



Short Communication

Preliminary validation of the IMQ-5: A brief intrusive memory questionnaire for PTSD

Lucas D. Baker, Jason T. Goodson*

Department of Mental Health Service, George E. Wahlen VA Medical Center, Salt Lake City, Utah, United States



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ABSTRACT

Intrusive memories and the associated clinical features (e.g., sense of nowness, sense of danger, fears of losing control) serve as hallmarks in the development and maintenance of PTSD and are a central focus in the treatment of the disorder. Despite their importance, no existing measure assesses for the relevant clinical features alongside intrusions. To address this gap, we aimed to develop and evaluate a brief intrusive memory questionnaire for clinical and research applications. A sample of treatment-seeking veterans ($N = 185$) were administered an item pool of intrusion questions together with measures of PTSD (PCL-5) and depression (PHQ-9). Intrusion items were subjected to tests of relative importance, which identified five items we termed the IMQ-5 (Intrusive Memory Questionnaire-5) that comprised a single factor, CFI (0.99), TLI (0.97), RMSEA (0.07, 90% CI [0.00, 0.14]), SRMR (0.03). The IMQ-5 evidenced greater convergent validity with the PCL-5 ($r = .69$) than the PHQ-9 ($r = .51$), and demonstrated an ability to distinguish probable PTSD from subthreshold symptoms ($AUC = 0.83$, 95% CI [0.74-0.93]). Implications of the findings and suggestions for future research are discussed.

Introduction

Intrusive memories of traumatic events are hallmark symptoms of posttraumatic stress disorder (PTSD; Michael et al., 2005). Intrusive memories are brief sensory fragments of traumatic memories, with the vast majority being visual images (Brewin et al., 2010; Ehlers et al., 2002). Due to the nature of traumatic memories (e.g., disjointed, decontextualized, poorly elaborated), intrusions have low triggering thresholds and are activated by a wide range of stimuli (Brewin, 2001; Ehlers et al., 2004), especially those temporally or physically related to stimuli present during the traumatic event (Ehlers & Clark, 2000). Notably, Ehlers and colleagues (2002) found that the majority of intrusive images represent stimuli present immediately before the worst part of the traumatic event, leading to speculation that intrusions represent a warning signal, designed to serve a protective function.

Clinical features associated with intrusion persistence and PTSD

Although intrusive memories are a hallmark of PTSD, they also frequently occur in individuals who experience a traumatic stressor without developing PTSD (Ehlers, 2010). This suggests that intrusions are necessary, but not sufficient, for PTSD development. Consequently,

researchers have sought to identify clinical factors that influence the persistence of intrusions and their contributions to PTSD. While not without inconsistencies, several clinical factors have often been found to be associated with intrusion persistence and PTSD. These factors include distress related to intrusions (Hackmann et al., 2004), a sense of nowness (Brewin et al., 2010; Ehlers et al., 2004), perceived threat or danger (Marks et al., 2018), fears of losing control of one's mind or going crazy (Steil & Ehlers, 2000), low self-efficacy (Brown et al., 2012), rumination (Arendt et al., 2021; Kubota et al., 2015), and dysfunctional coping strategies such as suppression and avoidance of trauma memories (Lavy & van den Hout, 1994; Steil & Ehlers, 2000), which can be conceptualized as safety behaviors given their function to reduce or prevent distress associated with intrusions (Goodson & Haefel, 2018, 2022).

Intrusive memories and treatment

Intrusive memories are central to the evidence-based treatment of PTSD. Essentially all effective psychological interventions (Prolonged Exposure, Cognitive Processing Therapy, Eye Movement Desensitization and Reprocessing, Cognitive Therapy, and Written Exposure; Bryant, 2019) place a significant emphasis on "processing" intrusive memories

* Corresponding author at: Department of Mental Health Service, PTSD Clinical Team, George E. Wahlen VA Medical Center, Salt Lake City, Utah, United States.
E-mail address: jason.goodson@va.gov (J.T. Goodson).

(e.g., organizing the trauma memory, creating a chronological narrative, reducing the negative emotional impact of intrusions). While various strategies have proven effective toward this end, such as imaginal exposure, written exposure, and visualizing trauma images, they typically strive to achieve the following aims: reduce the frequency and distress of intrusions, foster more helpful appraisals, enhance self-efficacy, and decrease the use of unhelpful safety behaviors related to trauma memories (Ehlers & Clark, 2000; Goodson & Haeffel, 2022; Oman & Bormann, 2015; Hackmann et al., 2004).

Rationale and aims for the current study

Given the central nature of intrusions in the development, maintenance, and treatment of PTSD, it is surprising that so few, if any, psychometric measures exist to assess intrusions and their related clinical features. Such a measure could provide rich clinical information to help guide treatment interventions. In addition, a brief measure of intrusions could help assist clinicians to identify when trauma processing is sufficient, especially if used for measurement-based care purposes. Along these lines, we generated a pool of self-report items, aiming to develop the Intrusive Memory Questionnaire (IMQ) suitable for both clinical and research applications. Specifically, the aims of the current study are twofold: 1) to describe the IMQ and present preliminary evidence for the psychometric properties of a brief version, and 2) to identify a clinical cutoff score for the brief version to use in the assessment of traumatic memory processing during PTSD treatment.

Method

Development of IMQ item pool

An initial pool of items was developed to assess for intrusive memories and associated clinical features in PTSD. The first round of items was generated based on the corresponding author's clinical and research experience with PTSD and a review of the literature on intrusive memories. The items were then reviewed by five PTSD experts who provided comments. Incorporating this feedback, 13 items were finalized that cover the following clinical features: frequency of intrusive traumatic memories (i.e., triggered and out-of-the-blue); immediacy and fears related to intrusions (i.e., sense of nowness, sense of danger, fears of loss of control/losing one's mind); safety behaviors related to intrusions (i.e., keeping the mind occupied, avoiding thinking about the memory); perceived self-efficacy related to intrusions (i.e., lacking confidence in the ability to cope with intrusions); distress and disruption related to intrusions (i.e., difficulty staying focused, worrying about intrusions, role-interference, and still feeling bothered by the memory); and rumination related to intrusive memories (i.e., repetitive analytical thinking about causes and consequences of intrusions). Table 1 displays all 13 IMQ items and the clinical feature they are designed to assess.

Participants and procedures

Participants were 185 veterans (86.0% male) between the ages of 22 and 87 with a mean age of 44.6 ($SD = 13.50$) who sought trauma-focused psychotherapy services at a Veterans Affairs Medical Center. The sample was predominantly White (85.8.0%), followed by 5.3% Black, 5.3% Hispanic, and 3.6% identifying as another race. The breakdown according to diagnosis was as follows: PTSD (59.8%), Other Trauma/Stressor Disorder (19.5%), non-Trauma/Stressor Disorder diagnosis (17.7%), and no DSM-5 diagnosis (3.0%). Participants were administered the PTSD Checklist-5 (Blevins et al., 2015), Patient Health Questionnaire-9 (Kroenke et al., 2001), and the pool of intrusion items (developed for the present study) during psychotherapy intake procedures at the medical center. All procedures were approved by the local Institutional Review Board.

Table 1
Intrusive Memory Questionnaire items

Intrusion Item	Clinical Characteristic
1. The memory intrudes out-of-the blue	Frequency
2. The memory has been triggered by reminders	Frequency
3. I kept my mind occupied to prevent the memory from intruding	Safety Behavior
4. When the memory intrudes, it feels like the event is happening now	Immediacy and Fear
5. I have been unable to stay focused on tasks because of the memory intruding	Distress and Disruption
6. When the memory intrudes, I feel a sense of threat or as if I am in danger	Immediacy and Fear
7. I purposefully tried to avoid thinking about the memory	Safety Behavior
8. I have been worried about the memory intruding	Distress and Disruption
9. When the memory intrudes, I worry I may be losing control of my mind	Immediacy and Fear
10. The memory still bothers me	Distress and Disruption
11. When the memory intrudes, I lacked confidence in my ability to handle it	Self-efficacy
12. The memory interferes with my life and/or relationships with others (e.g., interrupts concentration at work or school; causes difficulties communicating with significant others; causes distress, depression, or anxiety; causes me to isolate or withdraw; makes it difficult to relate to my family)	Distress and Disruption
13. I spent a lot of time thinking about the consequences of the event, or why the event happened, or how the event changed my life, or what could have done differently	Rumination

Note. This table presents the initial pool of IMQ items used in the study to assess their frequency and impact. Respondents rated each item on a four-point scale ranging from 0 (none or not at all) to 3 (daily or severely) to indicate the extent to which they experienced or were bothered by these events. These items were then subjected to item reduction methods to develop the Intrusive Memory Questionnaire-5 (IMQ-5).

Measures

Preliminary intrusive memory questionnaire (IMQ)

A total of 13 items were used in the current study to assess the frequency and intensity of intrusion-related events experienced over the past week. Items are scored on a four-point Likert-type scale ranging from 0 (none or not at all) to 3 (daily or severely), with higher scores indicating higher frequency and severity of intrusion-related symptoms. Using item reduction techniques outlined in the 'Analytic Approach' section below, we identified and retained the top five most effective items, which were then used to form a brief instrument called the Intrusive Memory Questionnaire-5 (IMQ-5). Psychometric properties of the IMQ-5 are reported in the 'Results' section below.

PTSD checklist-5 (PCL-5)

The PCL-5 (Blevins et al., 2015) is a 20-item measure that assesses symptoms across four PTSD clusters (intrusions, avoidance, negative alterations in cognition and/or mood, and hyperarousal). Respondents rate how bothered they have been by each symptom in the past month using a five-point Likert-type scale ranging from 0 (not at all) to 4 (extremely), with total scores ranging from 0 to 80. The PCL-5 demonstrated good internal consistency for the total score ($\alpha = .92$) and four subscales ($\alpha = .75 - .87$).

Patient health questionnaire-9 (PHQ-9)

The PHQ-9 (Kroenke et al., 2001) is a 9-item measure designed to assess symptoms of Major Depressive Disorder experienced in the past two weeks, including feelings of sadness or hopelessness, loss of interest in activities, and difficulty sleeping. Items are rated on a four-point Likert-type scale from 0 (not at all) to 3 (nearly every day), with total scores ranging from 0 to 27. The PHQ-9 demonstrated good internal consistency in the current sample ($\alpha = .95$).

Analytic approach

The analytic approach involved several steps using R (Version 4.2.2). First, use of the Lindeman, Merenda, and Gold's metric (LMG) approach from the *relaimpo* package (Grömping, 2007) was employed to determine each item's contribution in the model, regressing PCL-5 on each intrusive memory item from the IMQ pool. Results were bootstrapped using 1,000 iterations, and the relative importance of each item was ranked on a Relative Importance (RI) scale from 0 to 1.00, which represents the average R^2 value for each item over all model iterations.

Next, the top five IMQ items with the highest RI were selected to develop a brief measure of intrusion-related experiences, termed the IMQ-5. Confirmatory Factor Analysis (CFA) was conducted on the IMQ-5 to evaluate factor structure. Model parameters were estimated using the Maximum Likelihood (ML) estimator, with variance of the model fixed to 1.00. Model fit was assessed using the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR).

Then convergent and discriminant validity were examined by computing Pearson correlation coefficients between IMQ-5, PCL-5, and PHQ-9. Convergent validity was evaluated primarily from the correlation between IMQ-5 and PCL-5 intrusions subscale, while discriminant validity was assessed from the correlation between IMQ-5 and PHQ-9.

Finally, IMQ-5 was evaluated using Receiver Operating Characteristic (ROC) analysis to test the ability of IMQ-5 to distinguish probable PTSD from subthreshold symptoms. An optimal IMQ-5 cut-off score was determined by the maximum metric function and the area under the ROC curve (AUC) was calculated as a measure of discriminatory power. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated at the optimal cut-off score.

Results

Relative importance analysis

The relative importance analysis indicated that Item 9 accounted for the highest proportion of unique PCL variance (RI = 0.15, 95% CI [0.08-0.22]), followed by Item 11 (RI = 0.13, 95% CI [0.07-0.21]), Item 5 (RI = 0.13, 95% CI [0.07-0.19]), Item 2 (RI = 0.11, 95% CI [0.05-0.18]), and Item 12 (RI = 0.10, 95% CI [0.05-0.17]). The remaining intrusive memory items had RI values ranging from 0.02 to 0.08. An aggregate score of all 13 IMQ items accounted for 51.39% of PCL-5 variance, while the total score of the IMQ-5 identified through the LMG procedure (items 9, 11, 5, 2, and 12) accounted for 52.29% of PCL-5 variance.

Confirmatory factor analysis

The single-factor model of the IMQ-5 demonstrated an adequate fit. Both the CFI (0.99) and TLI (0.97) exceeded the recommended threshold of 0.95 (Kline, 2015). The RMSEA (0.07, 90% CI [0.00, 0.14]) and SRMR (0.03) were below the acceptable threshold of 0.08 (Kline, 2015). All factor loadings were statistically significant ($p < 0.001$), indicating a single factor fit the data well.

Convergent and discriminant validity

All correlations between IMQ-5, PCL-5, and PHQ-9 were significant at the $p < .001$ level. The IMQ-5 demonstrated convergent validity with the PCL-5 total score and intrusions subscale, showing significant and strong positive correlations ($r_s = .69$ and $.63$, respectively). Additionally, the IMQ-5 showed moderate to strong positive correlations with the avoidance ($r = 0.49$), negative changes ($r = 0.58$), and hyperarousal ($r = 0.57$) subscales. Discriminate validity was suggested with a significant but somewhat smaller correlations with the PHQ-9 ($r = .51$).

Receiver operating characteristic analysis

The ROC analysis results indicated the IMQ-5 demonstrated good discriminatory power to differentiate between probable PTSD and sub-threshold symptoms (AUC = 0.83, 95% CI [0.74-0.93]). The maximum metric function identified an optimal cut-off score of 5, yielding a sensitivity of 0.92 and specificity of 0.68. The PPV of the IMQ-5 at this cut-off was 0.95, indicating that 95% of individuals with a score of 5 or higher were probable for PTSD, while the NPV was 0.57. These results suggest that the IMQ-5 holds promise as a clinically meaningful measure of PTSD-related intrusions.

Discussion

Intrusive memories are a hallmark of both the development and maintenance of PTSD, and they play a significant role in the treatment of the disorder (Bryant, 2019; Michael et al., 2005). However, to our knowledge, no measure exists to assess intrusions alongside related clinical features. As such, the purpose of the current study was to describe and validate a measure of intrusion-related experiences. We aimed to provide preliminary validation for the measure and to identify a clinical cutoff to aid in trauma processing decisions (e.g., when trauma processing is sufficient) during PTSD treatment. Results of the current study largely supported our aims. The IMQ-5 (brief 5-item measure derived in the current study) was (a) found to be psychometrically sound and (b) differentiated probable PTSD from subthreshold symptoms well.

The results of the current study provide preliminary evidence for the validity and utility of the IMQ-5. The relative importance analysis identified five items (items 9, 11, 5, 2, and 12 from the IMQ item pool) accounting for 52.29% of PCL-5 variance, which demonstrated a single-factor structure with adequate fit indices. The IMQ-5 exhibited convergent validity, showing strong positive correlations with the PCL-5 total score and intrusion subscale, and was suggestive of discriminant validity with a smaller correlation with the PHQ-9. The IMQ-5 also demonstrated moderate to strong positive correlations with other PTSD symptom subscales. Furthermore, the ROC analysis indicated good discriminatory power for the IMQ-5 to differentiate between probable PTSD and subthreshold symptoms using an optimal cut-off score of 5. Overall, these findings suggest that the IMQ-5 holds promise as a clinically meaningful measure of PTSD-related intrusions.

Among all 13 items from the IMQ item pool, the best-performing indicator was item 9, which pertains to the fear of losing control of one's mind. This finding is consistent with several previous studies that have identified this fear as being strongly associated with PTSD, as well as intrusion persistence, and as a differentiating factor between individuals with PTSD and those who have experienced trauma without developing PTSD (Michael et al., 2005; Steil & Ehlers, 2000). When this particular issue is present, it should be regularly explored and addressed during treatment. Other items of the IMQ-5 included not being able to focus, interference, low self-efficacy, and triggered frequency. The majority of these items have been found to be associated with intrusion symptomology and PTSD, with perhaps the exception of the concentration/focus item. It may be that inability to focus in response to intrusions maps onto item 9 (fear of losing control/going crazy), when an important cognitive process is impaired. Interestingly, triggered frequency performed better than out-of-the-blue intrusion frequency. This is somewhat surprising as out-of-the-blue intrusions would seemingly be more distressing as they would likely be associated with a lack of control and predictability. It could be that triggered intrusions not only brings distress, but also contributes to future avoidance of the triggering stimuli. This would be particularly distressing if triggers were part of normal functioning prior to trauma (e.g., going to shopping centers, talking with friends). Low self-efficacy is not unexpected, as the connection between self-efficacy and PTSD is well established (Brown et al., 2012). With respect to interference, it seems intuitive that higher levels of interference would cause more distress and/or would be

associated with more severe PTSD.

Notably, the items that consistently performed the worst were the safety behavior items (i.e., keep mind occupied, avoid thinking about the memory). This is somewhat surprising as these are common safety behaviors in PTSD and are thought to maintain intrusions by preventing the processing of the trauma memory. However, these items differed from the others in that they were volitional responses to intrusive memories. One theory for their poor performance was that this was not a treatment sample and safety behavior items may become more relevant when used in a treatment study.

Though the current study provides promising preliminary evidence for the validity and utility of the IMQ-5 in assessing intrusive memories and related features, several limitations should be considered for use and future research. First, the sample consisted of treatment-seeking veterans, which may limit the generalizability of the findings to other populations with PTSD, such as civilians or individuals with different trauma backgrounds (e.g., first responders). Additionally, the cross-sectional design of the study precludes any conclusions about the predictive validity or sensitivity to change of the IMQ-5 over time, which are important considerations for its use in treatment studies and clinical

Appendix

Intrusive Memory Questionnaire-5 (IMQ-5)

Intrusive memories, also known as intrusions, are unwanted and distressing memories or images of traumatic events that pop into our minds or can be triggered. These intrusions can cause significant distress and negative feelings, and are different from nightmares because they occur when you are awake.

Please rate how bothered by, or how often, each of the following have occurred **over the past week**. While you may have experienced more than one trauma, your responses to the questions below should be related to the one traumatic event that bothers you the most.

	None OR Not at all	A small number of times OR A little	Several Times OR Quite a bit	Daily OR Severely
	0	1	2	3
1. The memory has been triggered by reminders	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. I have been unable to stay focused on tasks because of the memory intruding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. When the memory intrudes, I worry I may be losing control of my mind	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. When the memory intrudes, I lacked confidence in my ability to handle it	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. The memory interferes with my life and/or relationships with others (e.g., interrupts concentration at work or school; causes difficulties communicating with significant others; causes distress, depression, or anxiety; causes me to isolate or withdraw; makes it difficult to relate to my family)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Scoring instructions

To calculate the IMQ-5 score, sum the responses for each item. Each item is rated on a scale from 0 to 3, with 0 indicating "None or Not at all" and 3 indicating "Daily or Severely". Total scores can range from 0 to 15.

Clinically significant intrusions are indicated by a total score of 5 or greater. If the total score is 5 or higher, it suggests a presence of intrusive memory symptoms associated with probable post-traumatic stress disorder (PTSD).

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practice. Finally, the relatively poorer performance of the safety behavior items from the 13-item IMQ pool warrants further investigation to determine whether the wording of the items, the nature of the sample, or other factors contributed to this finding. Future research should address these limitations by validating the IMQ-5 in more diverse samples, employing longitudinal designs to assess its predictive validity and sensitivity to change, and exploring alternative methods of assessing safety behaviors and other relevant factors in the context of PTSD-related intrusions.

In conclusion, promising preliminary results of this study indicate that the IMQ-5 is a reliable and valid instrument for assessing intrusive memories in individuals with PTSD. Future research should focus on validating the IMQ-5 in larger and more diverse samples, as well as in treatment studies, to further establish its utility as a clinically meaningful measure of PTSD-related intrusions.

Declaration of Competing Interest

None.

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