In Press, *Memory*

The Trauma Memory Quality Questionnaire: preliminary development and validation of a measure of trauma memory characteristics for children and adolescents

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Abstract

It has been suggested that post-traumatic stress is related to the nature of an individual's trauma memories. While this hypothesis has received support in adults, few studies have examined this in children and adolescents. This article describes the development and validation of a measure of the nature of children's trauma memories, the Trauma Memory Quality Questionnaire (TMQQ), that might test this hypothesis and be of clinical use. The measure was standardised in two samples, a cross-sectional sample of non-clinic referred secondary school pupils (n=254), and a sample participating in a prospective study of children and adolescents who had attended a hospital Accident & Emergency department following an assault or a road traffic accident (n=106). The TMQQ was found to possess good internal consistency, criterion validity, and construct validity, but test-retest reliability has yet to be established.

Introduction

Cognitive theories of posttraumatic stress disorder (Ehlers & Clark, 2000; Brewin, Dalgleish, & Joseph, 1996) propose that the phenomenological quality of an individual's autobiographical memories of a traumatic event play a significant role in whether or not they go on to develop the disorder. For example, Ehlers and Clark (2000) have argued that the characteristic reexperiencing symptoms of PTSD (e.g. nightmares, intrusive images, flashbacks, and so on; American Psychiatric Association, 1994) are attributable to the memories of a traumatic event: i) being poorly elaborated and inadequately integrated into the autobiographical memory database; and, ii) containing strong stimulus-stimulus and stimulus-response links that facilitate the elicitation of emotional responses redolent of those experienced at the time of the trauma (see also Foa, Steketee, & Rothbaum, 1989).

Brewin and colleagues (Brewin et al., 1996; Brewin, 2001) have taken a slightly different line in attributing importance to neuroscientific data indicating that memory for emotional events may be represented across separable brain regions. In line with this, they have drawn a distinction between situationally accessible memories (SAMs) and verbally accessible memories (VAMs). SAMs encode different sensory, physiological, and motor aspects of the traumatic experience that, when elicited, lead to the characteristic re-experiencing symptoms of PTSD noted above. Crucially, it is proposed SAM information is not readily accessible to conscious editing and amendment. In contrast, VAMs are representations of the narrative aspects of the trauma. VAMs, it is argued, can be readily interrogated via introspection and drive the conscious discourse about the traumatic experience. The emphasis placed by these two models on the role played by the phenomenological quality of autobiographical memories following trauma has

received support from recent studies in adult trauma-exposed samples. Halligan, Michael, Clark, and Ehlers (2003) found that the presence of more disorganized and more perceptual memories predicted PTSD symptoms in a prospective study of adults who had been assaulted. In a subsequent analysis of this same dataset, Michael, Ehlers, Halligan, and Clark (2005) found that intrusive memory *characteristics* were a better predictor of later PTSD symptoms than the simple presence of intrusive memories. Convergent data come from a study examining the written narratives of adults with PTSD (Hellawell & Brewin, 2004) where participants noted which sections of their scripts were written while experiencing a flashback, and which sections were written during 'normal' autobiographical memory recall. Flashback periods of the narratives were found to comprise more perceptual detail, to make more use of the present tense, and to contain more mentions of death, fear, helplessness, and horror, while non-flashback sections of the narratives made greater mention of secondary emotions such as guilt and anger. Analysis of the narratives given by women engaged in exposure therapy for PTSD following sexual assault showed that trauma narratives comprised less description of actions and dialogue and more thoughts and feelings (in particular attempts to organize the narrative) as treatment proceeded (Foa, Molnar, & Cashman, 1995).

Despite this intriguing initial research in adults, very little research has examined the phenomenology of trauma memories in children and adolescents and the relationship to PTSD. Studies of sexually abused children (Burgess, Hartman, & Baker, 1995) and of young children involved in an earthquake (Azarian, Lipsitt, Miller, & Skriptchenko-Gregorian, 1999) have suggested that there is some variability in the phenomenology of children's memories of trauma (with both verbal and non-verbal memories being reported). However, neither study has sought to examine

whether memory quality is related to frequency of PTSD symptoms. Indeed, to our knowledge only one study (Stallard, 2003) has examined this issue. Stallard found that the presence of incomplete memories of the trauma did not differentiate between children with or without PTSD. However, the problems regarding the interpretation of null findings combined with an absence of well-validated measures of memory quality in this study suggest that these data cannot rule out the possibility that memory quality is significantly involved in the aetiology of child PTSD.

The present study therefore details the preliminary evaluation of a novel measure of trauma memory quality (the Trauma Memory Quality Questionnaire; TMQQ) suitable for use with children and adolescents, and in the process examines its relationship to PTSD and PTSD symptomatology. As well as allowing examination of cognitive theory in PTSD, it was anticipated that such a measure would be of clinical use in identifying which aspects of a child's memories merit therapeutic attention. The ability to measure session-by-session changes in the quality of a child's memories of a traumatic event would be helpful in assessing whether the memory-focused element of a psychological treatment (e.g. trauma-focused cognitive-behaviour therapy) was effective.

The initial development of the TMQQ utilised two child and adolescent samples. The first comprised a non-clinical sample recruited from secondary schools, while the second comprised youth exposed to assaults or road traffic accidents who had attended a hospital Accident and Emergency (A&E) department. In addition to completing the TMQQ, participants in each sample completed a self-report measure of PTSD symptoms, while children and adolescents in the A&E sample also completed a structured interview assessing for Acute Stress Disorder (ASD) and PTSD. We predicted that scores on our memory questionnaire corresponding to more

sensory-based and poorly verbalized memories would be related to greater PTSD symptoms. Furthermore, we predicted that greater scores on our measure would be correlated with stronger emotion experienced at the time of the trauma or frightening event.

Method

Participants

Participants were drawn from two sources. Sample 1 comprised children and adolescents recruited from two secondary schools in England, who were taking part in a study examining different aspects of children's responses to the most frightening event they had recently experienced. Of 433 children invited to participate in the study, 254 (58.7%) agreed. The sample had 146 (57.5%) females, and had an age range of 11-18 years (mean = 14.5, standard deviation = 2.2). Participants in this sample reported experiencing a wide range of frightening events, including road traffic accidents, the illness or injury of a close friend or family member, bereavement, being attacked or pursued by a stranger, bullying, among others.

Sample 2 comprised children and adolescents who participated in a study of PTSD in youth, who had attended an Accident and Emergency department in London following an assault or road traffic accident. Of 343 consecutive attendees at the department, 106 (30.9%) consented to participate in the study at a 2-4 week assessment. The sample had 39 (36.8%) females, with an age range of 11-16 years (mean 14.0, standard deviation = 1.9). Sixty (56.6%) participants had been involved in an assault, while 46 (43.4%) participants had been involved in a Road Traffic Accident. Only 50 (47.2%) completed a questionnaire battery at three months post-trauma, and only 68 (64.1%) participants completed an assessment at six months post-trauma.

Measures

Revised Impact of Event Scale, child version. The child version of the Revised Impact of Event Scale (RIES-C) is an amended form of an adult measure of post-traumatic stress symptoms (Horowitz, Wilner, & Alvarez, 1979). It comprises 13 items and has a three factor structure (pertaining to re-experiencing, avoidance, and hyperarousal symptoms). Children can respond either "Not at all", "Rarely", "Sometimes", or "Often" to each item, scored 0, 1, 3 and 5 respectively. The RIES-C has good reliability (Smith, Perrin, Dyregrov, & Yule, 2003).

Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions. ASD and PTSD diagnosis was assessed using a structured clinical interview, the Anxiety Disorders Interview Schedule for DSM-IV: Child and Parent Versions (ADIS-C; Silverman & Albano, 1996). The ADIS-C is a structured interview schedule designed for the assessment of anxiety disorders in children and adolescents, where diagnoses are derived from both child and parent reports. The ADIS-C has excellent test-retest reliability (Silverman, Saavedra, & Pina, 2001). The relative maturity of the sample of children and adolescents who participated in the study meant that parent reports were not considered in deriving diagnoses. We added some questions assessing dissociation into the ADIS-C at the first assessment so that a diagnosis of ASD could be made.

Trauma Memory Quality Questionnaire. When first designing this study, no existing multi-item measures of trauma memory quality were available, for adults or children. In devising the Trauma Memory Quality Questionnaire (TMQQ) we created a pool of 14 items that could be easily comprehended by children and easily used in the clinic (i.e. it should not be excessively long). Participants were asked to complete the measure in relation to their memories of the pertinent frightening experience. Face

validity for these items was established by following the descriptions of the types of trauma memory that were associated with PTSD given by Ehlers and Clark (2000) and Brewin et al. (1996). The items referred to visual quality, a variety of non-visual sensory qualities (e.g. auditory, olfactory, proprioceptive sensations), temporal context, and the extent to which the memory was in a verbally accessible format. As much as possible these items were designed to reflect the quality of the memories for a traumatic event, rather than the frequency of such memories. The items did not refer to how trauma memories were elicited, a feature of the PTSD that both Brewin and colleagues and Ehlers and Clark consider. This was because trauma memory cues may relate in part to other aspects of a child's response to a trauma (e.g. the use of avoidant coping strategies) rather than the quality of the memories themselves, and possible difficulties that children may have in remembering when such memories were elicited. Rather, the items focused on qualities of the memories as they are experienced or differences between such memories and more "normal", non-trauma-related memories. A list of these items is presented in Table 1. Participants could respond to each item by indicating "Disagree a lot", "Disagree a bit", "Agree a bit", or "Agree a lot", scored 1, 2, 3 or 4 respectively. Some items were reverse scored so that higher scores represented the sorts of memories hypothesised to be associated with greater post-traumatic stress.

Fear. A single item was used to index how scared participants were at the time of the event experienced. This allowed us to investigate whether greater peri-traumatic emotion would be associated with more sensory-based memories, as suggested by cognitive theorists (Brewin et al., 1996; Ehlers & Clark, 2000). Due to other concerns when assessing each sample, slightly different Likert scales were used to rate the participants' fear; in sample 1, a 0-10 scale was provided, while for sample

2 only four responses were available ("Disagree a lot", "Disagree a bit", "Agree a bit", or "Agree a lot", rated 1-4 respectively).

Procedure

Permission to conduct each individual study was granted by the Research Ethics Committee of the lead author's home institution. In addition to the consent of the individual child or adolescent, the opt-in consent of the child's parent or guardian was also required. In sample 1, however, this requirement was amended such that only opt-out consent (i.e. parents had to return a form if they did *not* want their child to participate) was required in order to make it more convenient for children and adolescents to take part.

Participants in sample 1 completed a battery of self-report questionnaires in relation to the most frightening event they had experienced in the preceding two months (more detailed findings from this study will be presented elsewhere). The lead author was present in the classroom during the completion of the questionnaires, in addition to a teacher. Participants in sample 2 were assessed at 2-4 weeks, 3 months, and 6 months post-trauma. The lead author met with participants, most often in their homes, and conducted a structured interview assessing for ASD (at 2-4 weeks) or PTSD (at 6 months) as well as other emotional disorders. Participants then completed a self-report questionnaire pertaining to the event they had experienced. Participants only completed a self-report questionnaire at the 3-month assessment. The TMQQ and the fear item were only completed at the 2-4 week assessment, while the RIES-C was completed at each assessment. In the event that a participant continued to have PTSD at the 6-month assessment, they were offered referred treatment at the Maudsley hospital Child Traumatic Stress Clinic.

Data analysis

As the measure comprised relatively few items from the outset, we opted to use principal components analysis and Cronbach's alpha coefficients to remove redundant items, and then evaluate the measure's internal consistency. Criterion validity was assessed in sample 2 by comparing TMQQ scores for participants with and without ASD/PTSD using a t-test, while construct validity was assessed in each sample by calculating correlations with scores on the RIES-C and a single item measure of fear experienced at the time of the event.

Results and Discussion

Item reduction and internal consistency

Preliminary principal components analyses were performed in order to identify redundant items. In both samples 1 and 2 it appeared that three items (2, 12 and 14) were not loading consistently with other items. However, a clear component structure was not identifiable across the two samples. It was therefore decided to retain a single-factor structure and consider the properties of the individual items and their contribution to the overall measure.

Cronbach's alpha coefficients for the measure if the item was removed and item-total correlations for the 14-item measure are displayed in Table 1. These data suggested that item 12 was a poor contributor to the overall measure in the sample 1 data, while items 2 and 12 appeared to contribute least to the overall measure in the sample 2 data. Table 2 displays the correlations between the individual items and RIES-C scores for each sample. Items 2 and 12 showed the weakest association with PTSD symptoms as assessed by the RIES-C in both sample 1 and sample 2 (at the initial assessment point). Items 2 and 12 were therefore dropped from the measure, as was item 14 which together with its poor contribution to the principal component analyses only demonstrated weak item-total correlations and detracted from internal

consistency (i.e. the Cronbach's alpha coefficient would improve if this item was removed).

Cronbach's alpha was used to assess the internal consistency for the 11-item TMQQ (see the Appendix for the final version of the measure). For sample 1 this coefficient was .76, while for sample 2 it was .82. These values suggest that the measure possesses satisfactory internal consistency (Cohen, 1960).

Criterion Validity

T-tests were used to examine criterion validity for the TMQQ in sample 2. Eighty-three participants completed the ASD assessment and the TMQQ at 2-4 weeks post-trauma, of whom 17 (20.5%) had a diagnosis of ASD. Participants with ASD (M=32.00, SD = 5.61) scored significantly higher on the TMQQ than participants without ASD (M = 23.29, SD = 6.99; $t[81]=4.75$, $p<.0001$). Of the 55 participants who completed both the TMQQ at 2-4 weeks post-trauma and the 6-month PTSD interview, 8 (14.5%) were found to have a diagnosis of PTSD. Participants with PTSD (M=30.19, SD=9.64) were found to score significantly higher on the TMQQ than participants without PTSD (M=24.18, SD=7.26; $t[53]=2.06$, $p<.05$). While the numbers for the PTSD analysis were quite small, the data for ASD suggest that this measure does possess criterion validity.

Construct validity

In Table 3 correlations between the TMQQ and the RIES-C (and its sub-scales) and trauma-related fear are presented. The TMQQ was significantly and positively correlated with post-traumatic stress symptoms (as assessed by the RIES-C) and the fear items in each sample. This supports the suggestion that the TMQQ possesses construct validity, i.e. the measure was related to PTSD symptomatology and peri-traumatic fear as proposed by cognitive models of PTSD.

Does the TMQQ account for unique variance in post-traumatic stress symptoms over and above that of the reexperiencing symptoms?

One criticism of this measure might be that it is simply assessing the reexperiencing symptoms of ASD/PTSD, as indicated by the strong correlations between the RIES-C intrusion sub-scale and the TMQQ. We assessed this possibility by investigating whether the TMQQ would account for any unique variance in post-traumatic stress as assessed by the RIES-C total score, over and above that of the reexperiencing sub-scale of the RIES-C. We chose this method as it is the most conservative; in other words, we were examining whether the TMQQ accounted for unique variance in a dependent variable over and above a sub-scale of that same dependent variable

In sample 1, both the TMQQ ($\beta = .15$, $t = 3.49$, $p<.002$) and the reexperiencing sub-scale of the RIES-C ($\beta = .76$, $t = 17.78$, $p<.0001$) did indeed account for unique variance in a linear regression model of the RIES-C total score, producing a significant model ($F = 303.93$, $df = 2, 221$, $p<.0001$) that accounted for 73% of variance in the dependent measure. The TMQQ accounted for 1.4% of the total variance that was not associated with the RIES-C intrusion sub-scale. Similarly, the RIES-C intrusion sub-scale accounted for 38.1% of the variance that was not associated with the TMQQ. In sample 2, both the TMQQ ($\beta = .25$, $t = 3.19$, $p<.003$) and the reexperiencing sub-scale ($\beta = .69$, $t = 8.92$, $p<.0001$) again accounted for unique variance in a linear regression model of concurrent RIES-C total scores, producing a significant model ($F = 166.65$, $df = 2, 83$, $p<.0001$) that accounted for 80% of variance in the dependent measure. The TMQQ accounted for 2.4% of the variance not associated with the RIES-C intrusion sub-scale, and the RIES-C intrusion sub-scale accounted for 19.1% of the variance not associated with the TMQQ. As an

even more thorough test of whether the TMQQ was measuring the quality of trauma memories, rather than just the frequency of such memories, we examined whether the TMQQ explained any unique variance in 6-month RIES-C scores, over and above 2-4 week scores on the RIES-C intrusion sub-scale. The TMQQ failed to account for any unique variance over and above the 2-4 week RIES-C intrusion sub-scale when the 6-month RIES-C total score was used as the dependent variable in a regression model (where R^2 for the overall model was .37, while RIES-C intrusion accounted for 8.2% of unique variance, and the TMQQ accounted for 1.4% of unique variance in the overall model). As a result of the poor response rate at the 3-month assessment point, there was not enough data to perform a similar analysis with RIES-C scores at this assessment as the dependent variable.

Aside from the non-significant model for RIES-C at 6 months (which may be the result of low power), these data suggest that the TMQQ is not simply an index of reexperiencing symptoms, in that along with the considerable shared variance with the RIES-C intrusion sub-scale, it also accounts for unique variance in RIES-C total scores. Furthermore, additional data from sample 1 (Meiser-Stedman, Dalgleish, Yule, & Smith, 2005) has indicated that memory quality accounts for variance in PTSD symptoms over and above intrusive memory frequency, suggesting that this measure is indexing memory *quality* rather than memory *frequency*.

Limitations

While the TMQQ was validated in moderately large samples, sample 1 comprised many non-trauma exposed children. An additional limitation of this measure is the lack of data concerning test-retest reliability. Further work on this measure is necessary to replicate the relationship with PTSD in other trauma-exposed youth samples, including younger children (i.e. under 10 years). Clearly there would

be developmental constraints on which children would be able to complete this measure. This investigation was preliminary, focusing on 10-18 year olds who would have passed most major cognitive developmental milestones. Younger children may lack the capacity to reflect on the nature of such memories.

Conclusions

To our knowledge the measure presented here is the only measure currently available to assess the quality of trauma memories in children and adolescents. We have preliminarily evaluated a brief measure that is comprehensible for children and possesses good face validity, internal consistency, criterion validity, and construct validity. Regression models were used to suggest that the TMQQ is not simply a measure of reexperiencing symptoms.

Our main hypothesis, that responses on our measure reflecting more sensory-based memories would be associated with greater post-traumatic stress, was supported. This suggests that a principal element of recent cognitive models of PTSD in adults, i.e. that the nature of the memories laid down for a trauma are linked to the onset of PTSD symptoms (Brewin et al., 1996; Ehlers & Clark, 2000), can be applied to children and adolescents. An additional hypothesis (that TMQQ scores would be associated with greater peri-traumatic emotion) was also supported, suggesting that fear at the time of a trauma is at least partly responsible for giving rise to these sorts of memories. Given these findings, and despite the limitations noted above, the TMQQ has promise as an index of trauma memory quality that may be used to track clinical improvement, and investigate mechanisms involved in the development of PTSD in children and adolescents.

Acknowledgements

The study was undertaken while RMS was supported by a research studentship awarded by the MRC. RMS is currently supported by a Peggy Pollak Fellowship, awarded by the Psychiatry Research Trust.

We would like to express our gratitude to all the young people who participated in these studies. We are grateful to Jen Rolfe and to two reviewers for their comments on earlier versions of this manuscript.

Table 1. Item-total correlations and Cronbach's Alpha if item removed for the Trauma Memory Quality Questionnaire

Item	Sample 1 (n=225)		Sample 2 (n=83)	
	Item-total correlation	Cronbach's alpha if removed	Item-total correlation	Cronbach's alpha if removed
1. My memories of the frightening event are mostly pictures or images.	.406	.694	.619	.684
2. When I think about the frightening event it is just like thinking about anything else that has happened to me. (Reverse scored)	.219	.716	-.131	.767
3. I can't seem to put the frightening event into words.	.311	.705	.448	.706
4. When I have memories of what happened I sometimes hear things in my head that I heard during the frightening event.	.481	.682	.550	.691
5. When I remember the frightening event I feel like it is happening right now.	.508	.681	.655	.684
6. When I think about the frightening event I can sometimes smell things that I smelt when the frightening event happened.	.269	.709	.374	.715

7. I can talk about what happened very easily. (Reverse scored)	.305	.706	.312	.721
8. I remember the frightening event as a few moments, and each moment is a picture in my mind.	.427	.691	.540	.694
9. My memories of the frightening event are like a film that plays over and over.	.562	.673	.710	.674
10. My memories of the frightening event are very clear and detailed.	.280	.708	.021	.752
11. Remembering what happened during the frightening event is just like looking at photographs of it in my mind.	.416	.692	.395	.711
12. I can remember the order in which things happened during the frightening event. (Reverse scored)	-.128	.752	-.214	.776
13. When memories come to mind of what happened, I feel my body is in the same position as when the frightening event occurred.	.316	.704	.523	.696
14. My memories of the frightening event feel like memories of other things that have happened to me that aren't very scary. (Reverse scored)	.265	.711	.186	.734

Table 2. Correlations between TMQQ items and RIES-C

	Sample 1 (n=225)				Sample 2 (2-4 week assessment; n=83)			
TMQQ item	RIES-C total	RIES-C intrusion	RIES-C avoidance	RIES-C arousal	RIES-C total	RIES-C intrusion	RIES-C avoidance	RIES-C arousal
1.	0.21**	0.27***	0.15*	0.10	0.58***	0.58***	0.38***	0.55***
2.	0.13*	0.15*	0.10	0.08	-0.01	-0.06	0.07	-0.05
3.	0.27***	0.26***	0.18**	0.25***	0.53***	0.48***	0.46***	0.53***
4.	0.40***	0.44***	0.27***	0.30***	0.52***	0.54***	0.36***	0.49***
5.	0.51***	0.47***	0.40***	0.41***	0.66***	0.57***	0.55***	0.61***
6.	0.22***	0.19**	0.12	0.24***	0.33**	0.31**	0.20	0.32**
7.	0.29***	0.23	0.28***	0.18**	0.44***	0.38***	0.47***	0.32***
8.	0.31***	0.32***	0.25***	0.24***	0.53***	0.56***	0.36***	0.46***
9.	0.44***	0.47***	0.29***	0.37***	0.64***	0.64***	0.51***	0.59***
10.	0.22***	0.24***	0.15*	0.17*	0.13	0.16	0.02	0.10
11.	0.26***	0.25***	0.18**	0.22***	0.42***	0.50***	0.31**	0.32**

12	0.02	-0.02	0.05	0.00	-0.06	-0.11	0.04	-0.05
13.	0.36***	0.31***	0.24***	0.36***	0.51***	0.54***	0.35**	0.42***
14.	0.28***	0.20**	0.25***	0.23***	0.18	0.23*	0.22	0.10

* = p<.05, ** = p<.01, *** = p<.001

Table 3. Correlations of the TMQQ with RIES-C sub-scales and event-related fear

Sample	Variable	Correlation with TMQQ
Sample 1	Fear rating	.41*** (n=233)
	RIES-C – total score	.59*** (n=224)
	RIES-C – intrusion	.58*** (n=225)
	RIES-C – avoidance	.43*** (n=225)
	RIES-C – arousal	.48*** (n=221)
Sample 2: 2-4 week measures	Fear rating	.37*** (n=86)
	RIES-C – total score	.78*** (n=88)
	RIES-C – intrusion	.77*** (n=88)
	RIES-C – avoidance	.59*** (n=88)
	RIES-C – arousal	.69*** (n=84)
Sample 2: 3-month measures	RIES-C – total score	.50** (n=43)
	RIES-C – intrusion	.51*** (n=41)
	RIES-C – avoidance	.41** (n=43)
	RIES-C – arousal	.52*** (n=41)
Sample 2: 6-month measures	RIES-C – total score	.54*** (n=57)
	RIES-C – intrusion	.50*** (n=57)
	RIES-C – avoidance	.42** (n=57)
	RIES-C – arousal	.54*** (n=57)

Note. RIES-C = Revised Impact of Event Scale, child version; TMQQ = Trauma Memory Quality Questionnaire.

** = $p<.01$, *** = $p<.001$

Appendix – The Trauma Memory Quality Questionnaire (TMQQ)

	Item
1.	My memories of the frightening event are mostly pictures or images.
2.	I can't seem to put the frightening event into words.
3.	When I have memories of what happened I sometimes hear things in my head that I heard during the frightening event.
4.	When I remember the frightening event I feel like it is happening right now.
5.	When I think about the frightening event I can sometimes smell things that I smelt when the frightening event happened.
6.	I can talk about what happened very easily. (Reverse scored)
7.	I remember the frightening event as a few moments, and each moment is a picture in my mind.
8.	My memories of the frightening event are like a film that plays over and over.
9.	My memories of the frightening event are very clear and detailed.
10.	Remembering what happened during the frightening event is just like looking at photographs of it in my mind.
11.	When memories come to mind of what happened, I feel my body is in the same position as when the frightening event occurred.

Participants could respond to each item by indicating "Disagree a lot", "Disagree a bit", "Agree a bit", or "Agree a lot", scored 1, 2, 3 or 4 respectively.

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