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The ICD-11 and DSM-5-TR prolonged grief criteria: Validation of the Traumatic Grief Inventory-Self Report Plus using exploratory factor analysis and item response theory

Cyrille Kossigan Kokou-Kpolou[1] | Lonneke I. M. Lenferink[2,3,4] | Alice Einloft Brunnet[5] | Sunyoung Park[6] | Olga Megalakaki[7,8] | Paul Boelen[4,9,10] | Jude Mary Cénat[11]

[1]School of Psychology, Laval University, Quebec, Canada

[2]Department of Psychology, Health, and Technology, Faculty of Behavioural, Management, and Social Sciences, University of Twente, Enschede, Netherlands

[3]Department of Clinical Psychology and Experimental Psychopathology, Faculty of Behavioral and Social Sciences, University of Groningen, Groningen, Netherlands

[4]Department of Clinical Psychology, Faculty of Social Sciences, Utrecht University, Utrecht, Netherlands

[5]Département de psychologie, UR CLIPSYD, Université Paris Nanterre, Paris, France

[6]Graduate School of Psychology, California Lutheran University, Thousand Oaks, California, USA

[7]Centre de Recherche en Psychologie: Cognition, Psychisme, Organisations (CRP-CPO), University of Picardy Jules Verne, Amiens, France

[8]Sigmund Freud University of Paris, Paris, France

[9]ARQ Centrum'45, Diemen, Netherlands

[10]ARQ National Psychotrauma Centre, Diemen, Netherlands

[11]School of Psychology, University of Ottawa, Ottawa, Canada

Correspondence

Cyrille Kossigan Kokou-Kpolou, School of Psychology, Laval University, 2325 rue des Bibliothèques, Local 1140, Quebec G1V 0A6, Canada.

Email: kossigan.kokou-kpolou@psy.ulaval.ca

Abstract

More recently, the prolonged grief disorder (PGD) has been recognized as a mental health disorder following bereavement, which is distinct from depression and PTSD. However, the number and proposed symptom items vary across the ICD-11 and the DSM-5-TR criteria for PG. The Traumatic Grief Inventory-Self Report Plus (TGI-SR+), which is an updated version of the TGI-SR, is currently the only robust instrument that assesses PG according to the ICD-11 and DSM-5-TR criteria. For research and clinical use among French-speaking countries, the forward-backward procedure was applied to translate the TGI-SR+ into French language. Exploratory factor analysis and parallel analysis converged towards a two-dimensional structure for the TGI-SR+, representing adaptation difficulties and traumatic separation distress. However, items mapping onto ICD-11 and DSM-5-TR criteria for PG represented a one-dimensional structure. Findings based on item response theory method provided strong evidence for discriminative characteristics of the items. The internal reliability was excellent for the TGI-SR+ (McDonald's $\omega = 0.97$) and ICD-11 and DSM-5-TR criteria for PGD (McDonald's $\omega = 0.95$). We also demonstrated a very high temporal stability for the TGI-SR+ total score (ICC = .91, $p < 0.0001$) and ICD-11 PGD and DSM-5-TR PGD (ICC = 0.90, and ICC = 0.88, $ps < 0.0001$, respectively). The concurrent validity of the instrument was also demonstrated, such that the TGI-SR+ total score and all combinations were positively and significantly associated with the levels of depression, anxiety and post-traumatic stress symptoms. However, the effect sizes were moderate. We conclude that for research and clinical use among French bereaved populations, the TGI-SR+ is a sound tool with very good psychometric properties.

KEYWORDS

assessment, DSM-5-TR, exploratory factor analysis, ICD-11, item response theory, prolonged grief

1 | INTRODUCTION

Since the mid-1990s, there have been accumulative empirical findings showing that not all bereaved persons adaptively grieve the loss of their loved ones. Nearly 10% of bereaved individuals following natural losses (Lundorff et al., 2017) and 50% following traumatic losses (Djelantik et al., 2020; Kokou-Kpolou, Moukouta, Masson, et al., 2020) may experience persistent and debilitating grief reactions that affect their psychosocial functioning and cause health impairments. This pathological condition, distinct from depression and posttraumatic stress disorder, is known as 'prolonged grief disorder' (PGD). The PGD is a diagnostic entity now included in the 11th edition of the International Classification of Diseases (ICD-11) and in the text revision of the 5th edition of the Diagnostic and Statistical Manual (DSM-5-TR) (Boelen & Lenferink, 2020; Prigerson, Kakarala, et al., 2021). Beyond the consensus about the name, the time-criterion (6 months in ICD-11 and 12 months in DSM-5-TR), the number and proposed symptom items vary across both diagnostic manuals. Yet it is unclear if the individual symptoms form the same construct across both diagnostic manuals (Haneveld et al., 2022) and how they perform as indicators of overall prolonged grief severity.

During the last decade, the PGD criteria underwent significant changes (Prigerson, Kakarala, et al., 2021). The 18-item Traumatic Grief Inventory-self report (TGI-SR) was developed by Boelen and colleagues (Boelen et al., 2019; Boelen & Smid, 2017) in Dutch bereaved samples to assess symptoms of Persistent Complex Bereavement Disorder (PCBD: the former terminology used by the DSM-5), symptoms of PGD as described by Prigerson et al. (2009), and PGD as per Maercker et al. (2013), the precursor of the current ICD-11 PGD criteria. The TGI-SR has demonstrated strong psychometric qualities across different bereaved samples, such as a clinical (Boelen & Smid, 2017), disaster-bereaved (Boelen et al., 2018) and community bereaved samples (Baş et al., 2020; Boelen et al., 2018). In terms of factor validity, a unidimensional structure of TGI-SR was found in Dutch sample (Boelen & Smid, 2017). However, the Turkish version of TGI-SR (Baş et al., 2020) exhibited a two-dimensional structure, representing separation distress and adaptation difficulties.

The TGI-SR is pre-dating to the official adoption of ICD-11 PGD and recently proposed changes to DSM-5-TR PGD. Consequently, further up-to-date validation studies of instrument assessing these newest criteria are needed. In this perspective, Lenferink et al. (2022) revised the TGI-SR by adding new four items, which fully cover the spectrum of both ICD-11 PGD and DSM-5-TR symptom items. This update measure is labelled TGI-SR+. To date, only one study by Lenferink et al. (2022) tested the psychometric properties of the TGI-SR+. They showed that the TGI-SR+ is a reliable and valid self-report measure to assess PGD criteria according to ICD-11 and DSM-5-TR in two Dutch bereaved samples.

Two other tools assessing PGD were recently published. The International Prolonged Grief Disorder Scale (IPGDS), which is based on the ICD-11 criteria, was tested in German and Chinese-speaking samples (Killikelly et al., 2020). In addition, the PG-13-Revised tapping the DSM-5-TR criteria for PGD was put forth by Prigerson, Boelen,

Key Practitioner Message

- The TGI-SR+ covers prolonged grief symptoms across ICD-11 and DSM-5-TR criteria and allows to compare diagnostic performance of PGD criteria-sets in both classification systems.
- Based on advanced statistical models, items representing ICD-11 and DSM-5-TR criteria for PGD discriminate well bereaved people high and low in prolonged grief.
- The TGI-SR+ demonstrates solid psychometric properties for research and clinical use.

et al. (2021). Both tools, however, do not cover PGD criteria as defined in ICD-11 and DSM-5-TR, compared to the TGI-SR+ that allows to directly compare diagnostic performance of PGD criteria-sets in both classification systems (Boelen & Lenferink, 2022).

1.1 | The present study and aims

The present study represents an international contribution to the validation of the TGI-SR+ in French-speaking countries. Prior published French studies relied on translated versions of the Inventory of Traumatic Grief-30 items (Delespaux et al., 2013; Delespaux & Zech, 2015; Zech, 2006), the Inventory of Complicated Grief-Revised (ICG-R) (Gana & K'Delant, 2011; Kokou-Kpolou et al., 2017; Kokou-Kpolou, Moukouta, Sani, et al., 2020) and short version drawn from ICG-R items (Kokou-Kpolou, Moukouta, Sani, et al., 2020, Kokou-Kpolou et al., 2021). Thus, there is a lack of formal and reliable validated ICD-11 and DSM-5-TR PGD assessment tools in French-speaking countries. This study also contributes to promote global applicability of the PGD guidelines in research and practice. International research efforts are of utmost importance for cross-cultural validity of grief assessment tools (Killikelly et al., 2020; Kokou-Kpolou, Cénat, et al., 2020). We believe that this goal can be reached using multicultural samples or accumulating evidence through study samples from different regions worldwide.

Furthermore, to improve the measurement validity of TGI-SR+, the present study examined how individual PG symptoms perform as indicators of the underlying dimension of overall PG severity. Indeed, the psychometric properties of the scales measuring ICD-11 and DSM-5-TR PGD have been established at the global 'test' level within classical test theory (CTT; involving factor analytic methods) framework; however, no studies as far we know, have used modern psychometric methods to evaluate these measures at the 'item' level. This information, offered by item response theory (IRT) models (Hambleton et al., 1991; Reise & Waller, 2009), is particularly important as it can enhance our knowledge about how responses to

individual items change across different levels of PG, the effectiveness of each item in distinguishing between different levels of PG and the degree to which items provide overlapping or unique information about levels of overall PG severity. Therefore, we applied advanced psychometric analyses using both CTT and IRT methods to assess item and scale functioning (set of items tapping the ICD-11 and DSM-5-TR criteria for PGD) and to inform content refinement, if necessary (Edelen & Reeve, 2007; Reise & Waller, 2009).

Considering the above-mentioned background, we translated the TGI-SR+ into French for research and clinical use in the French-speaking countries. This study relied on data collected in France, and the purpose of this paper was to examine the validity and reliability of the TGI-SR+. Specifically, we first examined the dimensionality of the TGI-SR+, including the PGD-symptom items proposed by ICD-11 and DSM-5-TR. Considering that there is still a need to further explore the clustering of items of the TGI-SR+, given the newly added items and lack of previous validation study in French-speaking countries, exploratory factor analysis (EFA) was used rather than confirmatory factor analysis (CFA). Second, following the EFA, we evaluated the psychometric quality of each proposed item within both diagnostic criteria using IRT approach. Third, we examined the internal reliability and the temporal stability of the TGI-SR+. Fourth, we evaluated its concurrent validity. We expected that different TGI-SR+ scores—including total scores, summed 12 ICD-11 PGD items and summed 10 DSM-5-TR PGD items—would be positively and significantly associated with concurrently assessed psychopathology, including levels of depression, anxiety and post-traumatic stress. Lastly, in terms of known-group validity, we explored whether scores on the TGI-SR+ varied as a function of several socio-demographic and loss-related variables. No specific hypotheses were formulated regarding socio-demographics given the inconsistent findings across the literature. However, regarding loss-related variables, we expected that greater TGI-SR+ scores among bereaved individuals who lost immediate family member (vs. more distantly related loved one) and those who have been bereaved by traumatic losses (vs. natural causes of death).

2 | METHODS

2.1 | Translation procedures of the TGI-SR+

Following the instructions of Lenferink et al. (2022), the forward-backward procedure was applied to translate the TGI-SR+. Two junior (CKK and AB) and one senior (JMC) researchers who were fluent in both English and French translated the questionnaire into French language. The three French translations were then compared and slightly corrected to form a single forward version. Besides, this version was re-translated into English by and independent senior researcher and one professional translator. Then, the backward English version was compared to the original scale in order to ensure that the main concepts were maintained. The scale was then administered to five bereaved individuals with different education background to assess the semantic comprehensiveness of items. Their

comments led us to reformulate two items (Items 3 and 4). See Data S1 for the presentation of the French version of the TGI-SR+.

2.2 | Assessment instruments

2.2.1 | Sociodemographic information form

A sociodemographic information form (SIF) included gender, age categories (recoded: 18–29, 30–49, 50 and above), education (recoded: college, high school, undergraduate, postgraduate and doctorate) and marital status (recoded: single, married/in relationship and separated/divorced/widowed).

2.2.2 | Bereavement-related characteristics form

The bereavement-related characteristics (BRC) form included questions regarding the age of the deceased and relationship of the participant with him or her (recoded: 1 = *immediate family members*, 2 = *extended family members* and 3 = *friends/peers*), the causes of the death (recoded 1 = *natural causes* and 2 = *traumatic deaths*) and the time since the loss (in months).

2.2.3 | Traumatic Grief Inventory-Self Report Plus

The translated French version TGI-SR+ was administered to assess the severity of problematic grief reactions. It comprises 22 items. Participants rated the occurrence of symptoms in the preceding month on a 5-point Likert scale (1 = *Never*; 5 = *Always*). Items are summed to form an overall severity score (Lenferink et al., 2022).

2.2.4 | Patient Health Questionnaire

We used the 9-item Patient Health Questionnaire (PHQ) (Carballeira et al., 2007 for French version; Kroenke & Spitzer, 2002) to assess depressive symptoms. Each item in PHQ-9 is rated on a 4-point Likert scale (0 = *not at all* to 3 = *almost every day*) and measures the presence of the symptoms over the past 2 weeks. Possible scores range from 0 to 27, with higher scores indicative of higher levels of depression symptoms. In this sample, the internal consistency reliability of the PHQ-9 was satisfactory ($\alpha = 0.88$).

2.2.5 | Generalized Anxiety Disorder Scale

Participants also completed the 7-item Generalized Anxiety Disorder Scale (GAD), a screening scale designed to measure worries and anxiety symptoms over the past 2 weeks (Spitzer et al., 2006; Spitzer et al., n.d. for French version). Participants rated each item on a 4-point Likert scale (0 = *not at all* to 3 = *almost every day*). The total

score of GAD-7 ranged from 0 to 21, with increasing scores indicating more severe functional impairments as a result of anxiety. In this sample, the GAD-7 displayed very good internal consistency reliability ($\alpha = 0.88$).

2.2.6 | Impact of Event Scale-Revised

Participants also completed the Impact of Event Scale-Revised (IES-R), a scale developed by Weiss and Marmar (1997); Brunet et al., 2003 for French version) to measure the level of psychological stress as response to traumatic life events during the past week. The death of the relatives was used as anchor event. It consists of 22 items on a 5-point Likert scale (1 = *Not at all*; 5 = *Extremely*). In this sample, the IES-R displayed excellent internal consistency reliability ($\alpha = 0.94$).

2.3 | Ethics and data collection

The research protocol adhered to the provisions of the World Medical Association Declaration of Helsinki and obtained a favourable opinion from the ethics committee of the Ecole des Psychologues Praticiens, Paris, France. Participants were recruited using a convenience sampling method, and the data were collected via Google Forms, from June to July 2020. Participation in the research link was announced through popular social media networks (Facebook, Twitter and LinkedIn). As eligible criteria, respondents with age 18 and above and who had lost a loved person over the recent years were invited to participate in the study. They were informed about the purpose of the study and gave electronic informed consent as a requirement for participation. All respondents voluntarily completed online questionnaires, and those who agreed to participate in the follow-up survey (December 2020) allowing temporal stability tests of the TGI-SR+ were invited to provide their e-mail address and personal pseudonym for data matching purpose. No incentive was offered for participation in the research.

2.4 | Statistical analytic plan

Data were analysed using R Version 3.5.0 (R Core Team, 2017). Prior to performing EFA and IRT analyses, descriptive statistics (frequencies, means and standard deviations) served to summarize data and probe normal distribution of the TGI-SR+ data using measures of skewness and kurtosis.

2.4.1 | Exploratory factor analysis

Aim 1

Under the CTT, we performed three EFAs to examine the underlying structure of the TGI-SR+: the first including 21 items (without item 13 which is related to functional impairment), the second including

the 12 items of the ICD-11 PGD criteria and the third including the 10 items of the DSM-5-TR PGD criteria. As noticed above, given that the construct validity of the TGI-SR was still questionable and the TGI-SR+ includes new items, EFA rather CFA was applied (e.g., Fabrigar et al., 1999). To this end, we used maximum likelihood (ML) extraction with direct geomin rotation. As our data are normally distributed, ML was the best extraction method in line with the recommendation by Fabrigar et al. (1999). To determine the correct number of latent traits to retain and rotate, each EFA model was evaluated according to the following rules: (1) eigenvalues greater than 1.0 (Kaiser, 1960), (2) scree (Cattell, 1966), (3) parallel analysis (PA) (Horn, 1965) and (4) interpretability. Among these multiple rules, note that PA is an often-recommended method as it shows good performances for assessment of the dimensionality of a variable set (e.g., Timmerman & Lorenzo-Seva, 2011).

2.4.2 | IRT analysis

Aim 2

IRT models are advanced mathematical models which have been developed to capture the interaction between an individual's response to an item and the latent construct or trait being measured by the scale (Hambleton et al., 1991; Reise & Waller, 2009). They are based on two major assumptions: the unidimensionality and local independence of the scale items. The dimensionality is tested using factor analysis and the local independence parameter (i.e., an individual's responses to pairs of items are not related when ability is held constant) can be ascertained by examining the residual correlations from the number of factors resulting in EFA or CFA models. As recommended by Reeve et al. (2007), we used correlations of more than 0.20 as indicative of the presence of local dependence in the items.

Among the IRT models, we employed the generalized partial credited model (GPCM; Muraki, 1992), which is well suited for polytomous items with multiple-ordered response categories such as the 5-point Likert scale used in the present study. GPCM generates item discrimination parameter (a_i), which provides estimate about the degree to which an item can discriminate a latent trait (θ; e.g., prolonged grief) among respondents. Values of a_i from 0.01 to 0.34 are considered poor, 0.35–0.64 marginal, 0.65–1.34 moderate, 1.35–1.69 good and >1.7, satisfactory (Baker, 2001). It also generates item difficulty parameter (b_i), which indicates the degree to which an item (e.g., emotional numbness) involves a difficulty for respondents to give higher ratings (5 = *Always*) regardless of the level of a latent trait (e.g., prolonged grief). In other words, item difficulty parameter represents the difficulty of the step when moving from one response option to another. As TGI-SR+ items are rated on 5-point Likert scale; this corresponds to 4 steps (i.e., 1–2, 2–3, 3–4 and 4–5). Values of b_i from −3.00 to −2.00 are considered very easy, −2.00 to −1.00 easy, −1.00 to 1.00 moderately difficult, 1.00 to 2.00 difficult and >2.00, very difficult (Baker, 2001). To estimate parameters, we used 'mirt' package in R-studio (Chalmers, 2012).

2.4.3 | Tests for reliability

Aims 3 and 4

To test for the internal reliability of the scales, we used different indices including McDonald's omega (ω) and the Greatest Lower Bound (GLB) which provide more accurate values of a scale's reliability than the traditional Cronbach's Alpha (McNeish, 2018; Peters, 2014; Trizano-Hermosilla & Alvarado, 2016). The 'true' internal reliability of the scale is confirmed when the value of ω is higher (Revelle & Zinbarg, 2009), and that of the GLB is in the interval of 0.8–1.0 (Sijtsma, 2009). Regarding the test–retest reliability of the TGI-SR+, we used the intraclass correlation coefficient (ICC) based on two-way mixed method.

2.4.4 | Concurrent validity

Aim 5

Pearson correlation tests served to establish the concurrent validity of the TGI-SR+ (including the ICD-11 PGD and DSM-5-TR PGD sum scores) with other measures of psychopathology (including GAD-7, PHQ-9, and IES-R sum scores).

2.4.5 | Known-group validity

Aim 6

Finally, as a preliminary test for known-group validity, we conducted a series of multivariate GLM analyses to examine if the total TGI-SR+ scores and derived item combinations differentiated participants in terms of their socio-demographics and loss-related variables.

3 | RESULTS

3.1 | Participants' characteristics

The study sample consisted of 220 participants, after removing 9 participants (6 for duplicates and 3 for non-human loss). The full detail on participants' characteristics is presented in the Table 1. Females represented 90.5%. Among the age groups, the 18- to 29-year participants represented the highest group (72.7%). Participants were highly educated with 74.1% having attained university level education. Given to the marital status, 47.7% were single, and 50.0% were married or in couple. The average period since the death occurred was 26.5 months (SD = 25.6; range = 1 to 96 months). The average age of the deceased was 73.5 years (SD = 22.6; Mdn = 76.5). Most of the participants reported the death of extended family members (75.7%). Ten participants (4.5%) reported experiencing two deaths. The most reported types of loss were those due to natural, anticipated causes (i.e., old age and medical chronic illness), which made up 86.2%, followed by traumatic losses, i.e., suicide, homicide and accident (13.8%).

TABLE 1 Sociodemographic and bereaved-related characteristics of the study sample

Variables	n	%
Gender (female)	199	90.5
Age groups		
18–29 years	160	72.7
30–49 years	33	15.0
50+ years	27	12.3
Education background		
Primary and college	24	10.9
High school	33	15.0
Undergraduate	93	42.3
Postgraduate and doctorate	70	31.8
Marital status		
Single	105	47.7
Married/in relationship	110	50.0
Separated/divorced/widowed	5	2.3
Age of the deceased, M (SD; range)	73.48 (22.6; 18 months to 101 years)	
Relationship with the deceased		
Immediate family members	28	12.8
Extended family members	165	75.7
Friends/peers	25	11.5
Missing data	2	
Causes of the death		
Natural causes	188	86.2
Traumatic deaths	30	13.8
Missing data	2	
Time since the loss (in months), M (SD; range)	26.47 (25.61; 1 to 96 months)	

### 3.2 | Factor structure of the TGI-SR+

In Table 2, we reported information on the central tendency, skewness, kurtosis and distributions of responses on each item of TGI-SR+. Following that, three EFAs were performed, a first including all 21 items (without item 13), a second including the 12 items of the ICD-11 PGD criteria and a third including the 10 items of the newest DSM-5-TR PGD criteria. Estimates of Kaiser–Meyer–Olkin measure of sampling adequacy were 0.93, 0.91 and 0.88 for the three combinations, respectively, and the Bartlett's tests of sphericity were all statistically significant ($p < 0.0001$). These estimates indicate that correlations between variables were suitable for factor analysis.

The first EFA generated three factors with eigenvalues greater than 1.0 (i.e., 11.86, 1.92 and 1.07). However, as shown in Figure 1a, parallel analysis indicated that up to two factors might be appropriately retained. The two factors accounted for 55.67% and 6.39% of the explained variance, respectively. Twelve items loaded into the first factor and nine into the second factor. In the two-factor solution,

TABLE 2 Item distribution of the traumatic grief inventory-self report plus (TGI-SR+)

Item	M	SD	Skewness	Kurtosis	Factor loadings in EFA after rotation TGI-SR+ Factor 1	Factor 2	ICD-11 PGD (one-factor model)	DSM-5-TR PGD (one-factor model)
Item 1. Preoccupation about the deceased	2.54	1.07	0.30	−0.48		0.86	0.71	0.67
Item 2. Emotional pain[a]	2.91	1.16	−0.01	−0.66		0.90	0.72	0.68
Item 3. Longing or yearning	2.02	1.08	1.08	0.48		0.65	0.62	0.65
Item 4. Confusion about one's role	1.70	0.98	1.82	2.91	0.69			
Item 5. Trouble accepting the loss	2.64	1.31	0.42	−0.78		0.65	0.80	
Item 6. Avoidance of reminders	1.92	1.17	1.39	0.97	0.43	0.31		0.68
Item 7. Difficulty to trust others	1.47	0.85	2.50	6.15	0.65			
Item 8. Bitterness/anger related to loss[a]	1.97	1.15	1.23	0.61		0.50	0.69	
Item 9. Difficulty moving on with life	1.55	0.92	2.39	5.56	0.71		0.82	0.80
Item 10. Emotional numbness	1.51	0.87	2.33	5.26	0.72		0.80	0.86
Item 11. Life empty or meaningless	1.71	1.01	1.77	2.50	0.71			0.90
Item 12. Stunned, shocked or dazed	2.46	1.31	0.59	−0.66		0.76		
Item 13. Functional impairment	1.52	0.87	2.38	5.62				
Item 14. Difficulty with positive reminiscing	1.99	1.06	1.19	0.97	0.42	0.49		
Item 15. Preoccupation about death circumstances	1.42	0.76	2.79	8.32				
Item 16. Negative thoughts about oneself	1.88	1.15	1.49	1.37	0.64		0.66	
Item 17. Desire to die to join the deceased	1.35	0.84	3.43	11.48	0.82			
Item 18. Feeling alone or detached from others	1.41	0.81	2.79	7.60	0.98			0.71
Item 19. Feeling unreal that the person is dead	2.37	1.30	0.72	−0.46		0.53	0.71	0.67
Item 20. Blame on others	1.54	0.97	2.34	4.75		0.31	0.55	
Item 21. Part of self died with the deceased	1.68	1.02	1.90	2.99	0.78		0.81	0.84
Item 22. Difficulty experiencing positive feelings	1.55	0.91	2.34	5.25	0.87		0.78	

[a]In DSM-5-TR criteria for PDG, the two symptoms were merged in the criterion C4. Here, the highest score of one of the two items is used to tap the symptom.
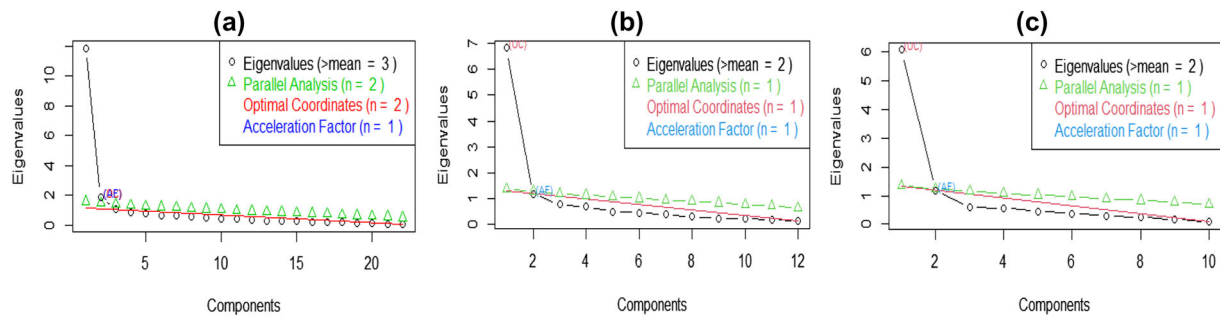
FIGURE 1 Non-graphical solution to screen test for the TGI-SR+ items (a), 12-item PGD according to ICD-11-criteria (b) and 10-item PGD according to DSM-5-TR criteria (c)

TABLE 3 Estimated item discrimination and difficulty parameters of the items mapping onto ICD-11 and DSM-5-TR prolonged grief criteria using the generalized partial credit model (GPCM)

| | Item parameter estimates[a] | | | | |
	a	b_1	b_2	b_3	b_4
Nb. Item in TGI-SR+					
	For ICD-11-PGD items				
Item 1	1.61	−0.83	−0.42	1.08	2.06
Item 2	1.54	−1.11	−0.70	0.80	1.38
Item 3	1.22	−0.32	1.72	0.58	2.19
Item 5	2.19	−0.48	−0.38	1.06	0.80
Item 8	1.34	−0.04	1.67	0.53	1.66
Item 9	3.49	0.23	1.38	1.23	1.61
Item 10	3.51	0.26	1.32	1.27	2.01
Item 16	1.16	0.13	1.84	0.90	1.07
Item 19	1.12	−0.42	1.43	0.71	0.79
Item 20	1.10	0.50	2.97	0.11	1.82
Item 21	2.88	0.17	1.30	1.01	1.62
Item 22	2.91	0.22	1.52	1.09	1.76
M	2.01	−0.14	1.14	0.86	1.56
SD	0.95	0.49	1.08	0.34	0.47
	For DSM-5-TR PGD items				
Item 1	1.47	−0.81	−0.46	1.13	2.11
Item 2	1.32	−1.10	−0.78	0.85	1.44
Item 3	1.18	−0.33	1.76	0.58	2.19
Item 6	1.38	0.06	1.80	0.52	1.41
Item 9	3.10	0.22	1.47	1.28	1.57
Item 10	5.45	0.27	1.20	1.35	1.85
Item 11	7.35	0.17	0.94	1.17	1.62
Item 18	1.75	1.65	1.74	0.73	2.35
Item 19	0.94	−0.42	1.63	0.70	0.72
Item 21	3.60	0.17	1.20	1.10	1.60
M	2.75	−0.01	1.05	0.94	1.69
SD	2.15	0.75	0.93	0.30	0.47

[a]The *a* parameter is the slope at the location of all *b* parameters and corresponds to the items ability to discriminate between bereaved individuals of different trait levels. Each of the *b* parameters corresponds to a probability = 0.5 of choosing the response that is +1 from the subscript.

factor loadings ranged from 0.32 (item 20) to 0.99 (item 18). Most of the items loaded into the first factor reflect adaptation responses to the loss and psychosocial functioning (e.g., moving on was difficult). The second factor included items designed to measure separative distress (e.g., yearning, emotional pain and feeling as if a part of me has died) and items mapping onto traumatic response to loss (e.g., trouble accepting the loss, feeling stunned/shocked and feeling unreal that the person is dead). The distribution of items on the two factors is almost equal to that found in previous research by Baş et al. (2020); we therefore called the two subdimensions: *adaptation difficulties* (ADD) and *traumatic separation distress* (TSD), respectively.

The second EFA, including ICD-11 PGD items, generated two factors (eigenvalues: 6.80 and 1.19, respectively). Items 1–3 loaded on Factor 1, eight items on Factor 2 and one cross-loaded item (item 8). Based on the parallel analysis, as shown in Figure 1b, one factor might be appropriately retained. The one-factor model accounted for 56.70% of the explained variance. The factor loadings ranged from 0.55 (item 20) to 0.82 (item 9).

Similarly, the third EFA, including DSM-5-TR PGD items, generated two factors (eigenvalues: 6.05 and 1.19, respectively). Items 1–3 loaded on Factor 1, six items on Factor 2 and one cross-loaded item (item 19). As can be seen in Figure 1c, parallel analysis indicated that one-factor model should be appropriately considered. This factor accounted for 60.48% of the explained variance. Factor loadings varied between 0.65 (item 3) and 0.90 (item 11).

3.3 | IRT analysis

As shown, the data supported the one-factor model for items tapping the ICD-11 and DSM-5-TR criteria for PGD, providing evidence of scale unidimensionality. Therefore, the first assumption of IRT was

met. As a result of local independence, for ICD-11 PGD criteria, all correlation coefficients of the residuals were <0.20, except between items 1 and 2, and items 2 and 3, where they were 0.27 and 0.24, respectively. For DSM-5-TR PGD criteria, all correlation coefficients of the residuals were <0.20, except between items 1 and 2, items 2 and 3 and items 1 and 3, where they were 0.37, 0.31 and 0.24, respectively. These estimations slightly exceed the recommended threshold and may suggest direct causal effects, semantic overlap, or reciprocal interactions between those items. However, taken together the findings from parallel analysis and IRT analysis, we conclude that the local independence can be assumed in our sample.

Table 3 presents the IRT parameter values for each item. In terms of discrimination (slope), all items tapping the ICD-11 criteria for PGD had positive values and ranged between 1.10 and 3.51 ($M = 2.01$, $SD = 0.95$). These values provide support for moderate to very good items, suggesting that all ICD-11 PGD items well discriminate respondents along the latent trait of overall PG severity. In terms of difficulty, parameter estimates spanned from −1.11 to 2.19. At step 1, 11 of 12 items are considered easy. Difficulty increased from steps 1 to 2 for nine items and then decreased at step 3; however, it decreased for items 1, 2 and 5 from step 1 to step 2, the increased at step 3. At step 4, all items increased in difficulty. These results are translated in Figure 2a, depicting how well individual items discriminated responded across the latent trait.

Again, in terms of discrimination (slope), all items tapping the DSM-5-TR criteria for PGD yielded positive values and ranged between 0.94 and 7.35 ($M = 2.75$, $SD = 2.15$). These values indicate moderate to very good items, suggesting that all DSM–5-TR PGD items well discriminate respondents along the latent trait of overall PG severity. In terms of difficulty, parameter estimates ranged between −1.11 and 2.35. At step 1, items are considered easy or moderately difficult. Difficulty increased from steps 1 to 2 for all items
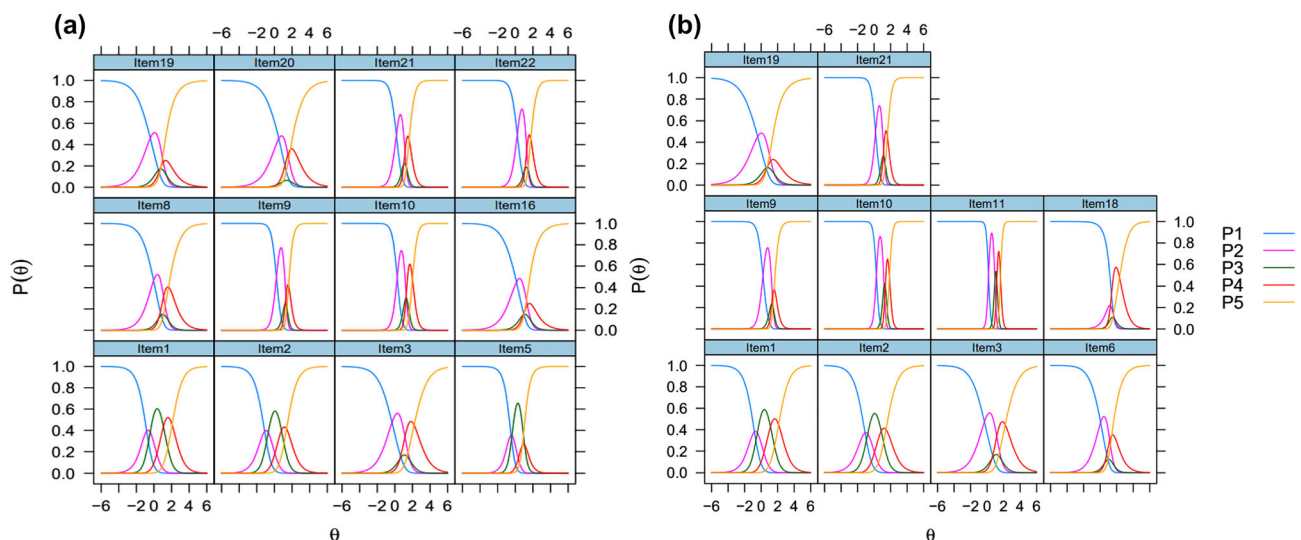
FIGURE 2 Item probability functions of the 12-item PGD according to ICD-11-criteria (a) and 10-item PGD according to DSM-5-TR criteria (b). *Note*: theta (θ), a variable used to express an individual underlying trait level (prolonged grief), is measured along the *x* axis. The *y* axis indicates the probability (P) of endorsing a response option and is scaled from 0.0 to 1.0.

except for items 1 and 2 which decreased and then increased at step 3. At step 4, all items increased in difficulty. See Figure 2b.

3.4 | Internal reliability and homogeneity of TGI-SR+

Items of TGI-SR+ were all significantly and positively intercorrelated, with effect sizes ranging from $r = 0.180$ (between items 1 and 11) to $r = 0.695$ (between items 7 and 8), all $ps < 0.0001$. As a result, the internal reliability estimates of McDonald's ω and GLB were 0.94 and 0.96 respectively, thus supporting the excellent internal reliability of the TGI-SR+. The internal reliability estimates of ICD-11 PGD and DSM-5-TR PGD were also excellent (McDonald's $\omega = 0.95$ and GLB = 0.96, respectively). Table 4 shows the results.

Test–retest reliability of the TGI-SR+, we used data from 12 of 15 volunteers (3 were excluded for significant missing data) who completed the follow-up survey for this purpose, with an interval of 5 to 6 weeks. The test–retest correlation for the TGI-SR+ total score was excellent (ICC = 0.913, $p < 0.0001$). The test–retest correlations for the ICD-11 PGD and DSM-5-TR PGD items were ICC = 0.902, and ICC = 0.875, all $ps < 0.0001$, respectively.

3.5 | Concurrent validity

Table 4 shows correlations between the TGI-SR+ scores (and the two derived item combinations) with GAD-7, PHQ-9 and IES-R scores, respectively. In compliance with Cohen's (1988) guidelines, we found moderate significant and positive correlations between different indices, such that higher scores on the TGI-SR+ were associated with higher scores on indices of symptoms of anxiety ($r = 0.328$), depression ($r = 0.409$), and posttraumatic stress ($r = 0.388$). A similar pattern of correlation coefficients was found for the summed 12 ICD-11 PGD scores and 10 DSM-5-TR PGD scores.

3.6 | Criterion validity

As a preliminary test of construct validity, we examined if the total TGI-SR+ scores and derived two combinations differentiated participants in terms of their socio-demographics and loss-related variables. The multivariate GLM results showed that, among socio-demographics, education was associated with TGI-SR+ scores (Wilks' $\lambda = 0.933$, Pillai's trace = 0.067, $F[3, 216] = 5.05$, $p = 0.002$, $\eta p^2 = 0.07$). Tukey's multiple comparison test indicated that bereaved individuals with postgraduate and doctorate reported lower TGI-SR+ scores (M = 35.60, SD = 13.20) than those with under undergraduate ($M_{diff} = -6.29$, $p = 0.014$), high school ($M_{diff} = -11.61$, $p < 0.001$) and college ($M_{diff} = -10.09$, $p < 0.01$) levels. No significant differences across gender, age groups, professional status and marital status were found.

Regarding the loss-related characteristics, the relationship with the deceased (Wilks' $\lambda = 0.992$, Pillai's trace = 0.048, $F[2, 215] = 4.57$, $p = 0.011$, $\eta p^2 = 0.04$) was associated with TGI-SR+ scores. Multiple comparison via Tukey's test showed that bereaved persons who lost their immediate family member had higher TGI-SR+ scores (M = 47.90, SD = 21.89) than those who mourned the death of an extended family member ($M_{diff} = 8.80$, $p < 0.01$). Further analysis showed that participants who lost immediate family members reported greater scores on the TSD of TGI-SR+ than those who lost extended family members (Wilks' $\lambda = 0.920$, Pillai's trace = 0.081, F [2, 215] = 6.08, $p = 0.003$, $\eta p^2 = 0.05$). The TGI-SR+ scores also differed significantly depending on the causes of deaths (Wilks' $\lambda = 0.938$, Pillai's trace = 0.062, $F[1, 218] = 12.58$, $p = 0.001$, $\eta p^2 = 0.06$) such that participants who lost their loved ones following natural sudden and violent death reported higher scores (M = 45.93, SD = 16.95) than those who reported death due to natural and anticipated causes (M = 37.98, SD = 15.40). The Pearson biserial correlation results showed that the age of the deceased was significantly and negatively associated with TGI-SR+ scores ($r = -.159$, $p = 0.022$). There were no significant differences in TGI-SR+ scores regarding time since the loss or whether the death occurred before or during the Covid-19 outbreak.

4 | DISCUSSION

This study used CTT and IRT methods to examine the psychometric properties of the TGI-SR+. This study has demonstrated that the

TABLE 4 Internal reliability of TGI-SR+ and derived item combinations and correlations with the other indices of psychopathology

	Correlations			Internal reliabilities		
	PHQ-9 scores	**GAD-7 scores**	**IES-R scores**	**Cronbach's α**	**McDonald's ω**	**GLB**
Total TGI-SR+ scores	0.33	0.41	0.39	0.96	0.97	0.98
TGI-SR+ ADD scores	0.29	0.36	0.35	0.95	0.96	0.96
TGI-SR+ TSD scores	0.32	0.41	0.37	0.91	0.93	0.94
ICD-11-PGD scores	0.32	0.41	0.40	0.93	0.95	0.96
DSM-5-TR PGD scores	0.29	0.36	0.37	0.92	0.95	0.96

Note: All correlation coefficients are statistically significant at $p < .001$.
Abbreviations: ADD, adaptation difficulties; GAD-7, seven-item Generalized Anxiety Disorder Scale; GLB, Greatest Lower Bound; IES-R, Impact of Event Scale-Revised; PHQ-9, nine-item Patient Health Questionnaire; TGI-SR+, Traumatic Grief Inventory-Self Report Plus; TSD = traumatic separation distress.

TGI-SR+ presented strong psychometric characteristics for assessing PGD symptomatology according to the ICD-11 and DSM-5-TR criteria. First, the English TGI-SR+ was translated into French using forward-backward procedure and the draft was pilot-tested in five bereaved people to ensure good comprehensiveness of the items. Following this step, the psychometric properties of the TGI-SR+ was evaluated in a heterogeneous sample of 220 French bereaved people. The results of EFAs have shown that the two-factor model of the TGI-SR+ yielded adequate psychometric characteristics. The estimates of internal and test-rested reliability were excellent, and the concurrent validity was demonstrated, which shows strong evidence for the adequacy of this French PGD measure. One another hand, the results based on the IRT-GCPM provided strong evidence of discriminative characteristics of the items for those high and low in prolonged grief according to the ICD-11 and DSM-5-TR criteria.

Previous validation studies on the TGI-SR resulted in two competing factor models: a one-factor (Boelen et al., 2018; Boelen & Smid, 2017) and two-factor model (Baş et al., 2020). It should be noted that although the two-factor model of the inventory exhibited better fit values in the original studies, the item distribution was not suitable for meaningful interpretation, so the researchers decided to use a single-factor model of the inventory (Boelen et al., 2018; Boelen & Smid, 2017). The present study provided support for a two-factor model of the up-to-date and revised TGI-SR, the TGI-SR+ (including ADD and TSD). The decision of a two-factor model was based on several recommended criteria, including parallel analysis and interpretability. The two-factor model mirrors the Turkish version of TGI-SR validated by Baş et al. (2020), and the item distribution was almost similar. More interestingly, the present study has shown that both sub-dimensions are significantly intercorrelated; however, they were differently associated to loss-related variables. For instance, the bereaved individuals who lost immediate family members were more likely to endorse severe traumatic separation distress than those who lost extended family members. If the two-dimensionality of the TGI-SR+ is confirmed in future studies, we suggest that researchers should consider both sub-dimensions separately in their analyses when all the TGI-SR+ items are used. The TGI-SR+ was designed to offer to researcher and clinicians the choice between ICD-11 PGD and DSM-5-TR criteria for PGD, according to their preference. However, very recently, Lenferink et al. (2022) through receiver operating characteristic curve analysis proposed a cut-off score for diagnosing PGD based on the total TGI-SR+ scores. Considering our findings, this procedure can be biassed in the presence of two latent dimensions on the TGI-SR+. The best procedure is to go with either of the two diagnostic criteria. In the long run, it may be useful to streamline the instrument by omitting extra items to reduce the burden on bereaved participants and minimize risk of missing data and participant attrition.

Regarding the factorial structure of item combinations representing ICD-11 PGD and DSM-5-TR PGD, results have shown that both constructs are unidimensional. These results are consistent with the recent studies using IPGDS (Killikelly et al., 2020), and PG-13-Revised (Prigerson, Boelen, et al., 2021) scales. They are also consistent with the studies testing the dimensionality of both ICD-11 and DSM-5-TR

criteria for PGD (Haneveld et al., 2022; Lenferink et al., 2022). From IRT perspective, we assumed that the assumption of local independence was satisfied; however, it is important to note that items 1 (preoccupation about the deceased), 2 (emotional pain) and 3 (longing or yearning) were slightly local dependent. In psychopathology research, some psychometricians noted that local independence appears to be often violated due to semantic overlap, direct causal effects or reciprocal interactions between putative indicators of a latent variable (Borsboom & Cramer, 2013; Epskamp et al., 2017). For example, it is possible that a bereaved person who is preoccupied that distressing thoughts and images about the deceased will suffer from intense emotional pain and, in turn, yearn for the deceased person. However, the results from IRT analysis showed that all items demonstrated discriminative characteristics. In other words, the proposed PGD items according to the ICD-11 and DSM-5-TR criteria can differentiate bereaved respondents high and low in prolonged grief. This also implies that these items are psychometrically good and do not need further content revision (Baker, 2001).

Furthermore, the TGI-SR+ and item combinations representing DSM-5-TR PGD and ICD-11 PGD have demonstrated very good internal reliability estimates, as determined through the different indices such as the McDonald's ω and GLB. The test-rested reliability coefficients were also high, which reflected the temporal stability of the inventory. We found significant but moderate association between TGI-SR+ and its different item combinations and symptoms of depression, anxiety and posttraumatic stress. These findings provide support to the concurrent validity of the TGI-SR+ and are largely consistent with prior research including factor analytic (Boelen, 2013; Boelen et al., 2010, 2017; Boelen & van den Bout, 2005; Lenferink et al., 2022) and latent class analytic studies demonstrating that PGD overlaps with, though is distinguishable from these neighbouring syndromes (Boelen & Lenferink, 2020; Eisma et al., 2019; Kokou-Kpolou et al., 2021; Lenferink et al., 2017).

The findings of this study should be interpreted in light of its strengths and limitations. Regarding the strengths, this study relied on a medium to large sample size. The subject-to-item ratio of the TGI-SR+ in the (first) EFA was nearly 11:1, which is consistent with the recommendation that there should be at least 10 observations for each independent variable (Osborne & Costello, 2019). Strengths of this study also include that we demonstrated the measurement performance of each item using IRT-GCPM and established the test–retest reliability of the TGI-SR+. In addition, the sample consists of participants with diverse loss-related profiles; this makes results more applicable to generalize to different bereaved populations.

In terms of limitations, the overrepresentation of females in our sample due to the online, non-probabilistic sampling method used reduced the possibility to explore potential gender differences. However, this is often the case in the bereavement research and particularly in previous French studies (Kokou-Kpolou, Jumageldinov, et al., 2020). Moreover, the online recruitment appears to have resulted in a relatively young bereaved sample. The study also relied on a self-report measure endorsement of grief rather than clinical interviews precluding formal assessment of PGD diagnoses. Another

limitation is that the sample size for the test–retest reliability is too small to draw firm conclusion about the stability of the TGI-SR+. Efforts need to be pursed in this direction and, if possible, lead to the verification of the measurement invariance of both ICD-11 PGD and DSM-5-TR PGD criteria over time. Also, we only evaluated limited aspects of validity. Future research could explore the association of TGI-SR+ scores with other measures of grief reactions (to further examine convergent and divergent validity) (Boelen et al., 2017). Finally, our readers should keep in mind that this version of the TGI-SR+ has been developed and validated in France and future validation studies in other French speaking countries, which are underway, are necessary for transcultural comprehensive assessment of reliability and validity of the TGI-SR+.

In conclusion, the present study has demonstrated that the TGI-SR+ possessed strong psychometric properties and is therefore a reliable and valid self-report instrument to comprehensively assess the ICD-11 PGD and DSM-5-TR PGD criteria sets in French bereaved people. The internal and test–retest reliability of the TGI-SR+ were very high, confirming its stability over time to identifying bereaved individuals at risk for developing PGD. The associations between the total score of TGI-SR+ and derived combinations, and indices of psychopathology provided evidence in support of the instrument's concurrent validity.

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CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author (CKK) upon reasonable request.

ORCID

Cyrille Kossigan Kokou-Kpolou https://orcid.org/0000-0003-2335-2132

Lonneke I. M. Lenferink https://orcid.org/0000-0003-1329-6413

Paul Boelen https://orcid.org/0000-0003-4125-4739

Jude Mary Cénat https://orcid.org/0000-0003-3628-6904

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.