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Trajectories of grief-related psychopathology: A decade after the MH17 plane disaster

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ABSTRACT

Violent losses increase the risk for prolonged grief disorder (PGD), posttraumatic stress disorder (PTSD), and major depressive disorder (MDD). Little is known about the course of grief-related psychopathology in the long term. Hence, we examined their latent trajectories, overlap, and predictors to enhance our understanding of differential long-term responses to violent loss. MH17-bereaved people ($N = 299$) completed annual self-report measures from one to nine years post-loss. Prolonged grief (PG), posttraumatic stress (PTS), and major depression (MD) symptom trajectories were identified using latent class growth modeling. Overlap in trajectory membership was examined using frequencies. Predictors of trajectory membership were examined using multinomial regression analyses. Four PG symptom trajectories emerged: low (41.0 %), moderate decreasing (34.2 %), high (13.5 %), and recovered (11.3 %). Four PTS symptom trajectories emerged: low (56.2 %), recovered (19.6 %), moderate increasing (17.6 %), and high (6.6 %). Four MD symptom trajectories emerged: low (55.7 %), moderate (19.6 %), moderate decreasing (15.1 %), and high (9.5 %). The findings indicate that if people report psychopathology, this often entails PGD by itself, and sometimes in combination with PTSD and MDD, yet rarely PTSD or MDD by itself. Around one in 20 people was assigned to all three high symptom trajectories. Different predictors were found across disorders. To conclude, most MH17-bereaved people reported low grief-related psychopathology, yet one in six reported high grief-related psychopathology levels (i.e., at least probable PGD, PTSD, or MDD) nearly a decade later. There is no indication of a delayed onset of grief-related psychopathology.

1. Introduction

The death of a loved one can give rise to grief-related psychopathology, such as prolonged grief disorder (PGD), posttraumatic stress disorder (PTSD), and major depressive disorder (MDD) (e.g., Heeke et al., 2023). When the death was violent and unexpected in nature (e.g., murder), people are more prone to develop grief-related psychopathology than when the death was natural (Buur et al., 2024; Heeke et al., 2019, 2023; Kokou-Kpolou et al., 2020; Lobb et al., 2010). For example, the risk of developing PGD is fourfold after unexpected loss (Doering et al., 2022).

Latent class analyses show that after loss, when people experience psychopathology, it often entails PGD, and when PTSD and MDD are experienced this is often in combination with PGD (see Heeke et al., 2023). Comorbidity between PGD, PTSD, and MDD can partly be explained by overlap in symptomatology (Djelantik et al., 2020; Heeke et al., 2023; Malgaroli et al., 2018). However, there is accumulating evidence supporting that PGD is distinct from PTSD and MDD (e.g.,

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Djelantik et al., 2020; Heeke et al., 2023; Komischke-Konnerup et al., 2023). What makes PGD distinct from PTSD and MDD, according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR), is that PGD[1] is characterized by separation distress (American Psychiatric Association [APA], 2022). This separation distress manifests as continuous yearning for the deceased and/or preoccupation with thoughts or memories of (the circumstances of) the loss (APA, 2022). This contrasts PGD with PTSD and MDD, which are characterized by, for example, re-experiencing the traumatic event and negative affect, respectively (Shear, 2015). Their relatedness, yet distinctiveness, highlights the importance of researching PGD, PTSD, and MDD in the same context, separately.

Research on prevalence rates of PGD, PTSD, and MDD and average levels post-loss is predominantly cross-sectional in nature and conducted among non-representative samples (i.e., mostly convenience samples) (see e.g., Table 1 in Komischke-Konnerup et al., 2021). Notably, this type of research does not consider that the course of grief-related psychopathology can change over time and, more importantly, that their course can differ between people. Latent trajectory research can be used to identify sub-groups with different courses of symptom levels (Jung & Wickrama, 2008).

The identified number of trajectories can vary greatly between studies (e.g., two vs. five PGD trajectories; see Table 1 in Pociunaite et al., 2023). Even so, latent trajectory research most often identified three trajectories for PGD: (1) low symptoms over time, (2) elevated symptoms followed by a decrease over time, and (3) high symptoms over time (see Table 1 in Pociūnaitė et al., 2023). The same three aforementioned trajectories are most often identified for PTSD and MDD following potentially traumatic events, such as loss (see Galatzer-Levy et al., 2018; van de Schoot et al. 2018). Notably, the low symptom trajectory is often most prevalent for PGD, PTSD, and MDD.

There are several explanations for differences in the number of identified trajectories across studies, such as differences regarding the duration of the study and the number of, and time intervals between, measurement occasions (for details see Pociūnaitė et al., 2023). Most prior latent trajectory research examined grief-related psychopathology within the first two years post-loss (Bonanno et al., 2002, 2005; Kuo et al., 2019; Levy et al., 1994; Majd et al., 2024; Mørk et al., 2023; Nam, 2015; Ott et al., 2007; see Table 1 in Pociūnaitė et al., 2023; Reiland et al., 2021; Reitsma et al., 2025; Wen et al., 2020, 2021, 2023; Zhang et al., 2008). The studies that extend their research beyond the first two years often examined measurement occasions with varying or relatively large time intervals (Boerner et al., 2005; Galatzer-Levy & Bonanno, 2012; Kristensen et al., 2020; Lenferink et al., 2020; Maccallum et al., 2015; Melhem et al., 2011; Nielsen et al., 2019; Pociūnaitė et al., 2023; Sveen et al., 2018; Szabó et al., 2020). Another caveat of prior literature, is that few latent trajectory studies have examined exclusively violently bereaved people (but see: Kristensen et al., 2020; Lenferink et al., 2020). As violent loss is known to increase the risk for developing grief-related psychopathology (Buur et al., 2024; Heeke et al., 2019, 2023; Kokou-Kpolou et al., 2020; Komischke-Konnerup et al., 2021; Kristensen et al., 2012; Lobb et al., 2010), it is likely that more people are assigned to high(er) symptom trajectories after violent loss than after natural loss, and in certain cases may result in the absence of a low symptom trajectory (see Kristensen et al., 2020). Taken together, there is a need for research examining PGD, PTSD, and MDD trajectories after violent loss over an extended period of time and using (relatively) regular time intervals.

When examining PGD, PTSD, and MDD trajectories, it seems valuable to assess what factors relate to trajectory membership as this allows us to identify who seems to be at risk for grief-related psychopathology. Research, mostly cross-sectional, among violently bereaved people often finds that women, lower educated people, those who experienced the death of a child or partner/spouse, and those who lost multiple people are at an increased risk for developing grief-related psychopathology (Heeke et al., 2019; Hibberd et al., 2010; Jann et al., 2024; Kokou-Kpolou et al., 2020; Kristensen et al., 2012). Nonetheless, it is uncertain whether these risk factors are related to long-term trajectories of grief-related psychopathology after violent loss, especially considering prior research among (mostly) naturally bereaved people has shown inconsistent findings concerning trajectory predictors (Aneshensel et al., 2004; Bonanno et al., 2005; Kristensen et al., 2020; Lenferink et al., 2020; Lundorff et al., 2020; Maccallum et al., 2015; Nam, 2015; Nielsen et al., 2019; Ott et al., 2007; Pociūnaitė et al., 2023; Smith & Ehlers, 2020; Sveen et al., 2018; Szabó et al., 2020; Zhang et al., 2008). Evidently, more research is needed to test whether biological sex, level of education, relationship to the deceased, and number of losses are related to long-term trajectories of grief-related psychopathology after violent loss.

Accordingly, the first aim of the present study was to extend the study by Lenferink et al. (2020). Lenferink et al. examined latent trajectories of persistent complex bereavement disorder (PGD as conceptualized in the DSM-5), PTSD, and MDD in people bereaved by the MH17 plane disaster – the resulting deaths of which were deemed murders – from one year to four years post-loss. We extended this study by adding four annual measurement occasions, to examine whether the criminal trial that followed six years after the disaster changed the course of grief-related psychopathology. To the best of our knowledge, there is no research on symptom trajectories in bereaved people in the context of a criminal trial. Therefore, we expected to identify the three most common trajectories (i.e., low symptoms over time, elevated symptoms followed by a decrease over time, and high symptoms over time) for DSM-5-TR PGD, PTSD, and MDD, separately (see Galatzer-Levy et al., 2018; Table 1 in Pociūnaitė et al., 2023; van de Schoot et al. 2018). As part of the first aim, we also explored overlap in DSM-5-TR PGD, PTSD, and MDD trajectory membership. The second aim of the present study was to examine predictors of trajectory membership. With this aim in mind, we included biological sex, level of education, relationship to the deceased, and number of losses as predictors. Based on prior research (Heeke et al., 2019; Hibberd et al., 2010; Jann et al., 2024; Kokou-Kpolou et al., 2020; Kristensen et al., 2012), we expected that being a woman, being lower educated, losing a child or partner/spouse, and losing multiple loved ones to be related to more severe symptom trajectories of grief-related psychopathology.

2. Methods

2.1. Procedures

A missile was shot at civilian aircraft MH17 on July 17 2014 in Ukrainian airspace resulting in 298 fatalities, including 196 Dutch citizens (Dutch Safety Board, 2015). Subsequently, a criminal trial took place between March 2020 and November 2022. Three of the four suspects were convicted for murdering the occupants of the aircraft (Ministry of Justice and Security, n.d.). This latent trajectory study is part of a longitudinal survey study examining psychosocial sequalae of people bereaved by the plane disaster (Buiter et al., 2022; Lenferink et al., 2017, 2019, 2020; Nijborg, Kunst, et al., 2024). The longitudinal survey study consisted of eight waves (hereafter: W1-W8) of data collection. The surveys were offered in Dutch and English. Data were collected on average 11, 22, 31, 42, 67, 79, 88, and 103 months after the loss. The last four waves were spaced in a specific manner. W5 took place right before the start of the criminal trial concerning the MH17 plane disaster (pre-trial). W6 took place before the bereaved people had the opportunity to deliver a statement in court (pre-statement) and W7 after this opportunity (post-statement). Lastly, W8 took place after the criminal trial was concluded (post-trial). People could enroll in the study

[1] In this article, the abbreviation PGD is used to denote all possible diagnostic criteria sets for prolonged grief reactions, while DSM-5-TR PGD specifically refers to the diagnostic criteria set outlined in the DSM-5-TR.

at W1, W5, and W8. For details regarding recruitment, see Lenferink et al. (2017), Buiter et al. (2022), and Nijborg, Westerhof, et al. (2024), respectively. Several studies have analyzed data from at least one wave and maximum four waves (Boelen et al., 2019; Buiter et al., 2022; Lenferink et al., 2017, 2019, 2020, 2021; Nijborg, Kunst, et al., 2024; Nijborg, Westerhof, et al., 2024; van der Velden et al., 2018), but never all eight waves. The present study was authorized by the ethics committee of the University of Groningen (ID: PSY-1920-S-0171). Written consent was obtained from all participants.

2.2. Participants

Participants were at least 18 years old, were proficient in either Dutch or English, and knew at least one person who was on board flight MH17. In total, 299 participants took part in at least one wave. To specify, 82 people (27 %) participated in one wave, 48 (16 %) in two waves, 36 (12 %) in three waves, 49 (16 %) in four waves, 15 (5 %) in five waves, 12 (4 %) in six waves, 16 (5 %) in seven waves, and 41 (14 %) in all eight waves.

2.3. Measures

2.3.1. Traumatic Grief Inventory Self-Report (TGI-SR)

DSM-5-TR prolonged grief (PG) symptoms were assessed with the 18-item TGI-SR (Boelen & Smid, 2017; English translation: Boelen et al., 2019). Two modifications were made to the instructions. First, in case of multiple losses, the participant was instructed to keep in mind the loss that is most on their mind and/or is experienced as most stressful. In case multiple losses were equally often on their mind and/or equally stressful, they had to select one person. Second, in the instructions the wording 'death of your loved one' was rephrased to 'the death of your significant other(s) due to the plane crash'. Each item, for example, "In the past month, I felt that life is unfulfilling or meaningless without him/her" was rated with scores between one (never) and five (always). A DSM-5-TR PG total score was calculated by summing scores on eight items (range: 8–40). In prior research, a total DSM-5-TR PG score ≥ 33 (i.e., mean item score of 3.3) indicates probable PGD when analyzing all 10 items using the extension of the TGI-SR, called the TGI-SR+ (Lenferink et al., 2022). However, as eight out of 10 items were analyzed[2], the cut-off score in this study was set to ≥ 26 (i.e., $33 - 6.6 = 26$). The psychometric properties of the Dutch TGI-SR are good, yet those of the English translation are unknown (Boelen & Smid, 2017). Cronbach's alpha levels were between .84 and .91 for W1-W8.

2.3.2. The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5)

Posttraumatic stress (PTS) symptoms were assessed with the 20-item PCL-5 (Blevins et al., 2015; Weathers et al., 2013; Dutch translation: Boeschoten et al., 2014). Instead of referring to 'the stressful event' in the instructions, we referred to 'the loss of your significant other(s) in the plane disaster'. Each item, for example, "In the past month, how much were you bothered by suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?" was rated with scores between zero (not at all) and four (extremely). A total PTS score was calculated by summing the scores on all items (range: 0–80). A total PTS score > 32 indicates probable PTSD (Krüger-Gottschalk et al., 2017). The psychometric properties of the Dutch and English PCL-5 are good (Blevins et al., 2015; Van Praag et al., 2020). Cronbach's alpha levels were between .92 and .95 for W1-W8.

[2] The DSM-5-TR PGD diagnostic criteria set was released in 2022, while data collection started in 2015. This resulted in the TGI-SR being used for W1-W4 and the TGI-SR+ for W5-W8. Therefore, not all DSM-5-TR PG symptoms were assessed during the first four waves. Hence, DSM-5-TR PG symptoms were assessed with eight items instead of 10 items.

2.3.3. Quick Inventory of Depressive Symptomatology Self-Report (QIDS-SR_{16})

Major depression (MD) symptoms were assessed with the QIDS-SR_{16} (Rush et al., 2003; Dutch translation: http://www.ids-qids.org/). The QIDS-SR_{16} comprises 16 items. Every item refers to experiences in the past week, for example, "View of Myself". Each item was rated with scores between zero (e.g., "I see myself as equally worthwhile and deserving as other people") and three (e.g., "I think almost constantly about major and minor defects in myself"). A total MD score was calculated by summing the scores on nine items (range: 0–27). A total MD score ≥ 16 indicates probable MDD (Rush et al., 2003). The psychometric properties of the Dutch and English QIDS-SR_{16} are good (Lako et al., 2014; Rush et al., 2003). Cronbach's alpha levels were between .77 and .84 for W1-W8.

2.3.4. Predictors of trajectory membership

Four characteristics of the participants were considered in the present study as potential predictors of trajectory membership: biological sex (1 = male, 2 = female), level of education (1 = primary school, 2 = middle school, 3 = secondary vocational education, 4 = university (of applied sciences)), relationship to the deceased (1 = child, 2 = partner/spouse, 3 = parent, 4 = sibling, 5 = other), and number of losses (range: 1–6). For people who lost multiple loved ones, only the closest relationship to the deceased was considered in the analyses (range from closest to most distant: child, partner/spouse, parent, sibling, and other). Biological sex was recoded as 0 = male and 1 = female. The remaining predictors were dichotomized, as it would be too computationally demanding to include all categories due to our limited sample. Specifically, level of education was recoded as 0 = other than university (of applied sciences) and 1 = university (of applied sciences), relationship to the deceased as 0 = other than child or partner/spouse and 1 = child or partner/spouse, and number of losses as 0 = single loss and 1 = multiple losses.

2.3.5. Statistical analyses

First, Latent Class Growth Modeling (LCGM) was performed, followed by Latent Growth Mixture Modeling (LGMM), using Mplus (version 8.0; L. K. Muthén & B. O. Muthén, 1998-2017). LCGM and LGMM are used to identify sub-groups that are characterized by differences in the course of symptoms over time. LCGM assumes homogeneity in change over time within trajectories (i.e., no variation in the slope is allowed), while LGMM allows variation in change over time within trajectories (i.e., variation in the slope is allowed) (Jung & Wickrama, 2008; B. O. Muthén & L. K. Muthén, 2000; Nylund et al., 2007). Although LGMM may be more accurate than LCGM, convergence problems are more likely to occur when examining smaller samples (van de Schoot et al. 2017). A large number of start values (maximum 3000 with 1000 iterations) was utilized to avert convergence issues (Jung & Wickrama, 2008; Nylund et al., 2007; van de Schoot et al. 2017). In the analyses, total scores of DSM-5-TR PG, PTS, and MD were modeled separately. For participants who had more than 50 % missing data on DSM-5-TR PG, PTS or MD items in a wave, their total score was considered to be missing (Pociūnaitė et al., 2023; van Denderen et al., 2016). When less than 50 % of DSM-5-TR PG, PTS, or MD items had missing data in a wave, missing data were handled using person-mean imputation. This means that missing data were replaced with the mean item score of the participant on that particular measure in that specific wave. The remaining missing data were presumed to be missing at random (MAR) and handled using full information maximum likelihood (FIML). In the end, none of the total DSM-5-TR PG scores, <4 % of the total PTS scores, and <1 % of the total MD scores were considered missing. The metric of time for the factor loadings was determined based on intervals in months between W1 (which was set at 0) and the measurement occasion under consideration. The factor loadings were set at 0 (W1), 11 (W2), 20 (W3), 31 (W4), 56 (W5), 68 (W6), 77 (W7), and 92 (W8).

The decision regarding the optimal number of trajectories was made using statistical and non-statistical criteria. Regarding statistical criteria, lower estimates of the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and Sample-Size adjusted Bayesian Information Criterion (SS-BIC) suggest better model fit (Nylund et al., 2007). Entropy R^2 estimates between 0.6 and 0.8 suggest acceptable to good accuracy of classification, and 1.0 excellent accuracy (Clark & Muthén, 2009). Lastly, significant ($p < .05$) Vuong-Lo-Mendell-Rubin Likelihood Ratio (VLMR-LRt), Lo-Rubin Likelihood Ratio (LMR-LRt), and Bootstrap Likelihood Ratio (B-LRt) tests suggest the examined model fits the data better than the model with one trajectory less (Nylund et al., 2007). Regarding non-statistical criteria, it was considered whether the trajectories were interpretable, in line with prior research, and had sufficient participants to be considered a trajectory (i.e., at least five percent of the sample per trajectory) (Nylund et al., 2007).

We first determined the optimal number of trajectories using LCGM with only intercept and linear slopes included. The best fitting number of trajectories was ascertained by fitting a model with one trajectory to the data, followed by a model with two trajectories, and so on (up until six trajectories). Then, the optimal number of trajectories was established when adding quadratic slopes. Quadratic slopes permit the change in symptom severity to become slower or faster over time. The same procedure was repeated for LGMM. Based on the theoretical background there was no indication of there being variance between classes. Hence, the variance between classes was fixed. In the end, the best fitting solutions of the LCGM and LGMM were compared to determine which one yielded better model fit. Lower estimates of BIC were used as the indicator to decide whether adding quadratic slopes significantly improved model fit, as well as whether LCGM or LGMM provided better model fit. The results were reported in accordance with the Guidelines for Reporting on Latent Trajectory Studies (GRoLTS; van de Schoot et al. 2017).

Once the best fitting number of trajectories was established, each participant was allocated to the trajectory for which they had the highest posterior probability estimate. After this, overlap in trajectory membership was determined by examining frequencies of different combinations of PG, PTS, and MD trajectory membership. Next, univariate multinominal logistic regression analyses were performed to examine predictors of PG, PTS, and MD trajectory membership using SPSS (Version 28; IBM Corp, 2021). The univariate multinomial logistic regression analyses were followed by multivariate analyses if multiple predictors were found to be significantly ($p < .05$) related to trajectory membership.

Prior to running the main analyses, univariate binary logistic regression analyses were performed using SPSS (IBM Corp, 2021). In these analyses it was investigated whether participants who completed W5 and (at least) one subsequent wave differed significantly from participants who only completed W5, in terms of the background and loss-related characteristics under investigation and DSM-5-TR PG, PTS, and MD symptoms at W5. The same analyses have been performed for W1-W4 (see Lenferink et al., 2020). These analyses were repeated for W5-W8.

3. Results

3.1. Sample characteristics

The majority of participants was female, Dutch-born, graduated from a university (of applied sciences), and lost multiple loved ones due to the MH17 plane disaster. One fourth lost (at least) a child and one third lost (at least) their sibling (see Table 1). Descriptive statistics of PG, PTS, and MD levels at each wave are displayed in Supplementary Table 1. Rates of probable caseness across all waves were 13–34 % for DSM-5-TR PGD, 10–20 % for PTSD, and 4–12 % for MDD. There were no significant differences between people who participated in W5 only and people who participated in W5 and a subsequent wave (i.e., W6, W7, or W8) in terms of the background and loss-related characteristics under investigation, and psychopathology levels at W5. With one exception, the people who participated in W5 in combination with W7 ($B = 0.644$, $SE = 0.311$, $p = .038$) more likely lost (at least) a child or partner/spouse (vs. other loved one) than those who only participated in W5.

3.2. Unconditional models for DSM-5-TR PG symptom trajectories

Fit indices of the unconditional DSM-5-TR PG symptom models can be found in Table 2 and Supplementary Table 2. Following prior research (Lenferink et al., 2020), we modeled persistent complex bereavement (PCB) symptom trajectories in the same manner as the DSM-5-TR PG symptom trajectories (see Supplementary Table 3). The AIC, BIC, and SS-BIC estimates of the linear LCGM DSM-5-TR PG symptom model with four trajectories were similar to those of the model with three trajectories, yet the entropy of the model with three trajectories was not acceptable. Additionally, the significant VLMR-LRt and B-LRt *p*-values would suggest a significant improvement in fit when comparing the model with four trajectories to the model with three trajectories. The linear LCGM DSM-5-TR PG symptom model with five trajectories did not show a significant improvement in fit compared to the model with four trajectories, as evidenced by the higher BIC estimate and non-significant *p*-values. Adding quadratic slopes, allowing variation in the linear slope (i.e., LGMM), and doing both also did not improve model fit or resulted in non-convergence (see Supplementary Table 2). Consequently, it was concluded that the linear LCGM DSM-5-TR PG symptom model with four trajectories showed optimal fit. The posterior probabilities for this model ranged from 0.726 to 0.838.

Fig. 1 displays the linear LCGM DSM-5-TR PG symptom model with

Table 1
Sample characteristics (N = 299).

Background and loss-related characteristics	
Biological sex (*N* = 299), *N* (%)	
Male	118 (40)
Female	181 (61)
Age at the time of the disaster (*N* = 299), *M* (*SD*), range	48.6 (16.1) 14–87
Time since loss(es) in months, *M* (*SD*), range	
Wave 1 (*N* = 167)	10.73 (1.77), 9–17
Wave 2 (*N* = 94)	21.91 (1.48), 21–28
Wave 3 (*N* = 102)	31.31 (0.98), 30–34
Wave 4 (*N* = 103)	41.66 (0.59), 41–43
Wave 5 (*N* = 199)	67.01 (0.07), 67–68
Wave 6 (*N* = 129)	79.27 (0.66), 79–82
Wave 7 (*N* = 103)	88.05 (0.22), 88–89
Wave 8 (*N* = 172)	103.35 (0.69), 103–106
Level of education (*N* = 299), *N* (%)	
University (of applied sciences)	205 (69)
Secondary vocational education	39 (13)
Secondary school	53 (18)
Primary school	2 (1)
Number of losses (*N* = 297), *N* (%)	
One	110 (37)
Two	94 (32)
Three	38 (13)
Four	50 (17)
Five	3 (1)
Six	2 (1)
Deceased relative is my…[a] (*N* = 296), *N* (%)	
Child	72 (24)
Partner/spouse	10 (3)
Parent	34 (12)
Sibling	91 (31)
Other	89 (30)
Country of birth (*N* = 299), *N* (%)	
Netherlands	241 (81)
Malaysia	17 (6)
Other	41 (14)

Note. [a] Only the participant's closest relationship to the deceased was included in the analyses in case of multiple deaths, ordered from child, partner/spouse, parent, sibling to other.

Table 2
Fit indices for unconditional models of DSM-5-TR PG (N = 299), PTS (N = 288), and MD (N = 296) symptom trajectories.

Nr. of trajectories	AIC	BIC	SS-BIC	Entropy	*p*-value VLMR-LRt	*p*-value LMR-LRt	*p*-value B-LRt	Sample size per trajectory
Linear LCGM DSM-5-TR PG symptom models								
1	6410.774	6451.479	6416.593					
2	6384.962	6436.768	6392.368	0.490	0.0097	0.0120	0.0000	242/57
3	6367.195	6430.102	6376.189	0.574	0.0131	0.0161	0.0000	183/78/38
4	**6358.875**	**6432.884**	**6369.456**	**0.628**	**0.0480**	**0.0570**	**0.0000**	**123/102/40/34**
5	6360.384	6445.494	6372.552	0.679	0.2541	0.2687	0.3333	121/104/36/34/4
6[a]	6363.983	6460.195	6377.739	0.710	0.1750	0.1843	1.0000	121/104/36/31/4/3
Linear LCGM PTS symptom models								
1	7661.036	7701.329	7666.446					
2	7597.099	7648.381	7603.985	0.819	0.5217	0.5345	0.0000	247/41
3	7558.954	7621.225	7567.316	0.708	0.2184	0.2246	0.0000	205/54/30
4	**7533.335**	**7606.594**	**7543.172**	**0.677**	**0.0290**	**0.0327**	**0.0000**	**162/56/51/19**
5	7519.458	7603.706	7530.770	0.708	0.1527	0.1662	0.0000	132/60/54/30/10
6[a]	7512.702	7607.939	7525.490	0.720	0.3975	0.4089	0.0000	126/62/54/19/15/12
Linear LCGM MD symptom models								
1	5692.018	5732.612	5697.728					
2	5646.480	5698.145	5653.747	0.844	0.0135	0.0165	0.0000	255/41
3	5620.668	5683.404	5629.492	0.589	0.2603	0.2723	0.0000	189/71/36
4	**5599.835**	**5673.642**	**5610.216**	**0.676**	**0.0433**	**0.0497**	**0.0000**	**165/58/45/28**
5	5595.424	5680.303	5607.362	0.731	0.0249	0.0295	0.0400	160/58/47/29/2
6	5593.455	5689.405	5606.950	0.711	0.2458	0.2615	1.0000	159/47/42/29/17/2

Note. The optimal number of trajectories is in bold. DSM-5-TR = Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision; PG = Prolonged Grief; PTS = Posttraumatic Stress; MD = Major Depression; LCGM = Latent Class Growth Model; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SS-BIC = Sample-Size adjusted Bayesian Information Criterion; VLMR-LRt = Vuong-Lo-Mendel-Rubin Likelihood Ratio test; LMR-LRt = Lo-Mendel-Rubin Likelihood Ratio test; B-LRt = Bootstrap Likelihood Ratio test.

[a] One or more perturbed starting value run(s) did not converge.

four trajectories. For the observed individual trajectories for each latent trajectory see Supplementary Figure 1. Supplementary Figure 2 displays the other linear DSM-5-TR PG symptom models. The trajectory with the largest number of participants ($n = 123$; 41.0 %) started at W1 with relatively low symptom levels ($b = 17.54$; SE = 0.60; $p < .001$) and had a significant linear slope ($b = -0.05$; SE = 0.01; $p < .001$). This trajectory was characterized by low, slightly decreasing DSM-5-TR PG levels over time and labeled as "Low PG symptoms". The trajectory with the second largest number of participants ($n = 102$; 34.2 %) started at W1 with moderate DSM-5-TR PG levels ($b = 23.35$; SE = 0.84; $p < .001$). This trajectory was characterized by moderate, slightly decreasing DSM-5-TR PG levels, as evidenced by the significant linear slope ($b = -0.02$; SE = 0.01; $p = .003$). This trajectory was labeled as "Moderate decreasing PG symptoms". Participants in the third trajectory ($n = 40$; 13.5 %) reported clinically relevant DSM-5-TR PG levels ($b = 32.31$; SE = 1.34; $p < .001$). For these participants, symptom levels were relatively stable over time, as evidenced by the non-significant linear slope ($b = -0.03$; SE = 0.02; $p = .082$). This trajectory was labeled as "High PG symptoms". Participants in the last trajectory ($n = 34$; 11.3 %) reported clinically relevant DSM-5-TR PG levels at the start of the study ($b = 28.97$; SE = 1.35; $p < .001$) and had a significant linear slope ($b = -0.16$; SE = 0.01; $p < .001$). This trajectory was characterized by a decrease from clinically relevant to low DSM-5-TR PG symptom levels. Consequently, this trajectory was labeled as "Recovered PG". Notably, for PCB symptoms, the model with linear and quadratic slopes, and three trajectories (i.e., a low symptom, recovered, and high symptom trajectory) showed optimal fit (see Supplementary Table 3). Supplementary Figure 3 displays the optimal linear + quadratic LCGM PCB symptom model with three trajectories (i.e., low symptoms, recovered, and high symptoms). Supplementary Figure 4 displays the other linear + quadratic PCB symptom models.

3.3. Unconditional models for PTS symptom trajectories

Fit indices of the unconditional PTS symptom models can be found in Table 2 and Supplementary Table 4. The linear LCGM PTS symptom model with four trajectories showed a significant improvement in fit when compared to the model with three trajectories, based on the lower AIC, BIC, and SS-BIC estimates, as well as the significant VLMR-LRt, LMR-LRt, and B-LRt tests. The linear LCGM PTS symptom model with five trajectories had lower AIC, BIC, and SS-BIC estimates than the model with four trajectories, yet the smallest trajectory consisted of less than 5 % of the sample. Adding quadratic slopes, allowing variation in the linear slope (i.e., LGMM), and doing both did not improve model fit or resulted in non-convergence (see Supplementary Table 4). Hence, it was concluded that the linear LCGM PTS symptom model with four trajectories showed optimal fit. This model had acceptable entropy. The posterior probabilities for this model ranged from 0.730 to 0.861.

Fig. 1 displays the linear LCGM PTS symptom model with four trajectories. For the observed individual trajectories for each latent trajectory see Supplementary Figure 5. Supplementary Figure 6 displays the other linear LCGM PTS symptom models. The trajectory with the largest number of participants ($n = 162$; 56.2 %) started at W1 with relatively low symptom levels ($b = 11.33$; SE = 0.80; $p < .001$) and had a significant linear slope ($b = -0.04$; SE = 0.01; $p < .001$). This trajectory was characterized by low, slightly decreasing PTS levels over time, and labeled as "Low PTS symptoms". The trajectory with the second largest number of participants ($n = 56$; 19.6 %) started at W1 with clinically relevant PTS levels ($b = 35.75$; SE = 2.66; $p < .001$) and had a significant linear slope ($b = -0.24$; SE = 0.02; $p < .001$). This trajectory was characterized by a decrease from clinically relevant PTS levels to low symptom levels. This trajectory was labeled as "Recovered PTS". The third largest trajectory ($n = 51$; 17.6 %) started at W1 with moderate PTS levels ($b = 19.58$; SE = 3.25; $p < .001$) and had a significant linear slope ($b = 0.09$; SE = 0.02; $p < .001$). This trajectory was characterized by an increase in PTS levels over time. Therefore, this trajectory was labeled as "Moderate increasing PTS symptoms". Lastly, the trajectory with the smallest number of participants ($n = 19$; 6.6 %) started at W1 with clinically relevant PTS levels ($b = 60.96$; SE = 6.28; $p < .001$) and had a significant linear slope ($b = -0.15$; SE = 0.05; $p = .005$), suggesting a decrease in PTS levels over time. However, as symptom levels remained above the cut-off score indicating probable PTSD throughout the duration of the study, this trajectory was labeled as "High PTS symptoms".

3.4. Unconditional models for MD symptom trajectories

Fit indices of the unconditional MD symptom models can be found in

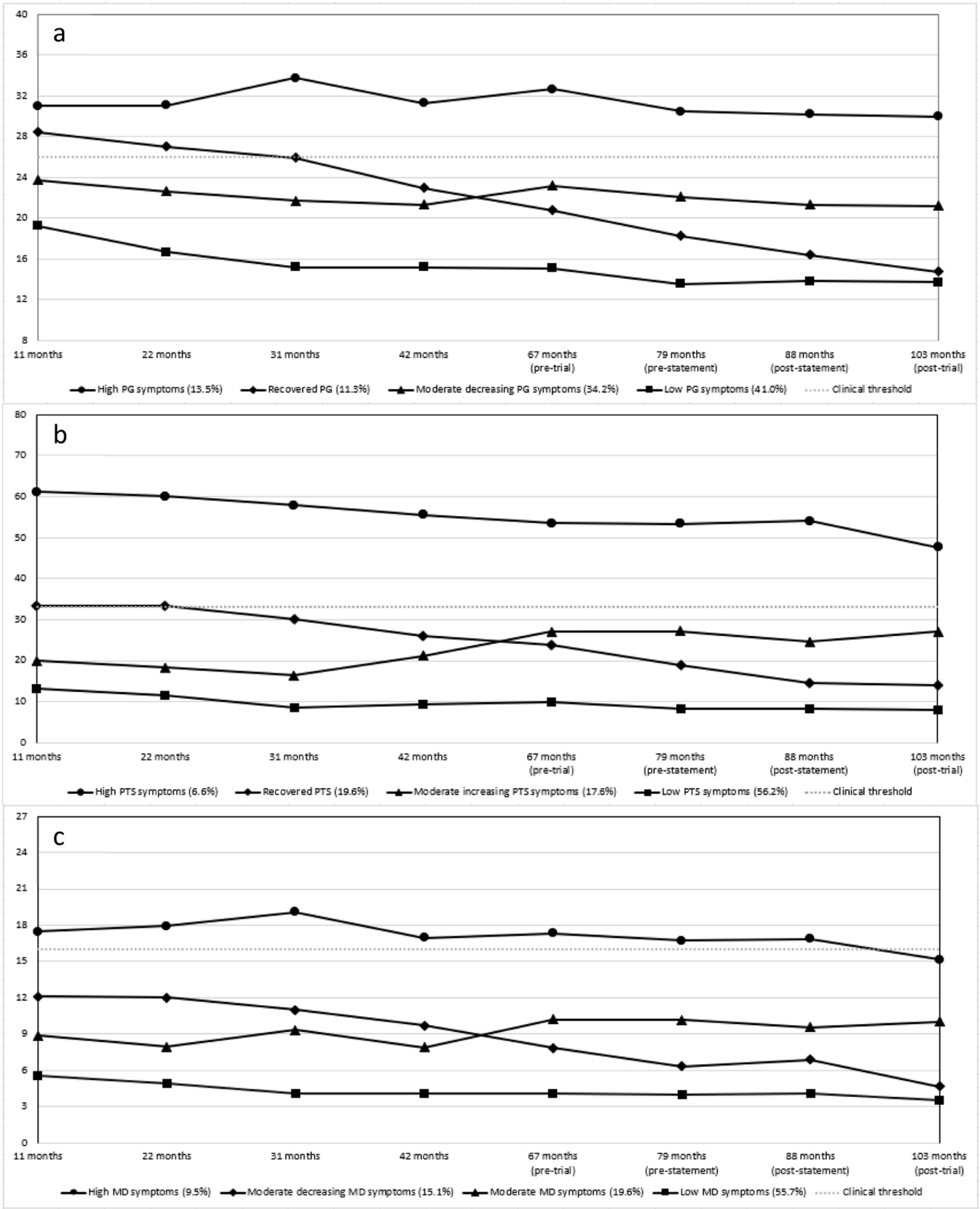


Fig. 1. Trajectories of DSM-5-TR PG (N = 299), PTS (N = 288), and MD symptoms (N = 296)**.** *Note.* The figure displays estimated means and trajectories for (a) DSM-5-TR PG, (b) PTS and (c) MD symptoms using linear latent class growth modeling, with the clinical threshold as a reference. DSM-5-TR = Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision; PG = Prolonged Grief; PTS = Posttraumatic Stress; MD = Major Depression.

Table 2 and Supplementary Table 5. The linear LCGM MD symptom model with four trajectories showed a significant improvement in fit when compared to the model with three trajectories, based on the lower AIC, BIC, and SS-BIC estimates, as well as the significant VLMR-LRt, LMR-LRt, and B-LRt tests. The linear LCGM MD symptom model with five trajectories did not show an improvement in fit, based on the higher BIC estimate. Also, the smallest trajectory consisted of less than 5 % of the sample. Adding quadratic slopes, allowing variation in the linear slope (i.e., LGMM), and doing both did not improve model fit (see Supplementary Table 5). Therefore, it was concluded that the linear LCGM MD symptom model with four trajectories showed optimal fit. This model had acceptable entropy. The posterior probabilities for this model ranged from 0.726 to 0.899.

Fig. 1 displays the linear LCGM MD symptom model with four trajectories. For the observed individual trajectories for each latent trajectory see Supplementary Figure 7. Supplementary Figure 8 displays the other linear LCGM MD symptom models. The trajectory with the largest number of participants ($n = 165$; 55.7 %) started at W1 with relatively low symptom levels ($b = 4.93$; SE = 0.50; $p < .001$) and had a significant linear slope ($b = -0.02$; SE = 0.01; $p = .005$). This trajectory was characterized by low, slightly decreasing MD levels over time, and labeled as "Low MD symptoms". The trajectory with the second largest number of participants ($n = 58$; 19.6 %) reported moderate MD levels at W1 ($b = 8.72$; SE = 0.88; $p < .001$) and these symptom levels were relatively stable over time ($b = 0.02$; SE = 0.01; $p = .183$). Therefore, this trajectory was labeled as "Moderate MD symptoms". The third largest trajectory ($n = 45$; 15.1 %) started at W1 with moderate MD levels ($b = 12.55$; SE = 1.36; $p < .001$), and had a significant linear slope ($b = -0.09$; SE = 0.02; $p < .001$). This trajectory was characterized by a decrease in MD levels over time. Therefore, this trajectory was labeled as "Moderate decreasing MD symptoms". Lastly, the trajectory with the smallest number of participants ($n = 28$; 9.5 %) started at W1 with clinically relevant MD levels ($b = 19.01$; SE = 0.84; $p < .001$), and had a significant linear slope ($b = -0.04$; SE = 0.01; $p < .001$). Although there is a slight decrease in symptom levels over time, symptom levels remained above the cut-off score indicating probable MDD until W8. Consequently, this trajectory was labeled as "High MD symptoms".

3.5. Overlap in trajectory membership

Table 3 displays the overlap in trajectory membership of DSM-5-TR PG, PTS, and MD symptom trajectories. Forty-nine participants (16.4 %) were assigned to at least one of the high symptom trajectories and fourteen (4.7 %) to all three high symptom trajectories. About half of the people assigned to the high DSM-5-TR PG symptom trajectory were also assigned to the high PTS or MD symptom trajectory. Yet, two-third of the people assigned to the high MD symptom trajectory and all but two of the 20 people assigned to the high PTS symptom trajectory were also assigned to the high DSM-5-TR PG symptom trajectory. Thus, people assigned to the high PTS or MD symptom trajectory are seemingly more likely to be assigned to the high DSM-5-TR PG symptom trajectory, but not vice versa. Moreover, almost all people assigned to the low DSM-5-TR PG symptom trajectory were assigned to the low PTS or MD symptom trajectory, but not vice versa. These findings indicate that if people report experiencing psychopathology, this often entails DSM-5-TR PGD by itself, and sometimes in combination with PTSD and MDD, yet rarely PTSD or MDD by itself.

3.6. Predictors of DSM-5-TR PG trajectory membership

In the univariate analyses, people assigned to the high DSM-5-TR PG symptom trajectory were less likely university-educated (OR = 0.15, 95 % CI[0.07, 0.33]) and more likely lost (at least) a child or partner/spouse than those assigned to the low symptom trajectory (OR = 3.55, 95 % CI[1.61, 7.82]). Similarly, people assigned to the moderate decreasing DSM-5-TR PG symptom trajectory were less likely university-educated (OR = 0.41, 95 % CI[0.23, 0.74]) and more likely lost (at least) a child or partner/spouse than those assigned to the low symptom trajectory (OR = 2.98, 95 % CI[1.63, 5.47]). Moreover, people assigned to the moderate decreasing DSM-5-TR PG symptom trajectory were more likely university-educated than those assigned to the high symptom trajectory (OR = 2.70, 95 % CI[1.29, 5.67]). The univariate and multivariate analyses resulted in similar findings (see Supplementary Table 6 and 7). Other trajectory comparisons were non-significant. The results of the multivariate multinomial regression analyses for the linear + quadratic LCGM PCB symptom model with three trajectories are displayed in Supplementary Table 8.

3.7. Predictors of PTS trajectory membership

In the univariate analyses, people assigned to the high PTS symptom trajectory were less likely university-educated than those assigned to the low symptom trajectory (OR = 0.17, 95 % CI[0.06, 0.45]). People assigned to the moderate increasing PTS symptom trajectory less likely lost multiple loved ones than those assigned to the low symptom trajectory (OR = 0.44, 95 % CI[0.21, 0.90]). The people assigned to the recovered PTS symptom trajectory were more likely to be female (OR = 2.02, 95 % CI[1.04, 3.94]) and less likely university-educated than those assigned to the low symptom trajectory (OR = 0.46, 95 % CI [0.24,

Table 3
Trajectory membership overview (N = 299).

	PTS symptoms ($N = 288$)				**MD symptoms ($N = 296$)**			
	High symptoms ($N = 20$)	Moderate increasing symptoms ($N = 36$)	Recovered ($N = 52$)	Low symptoms ($N = 180$)	High symptoms ($N = 28$)	Moderate symptoms ($N = 55$)	Moderate decreasing symptoms ($N = 27$)	Low symptoms ($N = 186$)
	N (%) in the specified PTS symptom trajectory				*N* (%) in the specified MD symptom trajectory			
DSM-5-TR PG symptoms ($N = 299$)								
High symptoms ($N = 40$)	18 (49)	9 (24)	8 (22)	2 (5)	19 (49)	15 (39)	3 (8)	2 (5)
Moderate decreasing symptoms ($N = 112$)	2 (2)	24 (22)	23 (21)	61 (56)	9 (8)	27 (24)	8 (7)	68 (61)
Recovered ($N = 18$)	0 (0)	0 (0)	15 (83)	3 (17)	0 (0)	2 (11)	10 (56)	6 (33)
Low symptoms ($N = 129$)	0 (0)	3 (2)	6 (5)	114 (93)	0 (0)	11 (9)	6 (5)	110 (87)

Note. The *N*'s shown in this table are the posterior probabilities without accounting for error. DSM-5-TR = Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision; PG = Prolonged Grief; PTS = Posttraumatic Stress; MD = Major Depression.

0.89]). In the multivariate analyses, biological sex no longer predicted trajectory membership when comparing the low PTS symptom trajectory to the recovered symptom trajectory (see Supplementary Table 9 and 10). Contrary to the non-significant result observed in the univariate analyses, in the multivariate analyses it was found that people assigned to the moderate increasing PTS symptom trajectory were more likely university-educated than people assigned to the high symptom trajectory (OR = 3.20, 95 % CI [1.00, 10.22]). Other trajectory comparisons were non-significant.

3.8. Predictors of MD trajectory membership

In the univariate analyses, people assigned to the high MD symptom trajectory were less likely university-educated (OR = 0.25, 95 % CI [0.11, 0.56]) and more likely lost (at least) a child or partner/spouse than those assigned to the low symptom trajectory (OR = 2.42, 95 % CI [1.05, 5.59]). Compared to people assigned to the low MD symptom trajectory, people assigned to the moderate symptom trajectory were less likely university-educated (OR = 0.49, 95 % CI [0.26, 0.93]) and less likely experienced the loss of multiple loved ones (OR = 0.51, 95 % CI 0.28, 0.95]), yet more likely lost (at least) a child or partner/spouse (OR = 3.48, 95 % CI [1.83, 6.59]). People assigned to the moderate decreasing MD symptom trajectory less likely lost (at least) a child or partner/spouse than those assigned to the moderate symptom trajectory (OR = 0.32, 95 % CI [0.11, 0.93]). In the multivariate analyses, relationship to the deceased no longer predicted trajectory membership when comparing the low MD symptom trajectory to the high symptom trajectory (see Supplementary Table 11 and 12). Also, level of education and number of losses no longer predicted trajectory membership when comparing the low MD symptom trajectory to the moderate symptom trajectory. Other trajectory comparisons were non-significant.

4. Discussion

In the present study, we examined DSM-5-TR PGD, PTSD, and MDD trajectories from one to nine years post-loss. Moreover, we examined overlap in, and predictors of, trajectory membership. To accomplish this, we analyzed eight waves of data of 299 people bereaved by the MH17 plane disaster in 2014 of which half were collected in the context of the criminal trial that resulted in convictions for murder for three of the four suspects.

As expected, we identified trajectories characterized by three different patterns for each outcome. The first pattern was characterized by relatively low symptoms. Even in this sample of people who have mostly lost multiple loved ones to murder, the low symptom trajectory was the most prevalent for all outcomes (i.e., 41–56 %). This accords with prior latent trajectory research suggesting that low symptom levels is the most common response after exposure to potentially traumatic events, such as loss (Galatzer-Levy et al., 2018; see Table 1 in Pociūnaitė et al., 2023; van de Schoot et al. 2018). The second pattern was characterized by elevated symptoms one year after the loss followed by a gradual decrease over time. For each outcome, around 11–20 % of the sample endorsed this symptom trajectory. These people might have received professional support that resulted in recovery or did not require professional support and improved naturally over time. Future studies may want to examine whether the timing and type of received professional support relate to trajectory membership. The third pattern was characterized by relatively high, clinically relevant symptoms. Specifically, one in six people reports high levels of grief-related psychopathology (i.e., at least probable PGD, PTSD, or MDD) almost a decade after the loss. This is in line with prior research showing that chronic high psychopathology levels are relatively rare after exposure to potentially traumatic events (Galatzer-Levy et al., 2018; see Table 1 in Pociūnaitė et al., 2023; van de Schoot et al. 2018). That the three identified trajectories resemble prior research suggests that the patterns do not seem to be related to how long ago the loss took place and are quite similar across outcomes and various potentially traumatic events. Moreover, concurring with prior research (Heeke et al., 2023), findings also indicate that if people develop complaints, it is often PGD by itself, and sometimes in combination with PTSD and MDD, yet rarely PTSD or MDD by itself.

Contrary to our expectations and prior research (Galatzer-Levy et al., 2018; see Table 1 in Pociūnaitė et al., 2023; van de Schoot et al. 2018), we identified an additional fourth pattern. For each outcome, the fourth pattern was characterized by moderate symptoms, either stable or slightly increasing or decreasing over time. Almost a decade after the loss, this sub-group of people still reports sub-threshold symptoms, which conveys they remain affected by the violent loss. Sub-threshold symptoms have been found to relate to negative outcomes, such as lower quality of life and functional impairment (Brancu et al., 2016; Klein et al., 2024; Krishna et al., 2015; Szuhany et al., 2021).

Our findings have several clinical implications. First, symptom levels reported after the first years of bereavement seem, in most cases, a relatively good indicator of how someone's symptoms will develop over time and in turn who will require professional support. As suggested by other researchers (e.g., Boelen & Lenferink, 2022; Glad et al., 2025; Kristensen et al., 2020; Nielsen et al., 2019), we propose that identifying who may be at risk during the early stages of bereavement and providing timely professional support might prevent long-term suffering and ensure people's day-to-day living is not impeded. Self-guided online treatment may be beneficial for these people (Reitsma et al., 2023). Second, people in the moderate symptoms sub-group may be in need of less intensive professional support, such as watchful waiting (e.g., Covers et al., 2021; Kostic et al., 2024; van der Aa et al. 2015) or attending a peer support group with other MH17 bereaved people (Bartone et al., 2019; Eyre, 2019), to alleviate distress. Third, the course of the trajectories does not seem to change due to the criminal proceedings. This aligns with prior research conducted among MH17 bereaved people (Nijborg, Kunst, et al., 2024; Nijborg, Westerhof, et al., 2024), suggesting that the criminal proceedings have only a minimal impact on grief-related psychopathology. However, in order to draw firmer conclusions related to the potential impact of criminal proceedings on people's ability to adjust to loss, replication of the findings is required.

When examining correlates of symptom trajectories, we found, as expected (e.g., Heeke et al., 2019; Kokou-Kpolou et al., 2020), that being lower educated (i.e., not university-educated) was generally related to membership of more severe symptom trajectories. This may be explained by university-educated people having more cognitive and psychosocial resources available to cope with these events (cf. Agaibi & Wilson, 2005; Boelen et al., 2006; Niemeyer et al., 2019). As expected (cf. Jann et al., 2024), losing at least a child or partner/spouse was related to membership of more severe symptom trajectories of DSM-5-TR PG and MD. This is in line with theories suggesting that different types of relatives play different roles (with varying importance) in a person's daily life, thereby complicating the adjustment to the loss (Fernández-Alcántara & Zech, 2017). Unexpectedly, biological sex and losing multiple loved ones were not associated with trajectory membership, for the exception of losing multiple loved ones being associated with an increased likelihood of being assigned to the low PTS symptom trajectory when compared to the moderate increasing PTS symptom trajectory. The non-significant findings may relate to the limited sample size resulting in an increased Type II error rate when examining predictors of trajectory membership.

The results of the present study were particularly insightful due to the strengths of the study design. First, we examined latent trajectories of multiple outcomes (i.e., DSM-5-TR PGD, PTSD, and MDD) using a large number of measurement occasions spread over almost a decade post-loss in a sample of people bereaved due to the same event. As a result, we were able to create a detailed picture of how symptom levels of grief-related psychopathology can be different between violently bereaved people who lost their loved one(s) due to the same cause,

under the same circumstances, at the same time, and for whom the course of the criminal proceedings was also the same. Second, differences regarding the identified trajectories and predictors per outcome, and that only a limited number of people were assigned to similar trajectories across outcomes, provide further support for PGD being distinct from PTSD and MDD, and the need for future latent trajectory research to examine these outcomes separately in the same sample (e.g., Lenferink et al., 2020). Third, we are the first to dive into the long-term effects of violent loss on the mental health of bereaved people in the context of a criminal trial. Fourth, with Pociūnaitė et al. (2023) and Reitsma et al. (2025), we are one of the first to provide information regarding the course of specifically DSM-5-TR PGD and risk factors associated with its long-term trajectories. Using the most contemporary conceptualization of PGD is important, considering that the identified trajectories can differ depending on the diagnostic criteria set under investigation (Bonanno & Malgaroli, 2020), which was supported by our findings. Fifth, due to our research design we are able to draw tentative conclusions regarding the chronicity of certain DSM-5-TR PG, PTS, and MD symptom trajectories. This is contrary to past research, which often presented certain trajectories, such as high symptom trajectories, as 'chronic' trajectories while examining symptoms over a relatively short time span (e.g., Djelantik et al., 2022; Majd et al., 2024; Mørk et al., 2023). Related to this, we did not find evidence for the existence of a delayed onset of symptoms following violent loss.

The findings of the present study also have to be seen in light of some limitations. First, while we did examine PG symptoms according to the most contemporary diagnostic criteria set (i.e., DSM-5-TR), it should be noted that eight out of 10 PG symptoms were assessed throughout the nine years due to the addition of PGD in the DSM-5-TR in 2022, while our data collection spanned from 2015 to 2023. That said, it is very unlikely that the DSM-5-TR PG symptom trajectories found in the present study would differ from the trajectories that would have been observed if all symptoms had been included. Second, the limited sample size may have led to reduced power to find differences between trajectories in terms of background and loss-related characteristics. Third and last, the generalizability of the findings to all violently bereaved people is limited due to the uniqueness of the event and the occurrence of a criminal trial.

We conclude that almost a decade after the MH17 plane disaster, that resulted in the deaths of 298 citizens, bereaved people most commonly report low psychopathology levels. There is also a sub-group of people who experience elevated symptom levels following the loss, yet their symptom levels decrease gradually over time. Despite this, one in six people still reports severe psychopathology levels almost a decade after the violent loss. This often entails PGD by itself, and in certain cases in combination with PTSD and MDD. For these people, early detection and timely professional support are necessary to prevent long-term suffering. For each outcome, i.e., DSM-5-TR PGD, PTSD, and MDD, we identified a sub-group of people who reported moderate symptoms. This sub-group may benefit from less intense professional support, such as a watchful waiting approach or a peer support group. In short, even after losing at least one loved one to murder, the majority of bereaved people develop only minor symptoms (if any), and there does not seem to be an indication of a delayed onset of grief-related psychopathology.

CRediT authorship contribution statement

Lieke C.J. Nijborg: Data curation, Formal analysis, Investigation, Visualization, Writing – original draft, Writing – review & editing. **Gerben J. Westerhof:** Investigation, Supervision, Writing – review & editing. **Justina Pociūnaitė-Ott:** Formal analysis, Writing – review & editing. **Maarten J.J. Kunst:** Funding acquisition, Investigation, Supervision, Writing – review & editing. **Jos de Keijser:** Funding acquisition, Investigation, Supervision, Writing – review & editing. **Lonneke I.M. Lenferink:** Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Supervision, Writing – original draft, Writing – review & editing.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.janxdis.2025.103036.

Data availability

The pseudonymized datasets, data dictionary, and Mplus output files can be accessed on the DANS repository through the following link: https://doi.org/10.17026/SS/JUNRB0.

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