Death Studies

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/udst20

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To cite this article: Jacques Cherblanc, Isabelle Côté, Camille Boever & Emmanuelle Zech (01 Nov 2024): Validity of the TGI-SR+ in Francophone populations: Insights from Quebec and Belgium, Death Studies, DOI: 10.1080/07481187.2024.2420882

To link to this article: https://doi.org/10.1080/07481187.2024.2420882

DEATH STUDIES
https://doi.org/10.1080/07481187.2024.2420882

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Validity of the TGI-SR+ in Francophone populations: Insights from Quebec and Belgium

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ABSTRACT

The loss of a significant person can lead to a broad spectrum of responses. While most individuals gradually recover within a year, a minority develop Prolonged Grief Disorder (PGD). The Traumatic Grief Inventory Self-Report Plus (TGI-SR+) was recently developed to ensure that the original scale (TGI-SR) still accurately assesses PGD in line with the latest diagnostic standards of the DSM-5-TR and ICD-11. This study aimed to validate the TGI-SR+ within two French-speaking cohorts: 276 French-Canadian and 469 Belgian participants. Data were collected through an online survey in 2022. Confirmatory factor analysis resulted in a 4-factor model for the TGI-SR+ total scale, but high inter-item correlations favored a 1-factor solution. A 1-factor model was found for the DSM-5-TR and ICD-11 PGD scores. Convergent validity with mental health disorder, depression, and post-traumatic growth, and known-group validity were confirmed. The findings endorse the TGI-SR+ as a valid tool for detecting potential PGD.

The loss of a significant person is a profoundly challenging experience, universally encountered yet uniquely experienced. This loss triggers a multifaceted reaction known as grief, encompassing a broad spectrum of emotional, cognitive, and behavioral responses. Emotionally, grief may manifest as anger, guilt, or longing; cognitively, it can involve denial, intrusive thoughts, or an overwhelming preoccupation with the loss; behaviorally, it may lead to changes such as professional burnout or social withdrawal; and physically, individuals might experience symptoms like loss of appetite or sleep disturbances (Stroebe et al., 2007). Grief can also manifest through positive, healthy, and even growth-oriented thoughts, emotions, and behaviors (Bonanno & Kaltman, 2001).

Grief, as a reaction to loss, is normal and variable in its expression. While most individuals gradually readjust to life within the first year after a loss, a minority develop Prolonged Grief Disorder (PGD) (Eisma et al., 2020; Lenferink et al., 2022; Nielsen et al., 2019; Pociunaite et al., 2023). PGD is characterized by persistent, debilitating grief symptoms, including intense yearning, preoccupation with the deceased, reactive distress, emotional numbness, and disruptions to social and personal identity (Prigerson et al., 2009). PGD exhibits symptomatic similarities with conditions such as depression and post-traumatic stress disorder (PTSD). However, it is recognized as a separate and distinct disorder, leading to its inclusion in recent editions of key psychiatric classifications (Eisma, 2023). Notably, PGD has been incorporated into both the International Classification of Diseases 11th Revision (ICD-11) (World Health Organisation, 2018) and the Diagnostic and Statistical Manual of Mental Disorders Fifth Edition, Text Revision (DSM-5-TR) (American Psychiatric Association, 2022b).

Understanding and effectively addressing PGD's impact on mental and physical health requires precise diagnostic tools (Eisma, 2023). In this regard, the Traumatic Grief Inventory Self-Report (TGI-SR) has represented a significant advancement (Boelen et al., 2019). Developed initially in Dutch contexts, the TGI-SR has demonstrated robust psychometric properties across various cultural settings, including French-speaking contexts (Cherblanc et al., 2023). Its validity has been upheld in different linguistic adaptations, revealing both unidimensional and multidimensional structures, reflecting the complex nature of grief (Baş et al., 2022).

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Supplemental data for this article can be accessed online at https://doi.org/10.1080/07481187.2024.2420882.

The TGI-SR was initially created prior to the official recognition of PGD in the ICD-11 (World Health Organisation, 2019) and before the latest updates to PGD in the DSM-5-TR (American Psychiatric Association, 2022a). Given these developments in the psychiatric field, it became imperative to update the TGI-SR to align with the contemporary understanding and criteria of PGD. Recognizing this need, Lenferink et al. introduced in 2022 an enhanced version of the instrument by integrating four additional items (Lenferink et al., 2022). These new elements were specifically designed to encapsulate the symptomatology of PGD as defined in both the ICD-11 and DSM-5-TR, thereby giving rise to an updated and more comprehensive version of the scale, now known as the Traumatic Grief Inventory Self-Report Plus (TGI-SR+). This adaptation ensures that the scale remains a relevant and effective tool for accurately assessing PGD in line with the latest diagnostic standards. The TGI-SR+ is available in 15 languages, including major world languages such as English, French, Norwegian, Swedish, Mandarin, Portuguese, Turkish, and Spanish.

Research on the Dutch (Lenferink et al., 2022), French (Kokou-Kpolou et al., 2022), and Swedish (Lenferink et al., 2023) versions supported the TGI-SR+'s reliability and validity. But the French version of this questionnaire has only been validated for the population of France, and its validity in other French-speaking cultures has not been proven. In previous research, factor analyses indicated that a one-factor model best fits the PG symptoms, with good internal consistency and temporal stability. Convergent validity was supported through positive correlations with depression and PTSD symptoms, while known-groups validity was demonstrated in the Dutch study by higher symptom scores among certain bereaved groups (e.g., lower education, recent loss, loss of a spouse or child, unnatural causes). In the French study, similar patterns were observed, with higher symptom levels reported among those who lost a first-degree relative or experienced an unnatural loss (Kokou-Kpolou et al., 2022; Lenferink et al., 2022). Overall, these findings affirm the TGI-SR+ as a valid tool for screening PG symptoms per DSM-5-TR and ICD-11, making it useful for research and clinical practice in various linguistic and cultural contexts which is critical given the current limited geographical scope of pathological grief research (Eisma, 2023; Stelzer et al., 2020). However, there remains a gap in its application and validation in diverse cultural contexts, where expressions of grief may vary significantly.

The present study aimed to address this gap by documenting the internal consistency, factor structure, convergent validity, known-group validity, and optimal cutoff scores of the TGI-SR+ within two distinct French-speaking populations in Canada and Belgium. In addition, our study aimed to identify the best item formulations by comparing two slightly different French-language versions of the TGI-SR+. This effort not only contributes to the psychometric evaluation of the tool but also enhances our understanding of PGD across varied cultural contexts.

As recommended by the COSMIN (COnsensus-based Standards for the selection of health Measurement INstruments) guidelines for methodological quality in studying the measurement properties of outcome measures (de Vet et al., 2011; Mokkink et al., 2019), the researchers formulated *a priori* hypotheses based on their expertise, previous validation studies of the TGI-SR+ (Kokou-Kpolou et al., 2022; Lenferink et al., 2022; 2023), and the literature on risk factors and correlates of disordered grief. (H1) A positive correlation >0.4 was expected with the depression subscale of the GHQ-28 (Eisma & Buyukcan-Tetik, 2024; Escobar-Agreda et al., 2023); (H2) A positive correlation >0.7 was expected with the PTGI (Lakshmi et al., 2024); (H3) Participants with low income will have a higher TGI-SR+ score than those with high income (Buur et al., 2024; Corden & Hirst, 2013; Kersting et al., 2011); (H4) Participants who lost a person from a natural cause of death will have a lower TGI-SR+ score than those who lost someone from an unnatural cause (Buur et al., 2024; Djelantik et al., 2020; Eisma et al., 2021); (H5) Participants who lost a spouse or child will have a higher TGI-SR+ score than those who had a different relationship with the deceased (Buur et al., 2024); (H6) A small negative correlation was expected with the number of days since death occurs (correlation between −0.1 and −0.2) (Reynolds & Grühn, 2024). Considering conflicting results regarding gender differences in PGD, we did not expect that there would be a significant difference in the TGI-SR+ scores between men and women (Lundorff et al., 2020) but nevertheless examined whether this would be the case.

Methods

Participants and procedure

The current study is a secondary analysis of data collected from a larger longitudinal study aimed at documenting the effects of the COVID-19 pandemic on grief complications. Participants were differently recruited between the two cohorts. Characteristics of participants from both cohorts are presented in Table

1. *Quebec cohort*—Participants were initially recruited through a webpage, social media (Facebook and Instagram), television and radio interviews. Some participants were also recruited through letters or emails sent to clients of the Quebec Funeral Cooperative Federation (*Fédération des coopératives funéraires du Québec*) who had lost a close one during the pandemic. The inclusion criteria were: (a) being 18 years old and over and (b) having experienced the death of someone since the beginning of the pandemic in March 2020. Participation was voluntary and consent was obtained from all participants. All survey participants were entered in a draw to win one of ten $20 gift cards. Ethics approval for the project (project #2021-697) was awarded by the Research Ethics Committee of the *Université du Québec à Chicoutimi*. Following the initial data collection where participants completed the TGI-SR, we reengaged them for a subsequent survey six months later. This time, those who had previously consented to further contact were invited via email to participate in an online survey featuring the TGI-SR+. Of the original 728 participants who completed the TGI-SR in the first round, a total of 276 complete responses were received from this follow-up survey between November 2021 and January 2022, which were then included into the current study. *Belgium cohort*—Participants were recruited using different strategies. Some of the Belgian participants agreed to participate after being contacted personally by the research team, by letter and then by telephone, having found their contact details in electronic obituaries. Others decided to take part in the study after hearing about it through the media, social networks, information relayed by the associations or the university, or by word-of-mouth. Inclusion criteria were like those in the Quebec study. Participation was also voluntary, and consent was obtained online or by paper from all participants. The Belgian study was approved by the Hospital-Faculty Research Ethics Committee of the *Cliniques Universitaires Saint-Luc – UCLouvain* on 23/12/2021 (project 2021/16NOV/483). The Belgium cohort includes 469 participants who completed the TGI-SR+ during the first phase of data collection, which took place from February to May 2022.

Table 1. Sociodemographic and bereaved-related characteristics of the two study populations.

	Quebec ($n=276$)	Belgium ($n=469$)	*p*-Value
Age of the bereaved	$n=275$	$n=467$	
Mean (SD)	50.2 (13.6)	53.1 (16.1)	.005
[Min–max]	[22–81]	[16–93]	
Gender of the bereaved, *n* (%)	$n=275$		
Men	32 (11.6)[a]	102 (21.7)[b]	<.001
Women	243 (88.4)[a]	364 (77.6)[b]	
Other	0[a]	3 (0.6)[a]	
Income, *n* (%)	$n=273$	$n=463$	
<15,000$ or 13,000€	3 (1.1)[a]	12 (2.6)[a]	<.001
15,000–24,999$ or 13,000–27,000€	16 (5.8)[a]	148 (32.0)[b]	
25,000–49,999$ or 27,000–50,000€	45 (16.3)[a]	182 (39.3)[b]	
50 000–99,999$ or 50,000–100,000€	112 (40.6)[a]	102 (22.0)[b]	
>100,000$ or >100,000€	97 (35.1)[a]	19 (4.1)[b]	
Marital status, *n* (%)			
With partner	191 (69.2)[a]	264 (56.3)[b]	.006
Single	32 (11.6)[a]	86 (18.3)[b]	
Divorced/separated	21 (7.6)[a]	49 (10.4)[a]	
Widowed	32 (11.6)[a]	70 (14.9)[a]	
Age of the deceased		$n=465$	
Mean (SD)	71.6 (19.8)	77.0 (16.0)	<.001
[Min–max]	[0–99]	[8–101]	
Gender of the deceased, *n* (%)		–=467	
Men	134 (48.6)	233 (49.7)	.409
Women	141 (51.1)	234 (49.9)	
Other	1 (0.4)	0	
Days since loss, *n* (%)	$n=270$	$n=393$	
Mean (SD)	449 (127)	439 (225)	.445
[Min–max]	[215–693]	[6–855]	
Deceased person was, *n* (%)			
Child or spouse	46 (16.7)	78 (16.6)	.568
Parent or sibling	167 (60.5)	267 (56.9)	
Other family member	44 (15.9)	94 (20.0)	
Other	19 (6.9)	30 (6.4)	
TGI-SR+ Total scale, mean (SD)	51.8 (17.3)	53.9 (19.3)	.133
DSM-5-TR PGD, mean (SD)	28.2 (9.7)	28.9 (10.5)	.338
ICD-11 PGD, mean (SD)	33.0 (11.0)	34.8 (12.0)	.039

Measures

In addition to sociodemographic characteristics, participants were asked about the deceased characteristics and circumstances of the death, which included the age and gender of the deceased, the date of death, and the relationship they had with the deceased. The number of days since the death occurred was calculated by subtracting the date of survey completion and date of death.

The *Traumatic Grief Inventory-Self Report Plus* (TGI-SR+) (Lenferink et al., 2022) includes four more items, in addition to the 18 items of the TGI-SR (Boelen et al., 2019; Boelen & Smid, 2017). In Canada, the French-Canadian validated version of the TGI-SR was used (Cherblanc et al., 2023), and the four new items were translated following the same process described by Wild et al. (2005). In Belgium, the team opted for a French-translated version of the TGI-SR+, available at https://osf.io/rxmtp. Although this version is titled "French-Canadian version," it has not been validated in

Canada (or Belgium), but France (Kokou-Kpolou et al., 2022). For practical reasons, the Belgian team chose to use this version rather than undertaking a new translation. The wordings in each of the scales are close but vary somewhat (Supplementary Table S1). The 22 items are rated on a 5-point Likert scale with 1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *frequently*, and 5 = *always*, for a total maximum score of 110. As described in Lenferink et al. (2022), a probable case of PGD can be determined using the following scoring rules. A symptom rated "frequently" or "always" was considered as endorsed. Probable cases of DSM-5-TR PGD: at least one item for Criterion B (items 1 and 3), at least three items for Criterion C (items 6, 9, 10, 11, 18, 19, 21; items 2 and 8 capture the same symptom, and thus the highest score of one of these two items is used to represent one criterion C), and the Criterion D (item 13). Liberal diagnostic rules of probable cases of ICD-11 PGD: at least one Criterion B (items 1 and 3), at least one Criterion C (items 2, 5, 8, 9, 10, 16, 20, 21 and 22), and the Criterion D (item 13). Based on previous studies (Boelen & Lenferink, 2020; Lenferink et al., 2022), this scoring rule was too liberal, leading to a higher prevalence rate of PGD and low agreement with the DSM-5 criteria. Thus, the more conservative diagnostic rules of probable cases of ICD-11 PGD were also used: at least one Criterion B (items 1 and 3), at least five Criterion C (items 2, 5, 8, 9, 10, 16, 20, 21 and 22), and the Criterion D (item 13).

In addition to the TGI-SR+, the results of three other scales were used for convergent validity analyses. The *General Health Questionnaire* (Goldberg & Hillier, 1979) 28-item version (GHQ-28) (Sterling, 2011)) is a questionnaire designed to assess mental health-related disorders. The GHQ-28 included four subscales: somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression. For the purposes of the present study, the total score as well as the severe depression subscale were used. The internal consistency of the total scale is excellent in our samples ($\alpha = 0.940$ (Quebec) and 0.933 (Belgium)). The *Posttraumatic Growth Inventory* 21-item version (PTGI) (Tedeschi & Calhoun, 1996) was used to assess the level of post-traumatic growth experienced by participants. The French-Canadian validated version (Cadell et al., 2015) used in this study displayed excellent internal consistency ($\alpha = 0.948$ (Quebec) and 0.943 (Belgium)).

Data analysis

Participant characteristics, death circumstances, and TGI-SR+ scores (total, DSM-5 PGD, and ICD-11 PGD) were compared between both cohorts (Quebec vs. Belgium) using an independent-samples t-test for continuous variables and a chi-square test for independence for categorical variables. Data were analyzed using IBM SPSS Statistics for Windows, version 28.0 (Armonk, NY: IBM Corp) and SAS software (version 9.4).

Internal consistency

Internal consistency was calculated using Cronbach's alpha for the total scale, and the DSM-5-TR PGD and ICD-11 PGD scores. A value between 0.7 and 0.9 is considered as acceptable consistency (de Vet et al., 2011).

Factor structure

The factor structure of the TGI-SR+ was first explored with exploratory factor analysis (EFA) for the Quebec and Belgium cohorts separately using a parallel analysis, which includes a factor analysis and a Principal Component Analysis (PCA). All items were included, without item 13, which is related to functional impairment, as the authors of the original version did (Lenferink et al., 2022). Confirmatory factor analysis (CFA) was thereafter used to examine the factor structure identified in the EFA. A factor loading should be >0.5 (Hair et al., 2010). When one item loaded on more than one factor, it was included in the factor with the highest factor loading. CFA was also used to compare a unidimensional structure and a 2-factor structure for both DSM-5-TR PGD (Factor 1 items: 1, 3; Factor 2 items: 2, 6, 9, 10, 11, 18 19, and 21) and ICD-11 PGD (Factor 1 items: 1, 3; Factor 2 items: 2, 5, 8, 9, 10, 16, 19, 20, 21, and 22). The following cutoff criteria for the fit indexes were used to evaluate the models: the ratio chi-square value/degrees of freedom (χ^2/df; ≤2 or 3) root mean square error of approximation (RMSEA; <0.08), Comparative Fit Index (CFI; ≥0.95), Tucker Lewis Index (TLI; ≥0.95), and standardized root mean square residual (SRMR; ≤0.05) (Schreiber et al., 2006). Internal consistency of each identified factor was determined with Cronbach alpha (must be >0.7), convergent validity of items within one factor with the Average Variance Extracted (AVE; >0.5), and discriminant validity of factors with the Maximum Shared Variance (MSV) and Average Shared Variance (ASV). MSV and ASV must be < AVE to conclude on a good discriminant validity of factors (Hair et al., 2010). Data were analyzed with R version 4.3.2.

Convergent validity

For all validity analyses, the total score of the TGI-SR+ and both DSM-5-TR and ICD-11 PGD scores were

used. The convergent validity of the TGI-SR+ was documented using the Pearson *r* correlation coefficient to assess the association with the GHQ-28 total score, GHQ-28 depression subscale, and PTGI total score.

Known-group validity

The TGI-SR+ mean score was compared between cause of death (natural [any diseases] vs. unnatural [accident, suicide, homicide]), relationship with the deceased (child/spouse vs. others [Parent or sibling; Another family member; Another person]), and income (low [<50 000$ or €] vs. high [≥50 000$ or €]). An independent t-test was used to check the potential gender difference in TGI-SR+ total score. The association with the number of days since the death occurred was assessed using the Pearson *r* correlation coefficient.

Rates of cases and cutoff scores

For these analyses, only participants with a time since death >12 months for the DSM-5-TR PGD and >6 months for the ICD-11 PGD were included. Probable cases were determined using the diagnostic rules defined above and were reported in percentage (number of probable cases/number of participants * 100). ROC curve analyses were used to determine the optimal cutoff score of the TGI-SR+ (total scale, sum of all 22 items) allowing the detection of probable cases of PGD. The area under the curve (AUC) and Youden's Index were reported to determine the accuracy of each cut-score. An AUC ≥0.70 and <0.80 is considered acceptable, ≥0.80 and <0.90 excellent, and ≥0.90 outstanding (Hosmer & Lemeshow, 2000). For the Youden's index, which is calculated as sensitivity—(1 – specificity), a value below 0.7 is poor, between 0.7 and 0.8 is fair, between 0.8 and 0.9 is good, and between 0.9 and 1 is excellent (Ferraris, 2019). The score with the higher Youden's index was considered as the optimal cutoff score.

Results

Characteristics of the sample

All participant characteristics and death circumstances are presented in Table 1. For the Belgium cohort, participants were older, and the man proportion was higher (21.7 vs. 11.6%), and the income and marital status were different than the Quebec cohort. Both cohorts were similar regarding the gender of the deceased and their relationship with the deceased, as well as the number of days since the death had occurred. However, participants from the Belgium cohort lost an older person than those from the Quebec cohort. Both cohorts also obtained similar TGI-SR+ scores for the total scale and the DSM-5-TR PGD score. However, a small but significant difference was observed for the ICD-11 PGD.

Factor structure

Results of the EFA show that for the Quebec cohort, the PCA generated one component, and the FA generated four factors (Supplementary Figure S1A). For the Belgium cohort, the PCA also generated one component while the FA generated three factors (Supplementary Figure S1B). Table 2 displays the factor loadings of items for the two cohorts. For both cohorts, the items #15 and #20 showed low factor loadings (<0.5) in the 1-factor model of the total scale. In the multifactorial models, several items loaded in more than one factor, with some factor loadings being <0.5 (item #1 and #17 (Belgium only), item #4, #14 and #18 (Quebec only), and item #16 (Quebec and Belgium)). The results of the CFAs performed on the unidimensional model, the two multi-factorial models of the TGI-SR+ total scale (4-factor from the Quebec cohort and 3-factor from the Belgium cohort), and the 1-factor and 2-factor models of the DSM-5-TR and ICD-11 PGD scores are presented in Table 3. For the TGI-SR+ total scale, the 4-factor model showed the best fit indexes, with RMSEA <0.08 and SRMR <0.05. The overall fit of the two models for both DSM-5-TR and ICD-11 PGD scores was similar. Therefore, the most parsimonious 1-factor model was selected as the optimal solution for the two scores.

The supplementary analyses performed on the 4-factor model of the TGI-SR+ total scale showed a good internal consistency for the four factors (Cronbach alpha = 0.80 – 0.88) and good convergent validity (AVE: factor 1 = 0.58; factor 2 = 0.58; factor 3 = 0.41; factor 4 = 0.52). However, the model did not show discriminant validity, factors being highly correlated between them, and MSV and ASV were all above the AVE (supplementary Table S2)

Internal consistency

For the Quebec cohort as well as the Belgium cohorts, the Cronbach α values for the items of the TGI-SR+ total scale, DSM-5-TR PGD, and ICD-11 PGD were 0.95, 0.92, and 0.92, respectively. Thus, the internal consistency of the TGI-SR+ French version is thus supported.

Table 2. Factor loadings of the exploratory factor analysis for the TGI-SR+ total scale.

	Quebec					Belgium			
		4-Factor model					3-Factor model		
Item	1-Factor model	Factor 1	Factor 2	Factor 3	Factor 4	1-Factor model	Factor 1	Factor 2	Factor 3
1	0.735	0.663				0.602	0.447		0.450
2	0.745	0.780				0.767	0.677		0.395
3	0.732	0.778				0.638	0.679		
4	0.697		0.492	0.474		0.738	0.473	0.591	
5	0.807	0.515			0.582	0.775	0.709		0.354
6	0.506			0.514		0.521			0.422
7	0.529			0.533		0.541		0.529	
8	0.708				0.624	0.675	0.359		0.629
9	0.795	0.356	0.512	0.520		0.802	0.506	0.615	
10	0.851	0.501	0.399	0.447		0.863	0.666	0.422	0.356
11	0.835	0.432	0.653			0.844	0.689	0.512	
12	0.736	0.448			0.662	0.820	0.668		
14	0.749	0.472			0.437	0.703	0.383		0.629
15	0.448			0.570		0.342		0.454	
16	0.546			<0.350		0.537		0.367	0.432
17	0.525		0.696			0.618	0.488	0.456	
18	0.660		0.488	0.481		0.719	0.398	0.632	
19	0.675	0.400			0.544	0.671	0.628		
20	0.363				0.401	0.411			0.502
21	0.721	0.382	0.613			0.764	0.657	0.401	
22	0.799		0.468	0.530		0.798	0.453	0.618	

Note. Grey highlighted cells represent the highest factor loadings for items that loaded in more than one factor.

Table 3. Results of the confirmatory factor analysis (total Quebec and Belgian samples, $N = 745$).

Models	χ^2/df	RMSEA	CFI	TLI	SRMR
TGI-SR+ 1-factor	7.6	0.094	0.871	0.857	0.055
TGI-SR+ 4-factor	5.4	0.077	0.916	0.903	0.048
TGI-SR+ 3-factor	5.8	0.080	0.907	0.895	0.048
DSM-5-TR PGD 1-factor	4.6	0.106	0.932	0.912	0.045
DSM-5-TR PGD 2-factor	8.6	0.101	0.940	0.921	0.042
ICD-11 PGD 1-factor	9.1	0.104	0.913	0.894	0.048
ICD-11 PGD 2-factor	8.7	0.102	0.918	0.898	0.046

Notes. TGI-SR+: Traumatic Grief Inventory-Self Report Plus; DSM-5-TR: Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision; ICD-11: International Classification of Diseases 11th Revision; PGD: Prolonged grief disorder; RMSEA: root mean square of approximation; CFI: comparative fit index; df: degree of freedom; TLI: Tucker Lewis Index; SRMR: standardized root mean square residual.

Convergent validity

As shown in Table 4, significant associations between the total TGI-SR+, DSM-5-TR PGD, and ICD-11 PGD were found with the level of mental health disorders and depression (as measured with the GHQ-28), and the level of post-traumatic growth (as measured with the PTGI). A priori hypothesis #1 was thus confirmed, since the correlations with the GHQ-28 were >0.4. However, the associations found with the PTGI (<0.4) were lower than expected (H2; >0.7).

Known-group validity

Regarding the difference in the mean TGI-SR+ score between participants with different sociodemographic and death-related characteristics, Table 5 shows that *a priori* hypotheses that relate to the cause of death (H4) and the relationship the bereaved had with deceased (H5) were confirmed in both cohorts, a higher score being observed for participants who lost someone from an unnatural cause (vs. natural cause) and those who lost a spouse or a child (vs. another relationship). The expected difference between low and high income (H3) was confirmed only for the Belgium cohort, the difference observed in the Quebec cohort being not significant. Similarly, the hypothesis #6 regarding the number of days since the death occurred was confirmed only for the Belgium cohort. Finally, for gender, women obtained a higher score than men in the Belgium cohort, which was not the case for the Quebec cohort.

Rates of cases and cutoff scores for probable caseness

Using the diagnostic rule for the DSM-5-TR PGD, the rate of probable caseness was 12.2% for Quebec and 14.9% for Belgium. When using the liberal diagnostic rule for ICD-11 PGD, the rate of caseness was 12.6% for Quebec and 17.4% for Belgium, while these rates were 8.5 and 14.0% when applying the conservative diagnostic rule for ICD-11 PGD.

Data from Quebec and Belgium were combined to determine the optimal cutoff scores of the TGI-SR+

Table 4. Associations between the TGI-SR+ scores and the level of mental health disorders, depression, and post-traumatic growth.

	Total TGI-SR+		DSM-5-TR PGD		ICD-11 PGD	
	Quebec	Belgium	Quebec	Belgium	Quebec	Belgium
Mental health disorder – GHQ-28						
Pearson *r*	0.586	0.631	0.552	0.613	0.567	0.606
p-Value	<.001	<.001	<.001	<.001	<.001	<.001
Depression – GHQ-28 depression subscale						
Pearson *r*	0.521	0.527	0.462	0.492	0.480	0.488
p-Value	<.001	<.001	<.001	<.001	<.001	<.001
Post-traumatic growth – PTGI						
Pearson *r*	0.354	0.276	0.379	0.296	0.356	0.271
p-Value	<.001	<.001	<.001	<.001	<.001	<.001

Notes. DSM-5-TR: diagnostic and statistical manual of mental disorders, fifth edition, text revision; GHQ-28: General Health Questionnaire 28 items; ICD-11: International Classification of Diseases 11th Revision; PGD: prolonged grief disorder; PTGI: Post-Traumatic Growth Inventory; TGI-SR+: Traumatic Grief Inventory-Self Report Plus.

Table 5. Comparisons of the TGI-SR+-derived scores between participants with different sociodemographic and death-related characteristics.

	Total TGI-SR+		DSM-5-TR PGD		ICD-11 PGD	
	Quebec	Belgium	Quebec	Belgium	Quebec	Belgium
Gender of the bereaved						
Men	49.0 (17.0)	44.5 (15.9)	26.4 (9.8)	23.7 (8.9)	31.0 (10.7)	28.7 (10.0)
Women	52.2 (17.5)	56.4 (19.4)	28.4 (9.7)	30.2 (10.5)	33.3 (11.0)	36.4 (11.9)
p-Value	.335	<.001	.280	<.001	.263	<.001
Income						
<50,000$ or €	55.0 (18.4)	56.0 (20.1)	30.1 (10.0)	30.0 (10.9)	34.8 (10.9)	36.0 (12.4)
≥50,000$ or €	50.9 (16.9)	48.2 (15.7)	27.6 (9.5)	25.8 (8.8)	32.5 (10.9)	31.6 (10.2)
p-Value	.105	<.001	.069	<.001	.146	<.001
Cause of death						
Natural	50.9 (17.1)	52.9 (18.9)	27.8 (9.6)	28.5 (10.4)	32.5 (10.8)	34.3 (11.8)
Unnatural	59.9 (19.1)	67.0 (20.3)	32.8 (10.8)	34.7 (10.5)	38.0 (12.6)	41.8 (11.7)
p-Value	.014	<.001	.016	.001	.017	<.001
Relationship with the deceased						
Child/Spouse	60.2 (18.2)	66.1 (20.2)	33.3 (9.6)	35.7 (10.8)	38.1 (11.0)	42.1 (12.0)
Other	50.1 (16.7)	51.5 (18.2)	27.1 (9.4)	27.6 (9.9)	32.0 (10.7)	33.4 (11.4)
p-Value	<.001	<.001	<.001	<.001	<.001	<.001
Number of days since loss						
Pearson *r*	−0.018	−0.146	−0.042	−0.155	−0.036	−0.146
p-Value	.764	.004	.489	.002	.551	.004

Note. Natural: any diseases; Unnatural: accident, suicide, homicide; Others: Parent or sibling, another family member or another person.

(total score, i.e., all 22 items). For all the results of the ROC analyses as well as the results for the Quebec and Belgium cohorts separately, see Supplementary Tables S3–S11. For DSM-5-TR PGD, the optimal cut-off was 64.5 (AUC = 0.952 (95% CI: 0.933 – 0.972; *p*-value <.001)), which correctly identified 97% of PGD cases and incorrectly identified 15% of PGD cases (Youden's index = 0.81). The optimal cutoff to identify ICD-11 PGD using the liberal diagnostic scoring rule was 65.5 (AUC = 0.933 (95% CI: 0.911 – 0.954; *p*-value <.001)), which correctly identified 87% of PGD cases and incorrectly identified 14% of PGD cases (Youden's index = 0.73). Finally, the optimal cutoff score was 67.5 for the ICD-11 PGD using the conservative diagnostic scoring rule (AUC = 0.969 (95% CI: 0.956 – 0.981; *p*-value <.001)), which correctly identified 99% of PGD cases and incorrectly identified 13% of PGD cases (Youden's index = 0.86).

Discussion

Our study showed that the internal consistency for the TGI-SR+ total scale and its subscales related to DSM-5-TR PGD and ICD-11 PGD was robust, evidenced by high Cronbach's alpha values of 0.95 and 0.92, respectively, in both the Quebec and Belgium cohorts. It also confirmed a notable correlation between the TGI-SR+ scores and both DSM-5-TR and ICD-11 criteria for PGD, with significant relationships to mental health problems, including depressive symptoms, as well as to post-traumatic growth, albeit with weaker than anticipated associations for the latter. Our initial hypothesis regarding the association with general mental health, as measured by GHQ-28 scores, is confirmed, with correlations exceeding 0.4. However, the connections with post-traumatic growth measured by the PTGI were not as strong as hypothesized. Further, the data supports the hypotheses that the cause of death and the bereaved's kinship with

the deceased are risk factors of grief intensity, especially for losses due to unnatural causes and the passing of a spouse or child. Overall, the variations in TGI-SR+ scores relative to the cause of death and the bereaved's relationship with the deceased align with existing findings in the scientific literature, as well as with outcomes reported in previous validation studies of the TGI-SR (Kokou-Kpolou et al., 2022; Lenferink et al., 2022).

In examining disturbances in grief responses, our study identified discrepancies between the Quebec and Belgian cohorts. Specifically, economic inequality in grief intensity, observed exclusively in the Belgian sample between lower (<50,000 €) and higher (≥50,000 €) income brackets, could be elucidated by several hypothetical factors. One hypothesis may involve the differential access to bereavement support and mental health resources, which are often more readily available to those with higher income levels (Sareen et al., 2011). Additionally, economic stability may buffer against the stressors associated with loss, allowing for a more resilient coping process (Thomson et al., 2022). Then, financial instability can also make coping with bereavement more complicated, as it constitutes an additional stressor to deal with and can lead to overload for the bereaved (Stroebe & Schut, 2016). Another consideration is the role of cultural differences in the perception and expression of grief, which could influence how individuals in varying economic circumstances experience and report their grief (Hardy-Bougere, 2008). The income distribution differs significantly between the Belgian and Quebec cohorts, with the Quebec cohort having more individuals with higher incomes. Varied recruitment strategies, like using obituaries, may explain these differences. These income variations could influence the grief intensity disparities observed. Further research is needed to understand these economic disparities in grief within the two contexts.

With regard to the hypothesis concerning the number of days since the death occurred, it is confirmed solely within the Belgian cohort. The difference in the survey completion history between the cohorts might be influential. Since the Quebec participants had previously completed the questionnaire six months earlier, this prior exposure could have influenced their responses in ways not mirrored in the Belgian cohort, where this survey was their first completion.

Finally, within the Belgian cohort, gender differences were evident, with female participants reporting higher grief scores, a contrast to the uniform responses observed across genders in the Quebec cohort. We first assumed no difference between men and women based on the study of Lundorff et al. (2020) who showed that men experience more acute grief reactions which decrease with time, while women's grief reactions are delayed and increase with time. As the mean time since loss was more than one year for both cohorts, we hypothesized that this difference should have diminished. Also, one might hypothesize that the observed gender differences in grief responses could be attributed to varying gender proportions in the two cohorts. However, this appears to be an unlikely explanation, as the gender distribution in the Belgian cohort (25% male, 75% female) aligns with that reported in Lenferink et al. (2022), where no significant gender-based differences were observed. It is important to note, though, that Lenferink et al. (2022)'s sample, despite having a similar gender ratio, comprised two separate groups: one primarily consisting of naturally bereaved individuals and the other composed of individuals bereaved specifically due to traffic accidents. This specificity makes direct comparison with our findings challenging, as the nature of the loss and its potential traumatic impact might influence grief responses differently across genders. From a gender perspective, the recruitment method utilized may offer an explanatory avenue for our findings. In Belgium, we observed that individuals recruited through obituary notices exhibited less intense grief reactions compared to those recruited via other strategies (Zech et al., 2023). Notably, there is a significant gender disparity in the recruitment methods. Specifically, 55% of the male participants (as opposed to 23% of females) in the Belgian sample were recruited through obituary notices. This disparity could partially account for the more pronounced gender differences observed in the Belgian cohort in contrast to the Quebec cohort, where such recruitment strategy variations were not present. Additionally, the more stringent social restrictions imposed in Quebec during the COVID-19 pandemic may have exerted a uniform impact on both genders, potentially mitigating the conventional tendency of men to avoidance or sublimate grieving emotions through work or activity (Hess et al., 2000; Spaten et al., 2011; Stelzer et al., 2019).

The factor analysis of the TGI-SR+ revealed differences between the two cohorts, with the four-factor model fitting the Quebec cohort better. However, high inter-item correlations suggest that the factors may be measuring similar constructs. This observation aligns with the original design of the TGI-SR+, which was intended to be used with a total score, anticipating such correlations. Consequently, a one-factor

model might be more appropriate, as the four factors are not meaningfully distinguishable. This suggestion is further supported by the findings for DSM-5-TR and ICD-11 PGD scores, where a one-factor model aligns with previous studies (Kokou-Kpolou et al., 2022; Lenferink et al., 2022, 2023). These studies also found that a single-factor structure could adequately capture the complexity of prolonged grief symptoms, reinforcing the notion that the TGI-SR+ may function more effectively as a unidimensional measure rather than a multidimensional one. This approach simplifies the interpretation and application of the TGI-SR+, ensuring its utility across diverse populations while maintaining robust psychometric properties (Kokou-Kpolou et al., 2022; Lenferink et al., 2022, 2023). In both cohorts, the same two items (#15 – I experienced difficulty with positive reminiscing about the lost person and #20 – I put an intense blame on others because of his/her death) had factor loadings below the 0.5 threshold in the 1-factor model. Based on that results, we cannot determine which French formulation is superior, as both items appear to be less associated with the construct assessed by the TGI-SR+ scale compared to the other

Our study has some limitations to consider. The Quebec sample completed the questionnaire twice, unlike the Belgian sample. The repetition of a questionnaire can introduce several biases that threaten the scientific integrity of a study, such as familiarity effect (the participants become accustomed to the questions), fatigue effect (the participants grow tired or disengaged due to the repetitive nature of the questionnaire), and memory effect (participants answer based on their recollection of previous responses rather than their current views) (Creswell & Creswell, 2018). To mitigate these, we implemented an interval of more than six months between questionnaire administrations to minimize test-retest effects and participant fatigue (Creswell & Creswell, 2018). A second limitation is the lack of a gold standard to determine the cutoff score of the TGI-SR+. It would have been more robust to determine PGD caseness using an external gold standard such as a clinical interview. However, we used the same method as Lenferink et al. (2022), allowing comparison with the original Dutch version of the scale.

In conclusion, this study suggests that the current translation of the TGI-SR+ is a useful and valid scale for measuring grief disturbances and identifying potential PGD according to the DSM-5-TR and ICD-11 criteria, with determined cutoff scores. However, the formulation of three items might require refinement to clarify their relevance to the previously proposed factors. The version of the TGI-SR+ scale developed by the Canadian team for this study appears to possess the best overall psychometric qualities and should be favored for future use.

Acknowledgments

The authors would like to thank all research collaborators who took part in the different parts of the global project and all participants who completed the LimeSurvey questionnaire.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported in part by [grant RN454290 – 463697] from the Canadian Institutes of Health Research.

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