<.001
PTSD T4	**.92**	<.001
PTSD T5	**.91**	<.001

Note. Std. *B*= Standardized beta coefficient; λ= standardized factor loading. Prolonged grief disorder (PGD); posttraumatic stress disorder (PTSD); T1= 2 months post-loss; T2= 6 months post-loss; T3= 11 months post-loss; T4=18 months post-loss; and T5= 26 months post-loss; Statistically significant results are indicated in bold.

Figure 1. The final model of temporal relationships between PGD, PTSD, and depression.



Note. All illustrated autoregressive and cross-lagged effects were statistically significant ($p < .05$); Non-significant effects (- - -); Correlations among symptoms at the same time point are not depicted; T1= 2 months post-loss; T2= 6 months post-loss; T3= 11 months post-loss; T4=18 months post-loss; and T5= 26 months post-loss; PGD= prolonged grief disorder; PTSD= posttraumatic stress disorder.

Table 5. Predictors of between-person differences in symptomatology.

	PGD		Depression		PTSD	
	Std. *B*	*p*	Std. *B*	*p*	Std. *B*	*p*
Gender (female)	.05	.081	**.10**	.001	**.08**	.006
Age	**-.35**	<.001	**-.21**	<.001	**-.40**	<.001
Relationship to deceased	**-.56**	<.001	**-.40**	<.001	**-.40**	<.001

Note. Std. *B*= Standardized beta coefficient; prolonged grief disorder (PGD); posttraumatic stress disorder (PTSD); $p < .05$ = statistical significance. Gender is coded (1 = man, 2 = woman). Relationship to deceased (1 = partner, 2 = child); Statistically significant results are indicated in bold.

Table S1. Standardized model correlation coefficients between outcomes.

	Dep T1	Dep T2	Dep T3	Dep T4	Dep T5	PTSD T1	PTSD T2	PTSD T3	PTSD T4	PTSD T5
PGD T1	0.54					0.55				
PGD T2		0.49					0.53			
PGD T3			0.51					0.56		
PGD T4				0.39					0.41	
PGD T5					0.36					0.43
PTSD T1	0.56									
PTSD T2		0.57								
PTSD T3			0.59							
PTSD T4				0.57						
PTSD T5					0.43					

Note. All correlations were statistically significant at $p<.001$.

Table S2. Unstandardized variance and residual variance estimates from the model.

	Univariate variance	Model residual variance (unstandardized)
PGD T1	81.88	-
PGD T2	77.95	17.66
PGD T3	71.75	14.26
PGD T4	58.54	7.77
PGD T5	49.53	7.25
Dep T1	33.89	-
Dep T2	33.45	9.54
Dep T3	31.01	8.28
Dep T4	26.66	7.10
Dep T5	25.94	8.31
PTSD T1	141.42	-
PTSD T2	131.35	31.74
PTSD T3	113.96	23.85
PTSD T4	98.90	15.30
PTSD T5	88.71	17.16

Note. No residual variance noted for T1 outcomes as these are only exogenous variables in the model. All were statistically significant at $p<.001$

Table S3. Standardized bivariate correlation coefficients between outcomes and Cronbach alpha values.

	PGD T1	PGD T2	PGD T3	PGD T4	PGD T5	Dep T1	Dep T2	Dep T3	Dep T4	Dep T5	PTSD T1	PTSD T2	PTSD T3	PTSD T4	PTSD T5
PGD T1	0.90	0.83	0.80	0.77	0.73	0.73	0.65	0.63	0.58	0.54	0.75	0.68	0.66	0.63	0.60
PGD T2		0.91	0.84	0.80	0.77	0.65	0.76	0.66	0.62	0.58	0.66	0.78	0.67	0.65	0.62
PGD T3			0.92	0.81	0.80	0.64	0.68	0.77	0.63	0.61	0.66	0.72	0.79	0.70	0.66
PGD T4				0.91	0.86	0.60	0.65	0.65	0.73	0.66	0.61	0.68	0.65	0.77	0.70
PGD T5					0.90	0.58	0.62	0.65	0.70	0.71	0.61	0.68	0.68	0.74	0.76
Dep T1						0.86	0.75	0.70	0.65	0.58	0.74	0.66	0.65	0.62	0.59
Dep T2							0.87	0.78	0.72	0.67	0.65	0.80	0.71	0.67	0.64
Dep T3								0.87	0.73	0.70	0.63	0.70	0.82	0.70	0.64
Dep T4									0.85	0.76	0.55	0.64	0.63	0.79	0.67
Dep T5										0.84	0.53	0.61	0.64	0.70	0.74
PTSD T1											0.92	0.80	0.75	0.72	0.69
PTSD T2												0.93	0.82	0.78	0.75
PTSD T3													0.92	0.79	0.77
PTSD T4														0.92	0.82
PTSD T5															0.91

Note. All correlations were statistically significant at p<.001. Cronbach alpha values for each measurement point are noted in the diagonal (marked with grey).