Master Thesis Positive Clinical Psychology and Technology

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Exploring Reactivity Effects of Self-monitoring Grief Reactions - A Randomized Waitlist Controlled Trial

Abstract

Introduction: Prolonged grief disorder (PGD) has recently been added to ICD11 and DSM-5-TR. Using Experience Sampling Methodology (ESM) to assess PGD symptoms within the context of daily life seems to be promising. This study investigated the reactivity effects of using ESM to measure levels of PGD symptoms in people who experienced the loss of a loved one three to six months prior.

Methods: Treatment-seeking individuals ($N = 184$) were randomly allocated to either an ESM or waitlist condition. PGD severity was assessed before (T1) and after a two-week ESM phase (T2). An ANCOVA was conducted to compare changes in the group average from T1 to T2. Reliable change indices (RCI) of individual reactivity effects were calculated based on which participants were regrouped into no change/worsening of symptoms or significant improvement. A binary logistic regression investigated a set of variables to predict membership to the latter two groups.

Results: The ANCOVA of changes in PGD severity was not significant [$F(1,120) = 0.01$, $p = .94$]. Calculating RCIs based on individual changes in PGD scores revealed a group of people (N = 35) improving in symptomatology. A binary logistic regression predicting belongingness to that group was significant for the variables "baseline PGD symptoms" (B = 0.06, Wald $\chi^2(1) = 9.05$, $p = .003$) and "unexpectancy of death" (B = 0.36, Wald $\chi^2(1) = 4.57$, $p = .03$).

Discussion: Findings indicate that ESM is safe to use for assessing PGD symptoms in bereaved people. Individual reactivity effects suggest that self-monitoring PGD symptoms might even help to improve more severely grieving people.

Keywords: Prolonged Grief Disorder, Experience Sampling Methodology, Reactivity Effects, Randomized controlled trial, Logistic regression

The experience of bereavement is a universal event that nearly every individual will encounter at some point in their life. While some individuals successfully navigate bereavement, others endure considerably more distress in response to loss (Boelen & Lenferink, 2020; Johannsen et al., 2019; Lundorff et al., 2017). Bereavement may include symptoms like emotional numbness, yearning, anger, and despair (American Psychiatric Association, 2022; Arizmendi et al., 2015; Lundorff et al., 2017; Maciejewski et al., 2007). In recent years, increased distress as a reaction to loss has been examined, and symptoms have been clustered into different sets of grief diagnoses (Lenferink et al., 2019). One of them prevailed, and in 2018, prolonged grief disorder (PGD) was added to ICD 11 and four years later to DSM-5- TR as well. As per ICD 11, PGD is characterized by persistent thoughts and memories that last for at least six months following a loss, significantly impeding daily functioning (World Health Organization, 2023). According to the meta-analysis of Lundorff et al. (2017), the prevalence rate of PGD lies between 9.8% and 11.0% of people experiencing the loss of a loved one. Recent research has emphasized the importance of identifying practical approaches for evaluating PGD, like assessing symptoms during daily life.

One method suitable for psychological research during daily life is experience sampling methodology (ESM; Csikszentmihalyi & Larson 1987; 2014). ESM describes an intensive longitudinal data collection approach in which individuals respond to inquiries multiple times per day over a specified study duration (Myin-Germeys et al., 2018). In a study by Lenferink et al. (2022), the acceptability and feasibility of utilizing ESM to measure PGD symptoms have been explored and validated. Employing ESM may have several advantages to assessing symptoms of PGD in daily life. Firstly, ESM's ecological validity may result in a more accurate assessment of the severity of PGD symptomatology (Reis, 2012, as cited in Lenferink et al., 2022). For example, the risk of recall bias, like missing or misleading information, is reduced as participants report within a few minutes (Ben-Zeev et al., 2010; Bylsma et al., 2011; Csikszentmihalyi & Larson, 2014; Telford et al., 2011). Secondly, in

opposition to conventional retrospective methods, ESM offers researchers insights into current emotional states due to the multiple data collections per day. In addition, questions about contextual factors can be asked that may then be, for example, linked to fluctuations in symptomology. Thirdly, the abundance of real-time data presents novel prospects for therapeutic interventions. Utilizing real-time information enables the implementation of real-time interventions, which has been shown to be promising in a variety of mental health disorders (Kramer et al., 2014; van Os et al., 2017).

There are also potential downsides to using ESM to study grief in daily life. Taking the time to fill out several questions throughout the day might be a burden to some participants (Beal, 2015; Trull & Ebner-Priemer, 2009). A time-consuming procedure like this might lead to increased dropout rates or participants only sporadically filling out the questionnaire. However, Wrzus and Neubauer (2022) state that they were not able to find support for the concerns mentioned previously. Their meta-analysis revealed an average compliance rate of slightly above 79% across 347 studies utilizing ecological momentary assessment (EMA), such as ESM. Moreover, dropout rates among 140 studies were approximately 10.5%. Both findings were neither related to the total number of assessment days nor the number of assessments per day.

Another potential issue might be reactivity effects, which may occur when frequent self-reporting influences the phenomenon under investigation (Conner & Lehmann, 2012, as cited in Lenferink et al., 2022). In the context of this study, this would mean that constantly screening emotions, symptoms, and situations changes the amount of symptoms people display. On the one hand, such confrontation can be distressing and negatively impact participants' overall well-being (Bos et al., 2019, as cited in Lenferink et al., 2022; Telford et al., 2011). Especially if they have not learned effective ways to deal with this emotional distress (Bos et al., 2019, as cited in Lenferink et al., 2022), it might lead to negative reactivity effects, namely an increase in PGD symptoms. On the other hand, there is also the

possibility for a decrease in symptoms, which, in this context, reflects positive reactivity effects. For example, the study by Lenferink et al. (2022) has shown that after a two-week ESM phase, PGD symptoms decreased. However, since no control group was included in their study, it remained uncertain whether the observed changes occurred because of the ESM assessment or solely due to the passage of time. For future research in this area, it appears to be necessary to investigate reactivity effects further and whether ESM can faithfully be applied to assess PGD symptoms of recently bereaved participants.

Therefore, it seems inevitable to not only look at group effects but also investigate individual reactivity effects. A valid approach for this could be calculating reliable change indices (RCIs) for each participant individually (Jacobson & Truax, 1992). RCIs describe a statistical measure that determines whether an individual's change in a particular measure is reliable. Resulting RCI scores are compared to critical values derived from a normal distribution to determine whether the change observed is statistically significant or occurred by chance. This procedure may help to get more differentiated results as people could be regrouped based on their RCI scores (e.g., positive reactivity, negative reactivity, and no reactivity).

Moreover, dividing participants into subgroups based on their reactivity could facilitate exploratory analysis of potential associations between particular variables and the likelihood of belonging to one of the newly defined subgroups. There is already a considerable amount of work investigating the influence of certain factors on the persistence and intensity of grief (Boelen & Lenferink, 2021; Lobb et al., 2010; Lundorff et al., 2021; Stroebe et al., 2006; Stroebe & Schut, 1999; 2010). For example, Stroebe et al. (2006) proposed a whole framework about possible risk factors based on their dual process model of coping with bereavement (Stroebe & Schut, 1999; 2010). Factors that are mentioned across studies about possible factors influencing grief severity, for example, are gender, education, and baseline symptom levels, as well as the contextual factors of the death of the person that

people grief about (Boelen & Lenferink, 2021; Lobb et al., 2010; Lundorff et al., 2021). Subsequently, it might be interesting to explore whether certain variables are also associated with the reactivity observed in bereaved individuals engaging in ESM.

A substantial amount of research remains yet to be conducted on how reactivity effects might affect people in the context of assessing PGD symptoms with ESM. This study tried to add more information to the current state of the art by focusing on three main points. First, replicating the findings of Lenferink et al. (2022) about a negative relationship between ESM and PGD symptoms of participants. As suggested by Lenferink et al. (2022), a waitlist condition has been added to account for validity, and the following research question (**RQ1**) has been stated: "To what extent are there group-level differences in average scores of PGD symptoms after following an ESM or waiting period compared to baseline PGD symptom levels?". Second, exploring individual differences in reactivity effects and identifying potential subgroups. Thus, the second research question (**RQ2**) was: "Are there potential subgroups in reactivity effects, based on individual differences in average scores of PGD symptoms after following an ESM or waiting period compared to baseline PGD symptom levels?". Third, exploring potential similarities among the new subgroup members. Hence, the third research question (**RQ3**) was: "Are there similarities among participants on an individual level that influence the probability of being in either of the subgroups?".

Methods

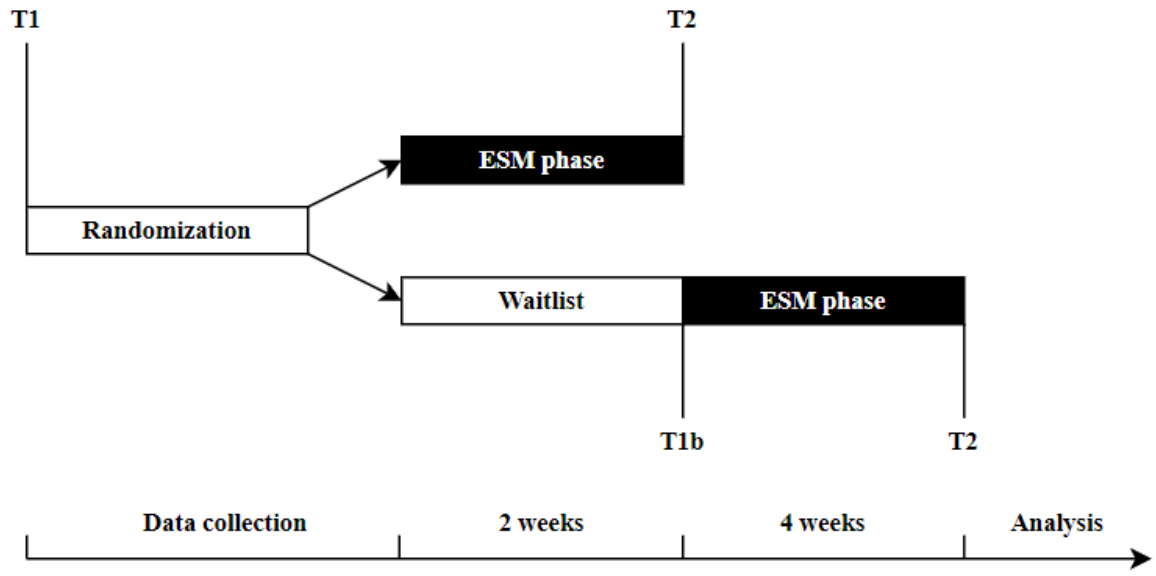
Design

A randomized controlled trial (RCT) was chosen as the study design. After giving consent, participants were randomly assigned to either the ESM condition or the waitlist condition using random.org (https://www.random.org). The study commenced with all participants being interviewed at the outset (T1) and upon completion of the self-monitoring phase (T2; see Figure 1). Subsequent to randomization, individuals allocated to the ESM

condition participated in a 14-day ESM phase, answering multiple inquiries administered throughout each day. Conversely, those assigned to the waitlist condition underwent a 14-day waiting period, after which an additional interview (T1b) exclusively to the waiting condition was conducted (see Figure 1). Additionally, participants in the waitlist condition underwent the 14-day ESM phase as well, post waiting period and prior to having T2. This study was approved by the ethics committee of the Behavioral, Management, and Social Sciences (BMS) Faculty of the University of Twente (ID: 221328).

Figure 1

Overview of the study design.



Note. ESM = Experience Sampling Methodology.

Participants

Participants were recruited through self-selected sampling. People who visited the Dutch website rouwbehandling.nl (https://rouwbehandling.nl) and filled out a survey about dealing with grief were able to indicate whether they consented to contribute to further research. If people responded with "Yes," they were contacted by a student from the University of Twente or the Erasmus University of Rotterdam. The recruitment process took place from February 2023 until April 2023. To be included, participants had to be at least 18

years old and experienced the loss of a loved one three to six months prior to participating in this study. Additionally, the participant needed to be able to speak Dutch sufficiently and have access to a smartphone. Participants were excluded when they were suicidal or had been diagnosed with a psychotic disorder before since this study could lead to adverse reactions (Lenferink et al., 2023; Reitsma et al., 2023).

Procedure

Invitation emails were sent to people who agreed to be contacted for further research. The email contained an invitational text as well as the informed consent that people had to sign to participate. The interview took approximately 30 to 45 minutes. If a person did not respond to the invitation email, one reminder email was sent a week later. T1, T1b, and T2 were conducted by master students who followed training by their supervisors prior to the study.

During T1, participants were queried about any previous diagnoses of psychotic disorders with the following question: "*Have you ever received a diagnosis for a psychotic disorder from a psychologist, therapist or psychiatrist?*". Subsequently, they were prompted to respond to inquiries concerning depression, including those pertaining to suicidality. Following the research of Reitsma et al. (2023), suicidality was assessed using the following question: "*Over the past two weeks, how often have you been bothered by thoughts that you would be better off dead, or thoughts of hurting yourself in some way*?" (Reitsma et al., 2023, p.3). If a participant scored higher than one ("*Not at all*"), the safety protocol was activated, and the person was excluded. The safety protocol included follow-up questions like "*Over the past four weeks, have you made a plan to end your life*?" and offered advice as well as options on where to find help (Reitsma et al., 2023, p.3).

The remaining participants were directly informed about the outcome of randomization. Participants of the waitlist condition were briefed that they had to wait for two weeks before there would be another interview. The ESM condition received an instruction

mail on how to install the app and how to sign up for the study, and the ESM period was immediately started using the Ethica app (https://avicennaresearch.com). During the ESM period, participants had to fill out the same questionnaire about their PGD symptoms and contextual factors for 14 consecutive days every three hours, five times a day. The first notification arrived between 08.30h and 09.30h, and the last notification arrived between 20.30h and 21.30h, following a three-hour semi-random time interval. Participants had 60 minutes to answer all questions. If participants missed a notification, they received a reminder 10 minutes and 20 minutes after the first signal. In detail, the questionnaire consisted of 17 questions, of which 11 were PGD-related, and the remaining six dealt with contextual factors while answering the questions.

Materials and measures

This study employed the suicidal risk protocol, the Patient Health Questionnaire (PHQ-9), the Work and Social Adjustment Scale (WSAS), the Traumatic Grief Inventory (TGI-CA), the Post-traumatic Stress Disorder Checklist (PCL-5), and the Self-Reflection and Insight Scale (SRIS). All questionnaires were included in all three interviews that were conducted, with the exception of the WSAS, which was only part of T1. For this specific paper, the TGI-CA, the SRIS, and the questions about the background and loss-related characteristics were relevant.

Background and loss-related characteristics

Background characteristics were assessed with questions about gender (1 = *male*, 2 = *female*, 3 = *other*), date, country of birth, and highest obtained level of education (0 = *primary school*, 1 = *high school*, 2 = voca*tional education*, 3 = *college*, 4 = *university*). Questions related to the loss of their loved one consisted of the date of death, the relationship towards the lost person (0 = *partner*, 1 = *child*, 2 = *parent*, 3 = *sibling*, 4 = *grandparent*, 5 = *grandchild*, 6 = *friend*, 7 = *other, namely*), the cause of the death (0 = *physical illness*, 1 = *accident*, 2 = *suicide*, 3 = *homicide/ manslaughter*, 4 = *other, namely*), to what extent this loss

was unexpected (1 = *completely expected* to 5 = *completely unexpected*), if they get psychological support (*0 = yes, 1 = no*) and grief support (*0 = yes, 1 = no*).

PGD-symptoms (TGI-CA)

At T1 and T2, PGD severity was assessed through the TGI-CA. The TGI-CA is the interview version of the Traumatic Grief Inventory-Self Report (TGI-SR+) and measures PGD symptoms as defined by the DSM-5-TR (Lenferink et al., 2023). The questionnaire includes 22 questions like "*In the past two weeks, did you feel alone or detached from others?*" or "*In the past two weeks, did you find it hard to trust others*?" and needed to be answered from 1 = *never* to 5 = *always*. In the original questionnaire, the period for which the questions were asked was one month, which has been adjusted to two weeks for this questionnaire, as the ESM period only lasted two weeks. The questionnaire can be scored in different ways. As the focus of this study was the average score of PGD symptoms, all scores for the 22 items were added up, leading to total scores ranging from 22 (lowest possible score) to 110 (highest possible score). Psychometric qualities of the TGI-CA have proven to be reliable and valid for measuring PGD symptoms in a non-clinical setting (Lenferink et al., 2023). Cronbach's alpha at baseline (T1) was .88 and .89 at T2, which, according to Bland & Altmann (1997), can be considered very good.

Self-Insight (SRIS)

For further exploration of the data, examining self-reflection and insight scores was important. The Self-Reflection and Insight Scale (SRIS) was asked at T1 and T2. It aims at measuring self-reflection and the direction of attention towards self-reflection (Grant et al., 2002). The questionnaire consists of 20 questions, subdivided into three categories, namely: Engagement in self-reflection, need for self-reflection, and insight. An example question would be, "*It is important for me to evaluate the things that I do,*" and all questions needed to be answered on a six-point Likert scale ranging from 1 = *strongly disagree* to 6 = *strongly agree*. The SRIS shows good psychometric qualities, validated by Grant et al. (2002) and

further confirmed by Silvia (2021). Internal validity for this questionnaire was .86 at T1, which was categorized as excellent by Bland and Altman (1997).

ESM questionnaire

The ESM items were developed by Lenferink and colleagues (2023) and drawn from the TGI-SR+, and the subsentence "*in the past three hours*" has been added to the original items of the TGI-SR+ (see Table 1). The questionnaire encompasses items that map onto the criteria of DSM-5-TR for PGD. It consists of 11 PGD items that could be answered on a 7-point Likert scale, ranging from "not at all" (0) to "very much" (6). Additionally, the questionnaire includes six contextual items to account for contextual influences like the location, activities, or company while staying within the time frame of the past three hours.

Table 1

Overview of ESM items to Assess PGD Symptoms, excluding the six contextual questions.

In the past three hours…
1. I experienced intense yearning/longing for the deceased person
2. I was preoccupied with thoughts or memories of the deceased person
3. I was feeling as though part of oneself has died
4. It felt unreal that he/she is dead
5. I avoided reminders that the person is dead
6. I experienced feelings of sadness
7. I felt anger about his/her death
8. I had difficulty moving on
9. I felt numb because of his/her death
10. I felt that life is meaningless because of his/her death
11. I felt alone because of his/her death

Statistical analysis

The main analysis was done using SPSS version 29.0 (IBM Corp, 2022) provided by the University of Twente. Only participants who completed at least 50% of the daily questionnaires were eligible for comparison. The 50% mark has been evaluated by Conner et al. (2012), as cited in Lenferink et al. (2022), and serves as a standard guideline. Additionally, participants of the ESM condition had to participate in T1 and T2 assessment, while participants of the waitlist condition had to participate in T1b and T2 to be included. All participants who did not answer the TGI-CA questionnaire at Tb1 and/ or T2 were excluded.

R studios was used to compute a variable that shows the number of completed questionnaires (R Core Team, 2023; see Appendix A). To be able to run the code effectively, excess variables have been removed from the dataset before applying the code. Since the code will compute percentages for all variables that are in a dataset, the dataset only contained the ESM questionnaires of all the participants. Subsequently, based on participant numbers, participants with less than 50% answered ESM questionnaires and were excluded from the main dataset for the analysis.

Analyzing reactivity effects

An ANCOVA was performed to answer **RQ1**. A new variable was computed to perform the analysis, which included the PGD symptom levels of each participant at either Tb1 (Waitlist condition) or T2 (ESM condition). The new variable was set as the dependent variable, and PGD levels at T1 were used as a covariate, while the condition of the participants served as the independent variable.

Identifying possible subgroups based on individual reactivity effects

RCIs were computed using the formula proposed by Jacobson and Truax (1992) to answer **RQ2** (see Figure 2). For this study, change had to be equal to or larger than positive or negative 1.96 standard deviations from the normal distribution. After calculating the RCIs in Excel, the scores were transferred back into SPSS. Those scores then have been used to compute a new variable that helped group the participants into three groups, namely: “No

change" = 0 (-1.95 - 1.95), "Decrease in symptoms" = 1 (≤ -1.96), and "Increase in symptoms" = 2 (≥ 1.96).

Exploring predictor variables

To answer **RQ3**, a binary logistic regression analysis was conducted, using the groups as dependent variables and the predictor variables as independent variables (Field, 2009). For this study, the predictor variables "Gender", "Age", "Education", "Kinship", "Unexpectancy of death", "Cause of death", "Time passed in weeks", "Mental support", "Grief support", "SRIS", and "Baseline PGD symptoms" have been included.

Figure 2

Formula to compute reliable change indices (RCIs) for change in PGD symptoms in this study after Jacobson & Truax (1992).

$$RCI = \frac{X_2 - X_1}{S_{diff}}$$

Note. X_1 is the score in PGD symptoms of a participant at T1. X_2 is the score in PGD symptoms of the same participant at either T2 when being in the ESM condition or Tb1 when being in the waitlist condition. S_{diff} characterizes the distribution spread of change scores anticipated in the absence of any real change. It can be derived from the formula $S_{diff} = \sqrt{2(\mathrm{S_E})^2}$, where $S_E = \sqrt{1 - \mathrm{r}}$, where r = reliability index (in this case, Cronbach's alpha of the PGD questionnaire).

Results

Background and loss-related characteristics

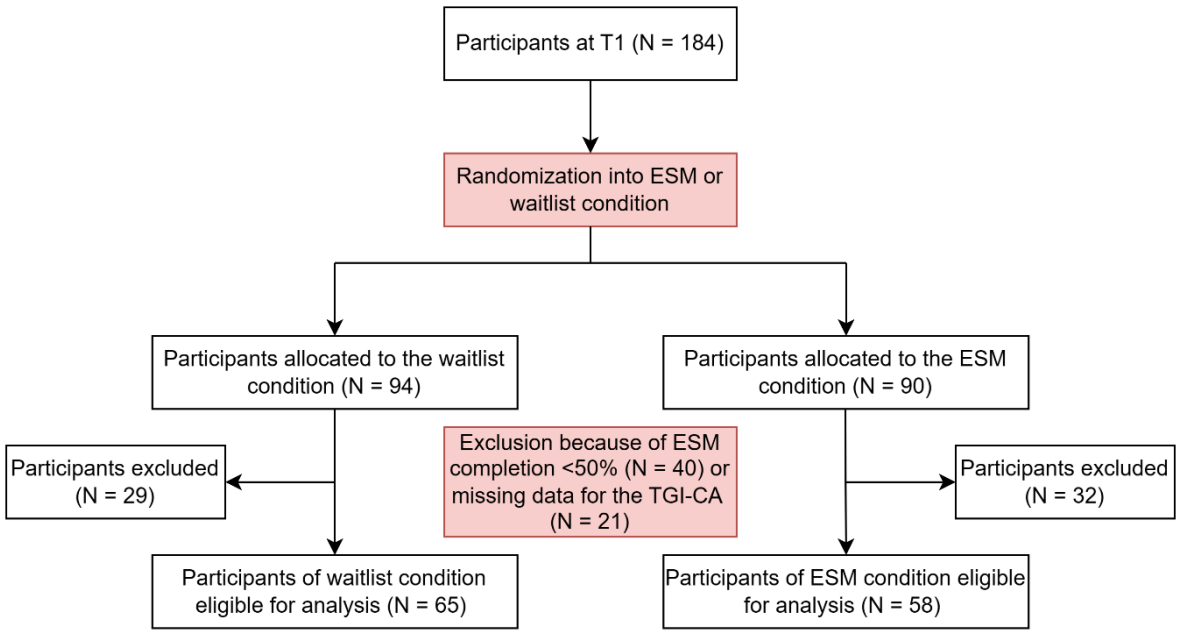
In total, 184 people were invited for T1. Sixty-one participants were excluded from data analysis because their retention of the ESM inquiries was below 50% and/ or data for the TGI-CA questionnaire was missing. After exclusion, the total sample (N = 123) consisted of

58 (47.2%) participants in the ESM condition and 65 (52.8%) participants in the waitlist condition (see Figure 3).

Most participants were females (82.9%) from the Netherlands (91.9%), with a mean age of 54.3 (*SD* = 11.5) ranging from 24 years old to 78 years old. 33.3% (*N* = 41) of the losses experienced were completely unexpected, while 20.3% (*N* = 25) were not at all unexpected. The leading cause of death in this sample was due to physical illness (*N* = 94; 76.4%). The demographics are summarized in Table 2. PGD levels at T1 ranged from 27 to 85, with a mean value of 55.3 (*SD* = 13.2). There were no significant differences in the scores in PGD symptoms at baseline between the ESM condition and the waitlist condition (see Appendix B).

Figure 3

Participant flow.



Note. T1 = Intake interview. ESM = Experience Sampling. TGI-CI = The interview version of the Traumatic Grief Inventory-Self Report.

Table 2

Background and loss-related characteristics for the total sample and per condition.

Characteristic	Total sample (*N* = 123)		ESM condition (*N* = 58)		Waitlist condition (*N* = 65)	
Gender, *N* (%)						
Female	102	(82.9)	47	(81.0)	55	(84.6)
Male	20	(16.3)	10	(17.2)	10	(15.4)
Other	1	(0.8)	1	(1.7)	0	(0.0)
Age (in years), *M* (*SD*)	54.3	(11.5)	54	(12.3)	54.6	(10.9)
Home country, *N* (%)						
The Netherlands	113	(91.9)	53	(91.4)	60	(92.3)
Germany	5	(4.1)	3	(5.2)	2	(3.1)
Belgium	3	(2.4)	1	(1.7)	2	(3.1)
Other	2	(1.6)	1	(1.7)	1	(1.5)
Education, *N* (%)						
Primary school	0	(0.0)	0	(0.0)	0	(0.0)
High school	8	(6.5)	3	(5.2)	5	(7.7)
Vocational education	39	(31.7)	21	(36.2)	18	(27.7)
College/ University	76	(61.8)	34	(58.6)	42	(64.6)
Kinship, *N* (%)						
Spouse	56	(45.5)	24	(41.4)	32	(49.2)
Child	11	(8.9)	5	(8.6)	6	(9.2)
Parent	43	(35.0)	22	(37.9)	21	(32.3)
Sibling	6	(4.9)	4	(6.9)	2	(3.1)
Grandparent	0	(0.0)	0	(0.0)	0	(0.0)
Grandchild	1	(0.8)	0	(0.0)	1	(1.5)
Friend	2	(1.6)	0	(0.0)	2	(3.1)
Other	4	(3.3)	3	(5.2)	1	(1.5)
Expectancy of death, *N* (%)						
Not at all unexpected	25	(20.3)	10	(17.2)	15	(23.1)
A little unexpected	17	(13.8)	11	(19.0)	6	(9.2)
Quite unexpected	19	(15.4)	10	(17.2)	9	(13.8)
Very unexpected	21	(17.1)	8	(13.8)	13	(20.0)
Completely unexpected	41	(33.3)	19	(32.8)	22	(33.8)
Cause of death, *N* (%)						
Physical illness	94	(76.4)	42	(72.4)	52	(80.0)
Accident	6	(4.9)	5	(8.6)	1	(1.5)
Suicide	8	(6.5)	5	(8.6)	3	(4.6)
Other	15	(12.2)	6	(10.3)	9	(13.8)
Time passed since loss (in weeks), *M* (SD)	20.4	(5.2)	20.7	(5.2)	20.1	(5.3)
Mental support – unrelated to loss, *N* (%)						
Yes	69	(56.1)	36	(62.1)	33	(50.8)
No	54	(43.9)	22	(37.9)	32	(49.2)
Mental support – grief support, *N* (%)						

Yes	49	(39.8)	24	(41.4)	25	(38.5)
No	74	(60.2)	34	(58.6)	40	(61.5)
SRIS scores at T1, *M* (*SD*)	90.5	(14.0)	89.0	(14.0)	91.8	(14.1)
Symptom-levels PGD at T1, *M* (*SD*)	55.3	(13.2)	56.8	(14.0)	53.9	(12.4)

Note. **ESM** = Experience sampling methodology. **SRIS** = Self-Reflection and Insight Scale. **PGD** = Prolonged grief disorder. *Due to the time passing between registration and T1, some dates are below or extend the range of 3-6 months.

Analysis of group-level reactivity effects

Levene's test and normality checks were carried out, and all assumptions except for homogeneity of variances and homogeneity of regression slopes were met. An ANCOVA indicated that there were no significant differences in PGD severity post ESM/ waiting period [$F(1,120) = 0.01$, $p = .94$] between conditions when including baseline PGD as a covariate.

Identifying possible subgroups based on individual reactivity effects

Based on the RCIs that have been computed, the sample ($N = 123$) has been split into three groups (see Table 3). Eighty-three participants (67%) have been grouped into group 0 ("No change"), 35 participants (28.4%) have been grouped into group 1 ("Decrease in symptoms"), and 5 participants (4.1%) have been grouped into group 2 ("Increase in symptoms"). Due to the small group size of group 2, group 0 ($N = 83$, "No change") and group 2 ($N = 5$, "Increase in symptoms") have been merged into a new group 0 ($N = 88$, "Reference group"). Group 1 ($N = 35$, "Decrease in symptoms") did not change.

Explorative analysis of predictor variables

A binary logistic regression analysis examined whether a set of eleven predictor variables, namely, "Gender" (0 = female, 1= male), "Age" (in years), "Education" (0 = other, 1 = college/ university), "Kinship" (0 = spouse and child, 1 = other), "Unexpectancy of death" (ranging from 0 = not expected at all, through 5 = completely unexpected), "Cause of death" (0 = other, 1 = accident and suicide), "Time passed" (in weeks), "Mental support" (0 = yes, 1 = no), "Grief support" (0 = yes, 1 = no), "SRIS" (questionnaire scores), "Baseline PGD

symptoms" (min. = 22 to max. = 110) predict RCI group membership (see Appendix C). Due to coding the variable "Gender" into a dummy variable, one more participant that indicated "other" as gender had to be excluded to achieve adequate group sizes. Descriptive statistics and frequencies of the new groups and predictor variables used for the binary logistic regression can be found in Appendix C.

When including all variables, "baseline PGD symptoms" (B = 0.06, Wald $\chi^2(1) = 9.05$, $p = .003$) and "unexpectancy of death" (B = 0.36, Wald $\chi^2(1) = 4.57$, $p = .03$) were both significantly related to a higher probability of being in group 1 ("Decrease in symptoms"). The model estimates for "baseline PGD symptoms" suggest that for every unit increase in baseline PGD severity, the odds of getting into group 1 ("Decrease of symptoms") are approximately 1.07 times higher (see Table 4). Similarly, the model estimates for "unexpectancy of death" suggest that for every unit increase in unexpectancy of the loss, the odds of getting into group 1 ("Decrease in symptoms") are approximately 1.44 times higher (see Table 4). Nagelkerke's R-squared value of .27 indicates that the predictor variables collectively explain 27% of the variance in group membership.

Table 3

Overview of the participant frequencies per group before and after the change in grouping (N = 123)

Group	Frequency (N)	Percentage (%)
Old grouping		
0 ("No change")	83	67.5
1 ("Decrease in symptoms")	35	28.4
2 ("Increase in symptoms")	5	4.1
New grouping		
0 ("Reference group")	88	71.6

1 (“Decrease in symptoms”)	35	28.4

Table 4

Variables predicting group 1 membership (“Decrease in symptoms”, N = 35).

			95% CI for Odds Ratio		
Included variables	**B (SE)**	***p***	**Lower**	**OR**	**Upper**
Constant	-4.47 (2.99)				
Gender	-0.42 (0.67)	.529	0.18	0.66	2.43
Education	0.22 (0.52)	.669	0.45	1.25	3.44
Kinship	-0.95 (0.59)	.105	0.12	0.39	1.22
Unexpectancy of death	0.36 (0.17)	**.033**	1.03	**1.44**	2.01
Cause of death	-1.47 (0.87)	.092	0.04	0.23	1.28
Time since loss	-0.18 (0.05)	.694	0.90	0.98	1.07
Mental support	-0.31 (0.50)	.530	0.28	0.73	1.94
Grief support	0.05 (0.50)	.922	0.39	1.05	2.81
SRIS	-0.01 (0.02)	.948	0.96	1.00	1.03
Baseline PGD	0.06 (0.02)	**.003**	1.03	**1.07**	1.10

Note. 95% CI = 95% Confidence interval. OR = Odds ratio. PGD = Prolonged grief disorder. SRIS = Self-Reflection and Insight Scale.

Discussion

This study explored possible reactivity effects of using experience sampling methodology (ESM) to measure levels of prolonged grief disorder (PGD) symptoms in 184 people who experienced the loss of a loved one three to six months prior. PGD symptom levels have been assessed before allocating participants into an ESM condition or a waitlist

condition (T1), after the ESM phase (T2), and after the waiting phase prior to the ESM phase for the waiting condition (T1b).

The first aim of this study was to replicate the findings of Lenferink et al. (2022) about a decrease in PGD symptoms from T1 to T2 on a group level. By adding a control condition, the impact of participating in the ESM intervention on reductions in PGD symptoms could be more accurately assessed to determine whether these changes were due to the intervention itself rather than other factors, such as the passage of time. In contrast to their previous findings, no significant decrease in average PGD symptoms from T1 to T2 could be observed. Nonetheless, the assumption made by Lenferink et al. (2022) that assessing PGD with ESM can be done safely is further supported by the present findings. People who participated in this ESM study to assess PGD symptoms, on average, did not get worse when confronted with their loss after engaging in self-monitoring.

The second research question aimed to explore differences in individual reactivity effects, as it can be assumed that people show diverse reactions when engaging in reflective measures that did not reflect in the group average. As expected, computing RCIs revealed that there are different subgroups of individual reactivity, namely group 0 (“Reference group”) and group 1 (“Decrease in symptoms”). These new groups do not only show that there are reactivity effects on an individual level, but they also indicate that there is a group of participants that seemed to be benefiting from ESM. At the same time, the majority of the participants were unaffected (group 1). This observation supports the findings of previous studies on employing ecological momentary assessment (EMA) like ESM to assess PGD and other psychopathological disorders (Dewey et al., 2015; Hensler et al., 2021; Lenferink et al., 2022) and provides further support for the safety of applying ESM when studying PGD.

The third aim was to explore potential similarities among participants in the new subgroup. A logistic regression revealed that there are two different variables shared among participants that predict an increase in the probability of belonging to group 1 (“Decrease in

symptoms"). People who show a higher amount of symptoms at baseline (T1) seem to be more likely to belong to group 1. The odds ratio (OR) for every unit increase in baseline PGD symptoms was 1.07 to belong to group 1. Expressed differently, for every point on the PGD symptoms questionnaire at baseline (T1), a participant was 7% more likely to belong to the "Decrease in symptoms" group. One possible explanation for this finding might be that people need to be pathologically diagnosed, or in the frame of this study, pathologically grieving to show improvement afterwards. Generally, finding a decrease in symptoms of people suffering from psychopathological disorders after engaging in EMA is known to the current state of the art in EMA research (Bakker & Rickard, 2018; Dewey et al., 2015). Bakker and Rickard (2018), for example, found that people engaging in a self-monitoring application showed a decrease in their depression levels throughout the assessment and even up to six months later.

The second variable that was significant for a higher probability of belonging to group 1 was "unexpectancy of death". The OR of 1.44 indicates that with every unit increase in unexpectancy of death, participants were 44% more likely to belong to the "Decrease in symptoms" group. Finding a relation between both variables does not seem surprising as sudden loss has been identified as a well-known predictor for higher grieving in several studies prior (Barry, 2002; Buur et al., 2024; Jann et al., 2023; Lobb et al., 2010). However, the outcome that participants were 44% more likely to belong to the "Decrease in symptoms group" offers great potential for further investigation. It seems to be reasonable to argue that people engaging in self-monitoring their symptoms (through ESM) could improve their symptomatology.

Considering those findings, both predictor variables seem to be linked to each other. Sudden loss is associated with more severe grief reactions (Barry, 2002; Buur et al., 2024; Jann et al., 2023; Lobb et al., 2010). More severe grief reactions have been found to be linked to a decrease in symptoms after an ESM assessment (Bakker & Rickard, 2018; Dewey et al.,

2015). To put this in the context of this study: “Unexpectancy of death” might be linked to increased baseline PGD symptoms, which, in turn, are linked to a decrease in symptoms after an ESM phase. This assumption may serve as a stimulus for subsequent research endeavours in this domain, aimed at investigating the significance of these factors in facilitating the treatment of PGD.

Strengths and limitations

Two main strengths of this study distinguish it from other work done in this area (Boelen & Lenferink, 2019; Lenferink et al., 2022; Lenferink et al., 2023). First, adding a control group to the study design of Lenferink et al. (2022) increased the validity of the results of this study. The possibility of confounding variables like the passage of time is minimized, and findings increase in generalizability. Second, gathering participants via the website www.rouwbehandeling.nl provided this study with a large group of people compared to most other studies regarding the effects of ESM on PGD severity.

However, this study was conducted in a real-world setting. People were seeking help to deal with bereavement but have not been clinically diagnosed with PGD. Thus, participants might have experienced normal levels of complaints, making it difficult to conclude whether findings can be generalized to people suffering from PGD (Lenferink et al., 2022). Second, the high variability of the confidence intervals of the OR of “unexpectancy of death” could not be further investigated. Possible mediators, moderators, or confounding variables that might explain this high variability have not been investigated.

Future research

The outcomes of this study suggest that employing self-reflective measures like ESM is safe to use and that the reactivity effects did not increase participants’ complaints. ESM instead even seems to support improvement in people with higher amounts of symptoms. This is an exciting insight for research on using mobile applications in measuring and/ or treating people suffering from PGD, similar to the mobile self-help application *My Grief*, which was

designed and planned by Eklund et al. (2021). Sufferers might already be able to recover to some extent if they show high amounts of symptoms. Furthermore, it will not lead to any negative consequences for people who might not suffer as intensely. Applying ESM in other psychopathological disorders has already been shown to be safe and even beneficial when used as an additional tool for treatment (Bakker & Rickard, 2018; Kramer et al., 2014). For example, Kramer et al. (2014) used the advantage of EMA to provide real-time feedback and support patients during recovery. They found a decrease in depression symptoms over time in the EMA group.

Conclusion

This study did not find any significant reactivity effects of ESM on the average amount of PGD symptoms in recently bereaved people. Calculating RCIs revealed that there are reactivity effects on an individual level. The majority of people did not show any reactivity effects, while there was a considerable amount of people who showed a decrease in PGD symptoms after the ESM phase. Additionally, this study provides further evidence that high amounts of symptoms at baseline are connected to a significant decrease in symptom severity. Similarly, findings also suggest that the higher the unexpectancy of the loss, the more likely participants were to belong to the “Decrease in symptoms” group as well. However, this finding must be interpreted under caution as the OR for “unexpectancy of death” shows high variability in its confidence interval. All in all, future research can faithfully employ ESM to assess PGD symptoms in bereaved people. It should focus on whether there are confounding variables to the effect “unexpectancy of loss” has on a decrease in symptoms. Researchers might even investigate (mobile) self-monitoring tools not only for measurement but also as a therapeutic tool.

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Appendix

Appendix A: R-code for creating a variable indicating completion percentages for each participant.

```
library(haven)
library(dplyr)
library(tidyr)

data <- data %>%
  mutate(answered_50_percent_or_more = rowSums(!is.na(across(everything()))) / ncol(data)
         >= 0.5)

data <- data %>%
  mutate(completion_percentage = rowSums(!is.na(across(everything()))) / ncol(data) * 100)

write_sav(data, "data.sav")
```

Appendix B: Additional information for demographic data.

Table A

Independent t-test comparing differences in baseline PGD symptoms between ESM (N = 58) and waitlist condition (N = 65).

Logistic parameter	ESM		Waitlist		T (121)	*p*	Cohen's d
	M	*SD*	*M*	*SD*			
PGD symptoms	56.75	13.98	53.92	12.44	1.19	.27	.22

Note. **ESM** = Experience sampling methodology. **PGD** = Prolonged grief disorder.

Appendix C: Additional information about regrouping.

Table 2

Descriptive statistics and frequencies for the predictor variables of the total sample and per RCI grouping.

Characteristic	Total sample (*N* = 122)		No change & Increase in symptoms (*N* = 87)		Decrease in symptoms (*N* = 35)	
Gender, *N* (%)						
Female	102	(83.6)	72	(82.8)	30	(85.7)
Male	20	(16.4)	15	(17.2)	5	(14.4)
Age (in years), *M* (*SD*)	54.4	(11.5)	54.8	(11.9)	53.3	(10.5)
Education, *N* (%)						
College/ University	75	(61.5)	52	(59.8)	23	(65.7)
Other	47	(38.5)	35	(40.2)	12	(34.3)
Kinship, *N* (%)						
Spouse/ Child	67	(54.9)	51	(58.6)	16	(45.7)
Other	55	(45.1)	36	(41.4)	19	(54.3)
Expectancy of death, *N* (%)						
Not at all unexpected	25	(20.5)	22	(25.3)	3	(8.6)
A little unexpected	16	(13.1)	14	(16.1)	2	(5.7)
Quite unexpected	19	(15.6)	13	(14.9)	6	(17.1)
Very unexpected	21	(17.2)	13	(14.9)	8	(22.9)
Completely unexpected	41	(33.6)	25	(28.7)	16	(45.7)
Cause of death, *N* (%)						
Accident/ Suicide	13	(10.7)	11	(12.6)	2	(94.3)
Other	109	(89.3)	76	(87.4)	33	(5.7)
Time passed since loss (in weeks), *N* (%)	20.4	(5.2)	20.5	(5.1)	19.9	(5.5)
Mental support – unrelated to loss, *N* (%)						
Yes	68	(55.7)	49	(56.3)	19	(54.3)
No	54	(44.3)	38	(43.7)	16	(45.7)
Mental support – grief support, *N* (%)						
Yes	49	(40.2)	35	(40.2)	14	(40.0)
No	73	(59.8)	52	(59.8)	21	(60.0)
SRIS scores at T1, *M* (*SD*)	90.5	(14.1)	91.2	(13.4)	88.5	(15.7)
Symptom-levels PGD at T1, *M* (*SD*)	55.3	(13.2)	52.6	(13.0)	62.1	(11.4)

Note. **ESM** = Experience sampling methodology. **PGD** = Prolonged grief disorder. **SRIS** = Self-Reflection and Insight Scale. *Due to the time passing between registration and T1, some dates are below or extend the range of 3-6 months.