The Modulating Effect of Geographical Proximity of Permanent Residence to Tsunami-Affected Regions on Posttraumatic Symptoms

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Abstract

Analysis of posttraumatic stress symptoms (hyperarousal, intrusion and avoidance) was undertaken in adult people-helpers exposed to the immediate aftermath of the 2004 Asian tsunami. At three weeks and six months post-tsunami people-helpers living in one of two geographically distinct locations, one affected by the tsunami and one relatively protected from the tsunami, completed a Sri Lankan version of The Impact of Events Scale Revised (IES-R-SL). Results revealed that there was a main effect of geographical location of permanent residence on posttraumatic stress symptoms at both three weeks and six months post-tsunami. IES-R-SL subscales identified that subjects who permanently reside in the tsunami-affected location had significantly higher hyperarousal and avoidance scores at both time points. Intrusion scores were significantly higher in subjects living in the tsunami-affected location at six months only. The modulating role of the environment in the development and maintenance of posttraumatic symptoms is discussed within an ecological framework of trauma.

1. Introduction

Following a traumatic event in which threat to life has either been experienced or witnessed, posttraumatic symptoms of hyperarousal, intrusion and avoidance are common. In the majority of individuals these symptoms gradually diminish over the weeks following the traumatic event and the individual returns to their general pre-trauma emotional, psychological and physiological state (Carr, Lewin, Webster & Kenardy, 1997; Blanchard et al., 1996; Shalev, 2002). For reasons not yet fully understood these symptoms do not diminish in some trauma survivors and they go on to develop a debilitating psychobiological disorder known as posttraumatic stress disorder (PTSD).

Contemporary theories of PTSD explain the ongoing presence of these symptoms in some trauma survivors in terms of varying combinations of individual trauma-related emotional cognitive or information processing problems (e.g., Foa & Rothbaum 1998; Foa, Huppert, & Cahill, 2006; Ehlers & Clark 2000; Brewin, Dagleish & Joseph 1996; Dagleish, 2004). A problem with these trauma-centric and person-centric accounts of PTSD is that they fail to incorporate the growing body of research that suggests that post-trauma environmental variables also contribute to the development and maintenance of posttraumatic symptoms. For example, lack of post-trauma social support, (Ozer, Best, Lipsey & Weiss, 2003; Brewin Andrews & Valentine, 2000), ongoing societal stressors such as poverty, discrimination (gender, race, class), poor social location (Kubiak, 2005), forced migration (Steel, Frommer, & Silove, 2004) and additional life stressors such as loss of job, serious illness, death or illness of close friends/family or broken relationships (Brewin, Andrews & Valentine, 2000; Maes, Mylle, Delmeire & Janca, 2001; Mayou, Ehlers & Bryant, 2002) have all been identified as risk factors for PTSD. A study by King, King, Gudanowski and Vreven (1995) also identified that the associated physical environment impacts the development and maintenance of posttraumatic symptoms. They reported that out of four war stressor experiences: traditional combat, atrocities-abusive violence, malevolent environment (i.e. discomforts and deprivations in day to day life) and perceived threat, that a malevolent environment was the most potent factor in developing PTSD in both men and women.

In addition to the above post-trauma stressors, a small number of studies have found a significant effect of geographical proximity of current residence to disaster sites on posttraumatic

symptoms. Blanchard et al. (2004) identified that geographical proximity of residence to New York City following the 2001 September 11th attacks on the World Trade Centre was a predictor of higher levels of acute stress disorder (ASD), ASD symptoms, PTSD and PTSD symptoms. Based on permanent home address, they found greater levels of posttraumatic symptoms in students from Albany, New York, 150 miles away from the World Trade Centre site, compared to students in Augusta, 800 miles away from the World Trade Centre site who in turn had greater levels of symptoms than students in Fargo, 1500 miles away from the World Trade Centre site. A follow up study a year later with comparable student populations confirmed that posttraumatic stress symptoms remained higher in populations whose permanent home address was closer in proximity to the World Trade Centre site (Blanchard, Rowell, Kuhn, Rogers, & Wittrock, 2005). An earlier study by Fairbrother, Stuber, Galea, Fleischman & Pfefferbaum (2003), with children from New York City similarly found that proximity to the World Trade Centre site predicted greater posttraumatic symptoms. Thus it would seem that living in geographical proximity to where the traumatic event originally occurred modulates ongoing posttraumatic stress symptoms.

The aim of this study is to explore further the role of geographical proximity to the site of a traumatic event on the development and maintenance of posttraumatic symptoms. This aim is achieved by comparing avoidance, intrusion and hyperarousal symptoms in Sri Lankan adults from two different geographical locations at three weeks and six months after the 2004 Asian tsunami. Both populations consisted of individuals who had not directly lost property or immediate family in the tsunami but had been exposed to the immediate aftermath of the tsunami through various people-helping roles. The traumatic event for these people was exposure to the tangled destruction of human life, nature and property left by a forty-foot wall of water. The groups were differentiated on the basis of current permanent residence; one group resided on the east coast of Sri Lanka in Batticaloa and the other group resided in Colombo, situated on the opposite coastline of Sri Lanka to where the tsunami struck. Portions of Batticaloa had experienced loss of life and property from the tsunami, whereas Colombo had been relatively protected, impacted by higher tides only. Based on the studies outlined above it was predicted that adults who lived in Batticaloa, which was closer in proximity to where the tsunami had struck, would exhibit higher posttraumatic symptoms of intrusion, hyperarousal and avoidance than adults who lived in Colombo post-tsunami.

2. Method

2.1 Participants

Participants were drawn from two geographically distinct locations in Sri Lanka: Batticaloa and Colombo. Participants had all been exposed to the immediate aftermath of the tsunami through various people-helping roles. All participants were adults and roughly comprised of an equal mix of educated males and females. Due to cultural and political factors it was agreed that data such as age, gender and language would not be collected to maximise a sense of complete anonymity. Precise demographics for the participants are therefore not available.

2.2 Materials

2.2.1 Sri Lankan version of the Impact of Events Scale-Revised (IES-R-SL)

The Impact of Events Scale-Revised is a measure of posttraumatic stress symptoms (hyperarousal, intrusion and avoidance) adapted by Weis and Marmar (1997) from the original Impact of Events Scale (Horowitz, Wilner & Alvarez, 1979). Following the tsunami the scale was translated into the local Sri Lankan dialect of Sinhala and Tamil. Factor analysis of the Sri Lankan version revealed equivalent factorial structure to the original English IES-R (see Dawson, Ariadurai, Fernando & Refuge, 2007). The scale is a 22-item self-report measure of current subjective distress relating to a specific traumatic event, in this case the tsunami. Each item asks for a subjective rating on a 5-point Likert scale (0 = not at all; 1 = a little bit; 2 = moderately; 3 = quite a bit; 4 = extremely). The scale measures posttraumatic symptom clusters of avoidance, hyperarousal and intrusion and is scored by computing the mean of non-missing items for each subscale and total (Weiss & Marmar, 1997). Cut-off scores above 1.5 (raw score of 33/34) for the total scale have been shown to be a reliable marker for the detection of PTSD (see Creamer, Bell, & Failla, 2003; Huang, Zhang & Xiang, 2006).

2.3 Procedure

Adults attending a brief trauma management workshop for individuals involved in helping roles in the immediate aftermath of the tsunami were given the option of completing the IES-R-SL. Instructions on how to fill out the IES-R-SL and procedures to follow should they become distressed were given to all participants by the principal researcher. The IES-R-SL was then completed and returned anonymously to a central collection point. Six months after the initial

data collection, Sri Lankan colleagues mailed the IES-R-SL to all participants to complete for a follow-up measure. The returned IES-R-SL forms were then mailed to Australia for analysis.

2.4 Analysis

All statistical analyses were carried out using SPSS version 12 for Windows. The IES-R-SL was scored according to the procedure outlined by Weiss & Marmar (1997). Analysis of variance was conducted to determine if there were any differences in IES-R-SL scores between the two locations. Due to the dropout rate at the six-month follow-up and the inability to match subjects across the two time points, separate analyses were conducted for the initial data and follow-up data.

3. Results

At three weeks post-tsunami, 157 Colombo subjects and 145 Batticaloa subjects completed the IES-R-SL. Of the 302 IES-R-SL mailed out to these subjects at six months post-tsunami, 154 were returned. Two-thirds of those returned were Colombo subjects (n = 105) and one-third were Batticaloa subjects (n = 54).

In the absence of clinical assessments, cut-off scores (i.e. mean scores above 1.5) can only be taken as an indication of PTSD and only if assessed one month after the traumatic event. Therefore, percentages reported above the recommended cut-off for PTSD are taken as an indication of potential PTSD only. Of the 157 participants who resided in Colombo at three weeks post-tsunami 45.4 % had mean total scores above the recommended cut-off (1.5) for PTSD. At six months post-tsunami, of the 105 Colombo participants an identical percentage (45.4 %) had scores above the recommended cut off.

Of the 145 participants who resided in Batticaloa at three weeks post-tsunami 71.7 % had scores above the recommended cut off (1.5) for a probable diagnosis of PTSD. At six months post-tsunami of the 54 Batticaloa participants a similar percentage of participants (72.9 %) had scores above the recommended cut off for PTSD. Sample means and standard deviations for the mean total score and mean subscale IES-R-SL scores are presented in Table 1.

Table 1. Mean scores and standard deviations for the IES-R-SL at 3 weeks and 6 months post-tsunami

	Colombo				**Batticaloa**			
	3wks (*n* = 157)		**6mths (*n* = 105)**		**3wks (*n* = 145)**		**6mths (*n* = 54)**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
IES-R-SL Total	1.57	.65	1.43	.78	1.91	.68	2.0	.70
Hyperarousal	1.44	.83	1.14	.93	1.77	.80	1.85	.99
Intrusion	1.86	.81	1.57	.95	2.02	.83	2.10	1.02
Avoidance	1.36	.73	1.51	.88	1.91	.74	2.02	.78

3.1 Analysis of Variance Results

Three weeks post-tsunami

The ANOVA revealed a significant main effect of location [Wilks' Lambda = .868, F(3,298) = 15.05, $p < .0001$]. There was a significant difference between Batticaloa and Colombo in the hyperarousal [F(1,300) = 12.302, $P = \leq 0.001$] and avoidance [F(1,300) = 41.508, $P = < 0.0001$] subscales. There was no significant difference in the intrusion subscale between the two locations [F(1,300) = 2.805, $P = 0.095$].

Six months post-tsunami

The ANOVA revealed a significant main effect of location [Wilks' Lambda = .865, F(1,157) = 8.051, $p < .0001$]. There was a significant difference between Batticaloa and Colombo in all three subscales. Hyperarousal = [F(1,300) = 19.654, $P = < 0.0001$]. Avoidance = [F(1,157) = 12.902, $P = < 0.0001$]. Intrusion = [F(1,157) = 10.141, $P < 0.01$].

4. Discussion

Results revealed that at three weeks post-tsunami intrusion scores were not significantly different between the two subject groups. Hyperarousal and avoidance scores were significantly different at three weeks post-tsunami with the Batticaloa group exhibiting higher avoidance and hyperarousal scores than the Colombo group. At six months post-tsunami the Batticaloa group

had significantly higher hyperarousal, intrusion and avoidance scores than the Colombo group. Results also revealed that even though there was a high drop out rate at six months post-tsunami, near identical percentages of participants in Batticaloa (71.7 and 72.9) and identical percentages of participants in Colombo (45.4) had cut-off scores above the recommended cut-off for PTSD (above 1.5) as at three weeks post-tsunami.

The similarity in intrusion scores between the two groups at three weeks post-tsunami suggests that residential proximity to tsunami-affected regions does not have an impact on intrusion scores initially. This is consistent with the assertions of Rothbaum and Foa (1993) who report that trauma survivors, almost universally, experience intrusive recall in the immediate aftermath of a trauma. However residential proximity to tsunami-affected regions does appear to play a role in modulating levels of posttraumatic avoidance and hyperarousal symptoms initially and all three symptom clusters as time goes on.

A recent study offers explanation for how residential proximity to tsunami-affected regions may modulate posttraumatic symptoms. Dawson (2007) tested whether posttraumatic symptoms of intrusion, hyperarousal and avoidance are modulated by variables analogous to those that modulate animal preparatory antipredator responses of apprehension, vigilance and avoidance (see Kavaliers & Choleris, 2001 for animal preparatory antipredator responses). The results revealed that similar to animals, current perceived risk of life-threat, individual exposure to life-threat, individual resources to negotiate life-threat and access to environmental refuge from life-threat also modulate posttraumatic avoidance, hyperarousal and intrusion symptoms in humans.

Within this framework, although the subjects from both groups had similar exposure to the aftermath of the tsunami and it was assumed that they had similar levels of individual resources to negotiate the traumatic aftermath of the tsunami (e.g., all educated people-helpers), the Batticaloa group also had to negotiate living in close proximity to where the tsunami had struck. Living in the local environment in which the tsunami struck is likely to contribute to a higher level of perceived risk and a lower level of perceived refuge than living further away. The higher levels of avoidance and hyperarousal symptoms in the Batticaloa group at both time points and intrusion symptoms at six months post-tsunami are explained by a higher current risk (e.g., 'the tsunami struck here before so may again') and a lower availability of refuge in this group compared to the Colombo group. It would be particularly difficult for Batticaloa residents to

imagine access to a safe refuge if a tsunami did strike again, as a safe refuge was virtually non-existent for those unfortunate enough to be within the tsunami strike zone.

Fear conditioning studies with rats also offers explanation for why Batticaloa residents reported significantly higher avoidance and hyperarousal symptoms at both time points and intrusion symptoms at six months post-tsunami than the Colombo group. Morris, Furlong and Westbrook (2005) demonstrated that recent fear to a dangerous context completely reinstated a learned fear response to a conditioned stimulus such as a tone. This effect suggests that an environment experienced as dangerous can retrieve a cue associated with a previous traumatic experience. Morris et al. (2005:54) states, "Thus, it is possible that the fear elicited by exposure to the dangerous context serves two functions. First, it acted as a retrieval cue that favoured activation by the extinguished CS [cue] of the conditioning memory. Second, it increased adrenergic activity that promoted the consolidation of the conditioning memory, and thereby rendered that memory more salient than the extinction memory at the final test". A geographical region considered to be dangerous because of a recent natural disaster may therefore have the potential to reinstate fear-related posttraumatic avoidance, hyperarousal and intrusion responses to trauma-related cues and consolidate trauma memories.

Additionally, verbal communication with residents of Sri Lanka indicated that at six months post-tsunami, many residents of Batticaloa were still living in tents in internally displaced people camps (IDP camps) and rubble was still part of the landscape. These physical trauma reminders that formed part of the current environment may also have contributed to the higher levels of posttraumatic symptoms in the Batticaloa group at six months post-tsunami. Animal studies have demonstrated that situational reminders following a single aversive experience can cause long-term fear-related behavioural and HPA alterations (see Louvart, Maccari, Ducrocq, Thomas & Darnaudéry, 2005; Louvart et al., 2006). Thus a debilitating cycle may eventuate in environments where there are situational reminders of the earlier trauma. Situational reminders may maintain the perception of a dangerous environment. The perception of a dangerous environment then has the ability to retrieve and consolidate specific trauma memories, which in turn maintains the perception of a dangerous environment, that in turn facilitates retrieval and consolidation of trauma memories and so on.

This possibility, that the environment and trauma cues may interrelate to maintain or mitigate posttraumatic symptoms, supports concerns raised by various researchers (e.g., see Kenardy, 2000; Raphael, 2000; Bisson, 2003) over the efficacy of early psychological debriefing procedures. Exposure to trauma cues through debriefing procedures in the immediate aftermath of a trauma, in an environment still likely to be perceived as dangerous, may result in the reinstatement of learned fear and the consolidation of trauma images rather than the mitigation of posttraumatic symptoms. An intervention that rebuilds community and a sense of environmental safety may be a more appropriate intervention initially than psychological interventions.

This study was limited in that anonymous self-report questionnaires were used rather than clinical interviews and the study was subject to a larger drop out rate in one group. It is difficult to ascertain why there was a higher drop out rate in the Batticaloa subjects. Posttraumatic avoidance symptoms may have been the reason, which could have resulted in an underestimation of the significant difference in posttraumatic symptoms compared with the Colombo subjects. Additionally, the Batticaloa landscape was still much the same at six months post-tsunami to three weeks post-tsunami. The minimal 'outside' help received in rebuilding Batticaloa may have diminished the willingness of Batticaloa subjects to participate in an 'outside' research study.

A further limitation of the study is that a pre-trauma history was not taken. Local leaders report that previous civil war experiences with Tamil Tigers and Government armies impacted Batticaloa residents more than Colombo residents. Thus prior trauma exposure may have also contributed to the Batticaloa subject's higher symptoms levels. This can only be speculated. Despite the limitations, the groups were reasonably homogenous and the same populations were assessed at both time points. The study highlights the stability of PTSD, as there were similar percentages of individuals with cut-off scores indicating PTSD (i.e. above 1.5) across time. It also highlights the need for future research to explore further the interrelationship between environmental and individual factors in the development and maintenance of posttraumatic symptoms so that safe, effective interventions can be developed.

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