Psychological effects of earthquakes in children: prospects for brief behavioral treatment

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Background: **Treatment of child earthquake survivors is a relatively less investigated issue in disaster research. A review of the evidence on the mental health effects of earthquakes, risk factors, and findings from treatment studies may provide useful insights into effective treatment of traumatized children.**

Data sources: **Studies of child and adolescent earthquake survivors included the PILOTS database (electronic index for literature on psychological trauma) and relevant evidence from various studies of adult earthquake survivors.**

Results: **Evidence points to elevated rates of posttraumatic stress disorder (PTSD), depression, and earthquake-related fears in children and adolescents. Traumatic stress appears to be mediated by loss of control over fear induced by exposure to unpredictable and uncontrollable earthquakes. This implies that interventions enhancing sense of control over fear are likely to be most effective. Recent studies indeed show that a control focused behavioral treatment (CFBT) involving mainly encouragement for self-exposure to feared situations is highly effective in facilitating recovery from earthquake trauma. Evidence also suggests that CFBT can be delivered through booklets and similar media.**

Conclusions: **Pilot studies suggest that CFBT has promise in effective treatment of PTSD in children. Further research is needed to confirm these preliminary findings and to develop self-help tools for children.**

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During the 30 years between 1973 and 2003 an average of 58 000 people died and 255 million people were affected globally each year as a result of natural disasters.[1] Earthquakes rank second among the deadliest natural disasters that affect humans. In this article we briefly review the current status of knowledge on the mental health effects of earthquakes on children and their treatment, based on a literature search using the PILOTS database (electronic index for literature on psychological trauma). We also present a mental health care model for earthquake survivors developed after the 1999 earthquakes in Turkey.

Mental health impact of earthquakes on children

As in adults, posttraumatic stress disorder (PTSD) is among the most common psychiatric outcomes of exposure to trauma in children. PTSD symptoms in children, particularly in infants, may show some differences from adults. For example, re-experiencing often takes the form of repetitive and compulsive play that represents parts of the traumatic event or that re-enacts trauma.[2] Similarly, constriction of play may be indicative of loss of interest. Symptom manifestation in older children more closely resembles that in adults.[3]

Studies that examined the prevalence rates of PTSD and depression in child and adolescent survivors of earthquakes are listed in the Table.[4-16] The prevalence rates in these studies ranged between 4.5% and 95% for PTSD and 13.6% and 76% for depression. This substantial variability in prevalence rates could be explained with the differential impact of earthquakes in different countries and the diversity of research methodologies employed. Furthermore, many studies used convenience samples, did not involve controls, and most did not report the cross-cultural validity of the scale used in measuring PTSD. These problems make comparison across studies difficult and preclude a reliable conclusion regarding the prevalence of PTSD and depression in children after earthquakes. Nevertheless, available evidence is consistent with that from studies of adult survivors showing that exposure to devastating earthquakes is associated with elevated

Special article

165

rates of traumatic stress reactions.

One of the important findings from these studies is that depression in children is often comorbid to PTSD.[5,7,11,13] Other secondary problems observed in children include anxiety disorders, separation anxiety, school avoidance, psychosomatic problems and enuresis.[6,8,11,17] Finally, earthquake-related fears and phobic avoidance, which cause significant impairment in survivors' daily life, are pervasive in children. In two studies, over 80% of children reported fear of entering and staying in buildings, being alone, darkness, loud noises and aftershocks.[4,17] These findings, consistent with similar observations with adult survivors,[18-21] demonstrate the extent of the task faced by mental health care providers.

Risk factors

Studies generally yielded inconsistent results with respect to risk factors. Higher prevalence of PTSD was associated with an earthquake experience closer to the epicenter[12,13,22,23] or exposure to greater level of devastation,[8,24] though other studies[7,9] failed to

Table. Posttraumatic stress disorder (PTSD) and major depression (MD) prevalence in child and adolescent survivors of earthquakes[*]

Study	Earthquake	Time (months)	Measure	Sampling strategy	Age range	n	PTSD (%)	MD (%)
Abalı et al[4]	Turkey 99	1	CI	Consecutive self-referrals to a makeshift psychiatric clinic set-up for survivors	<19	102	74.5[†]	-
Ekşi et al[5]	Turkey 99	1	CAPS CI	Convenience sampling from two schools in a city located 37 km from the epicenter (response rate: 37%)	9-18	160	60.0	30.6
Hsu et al[6]	Taiwan 99	1.5	ChIPS	All junior high school students in a village close to the epicenter (response rate: 82%)	12-14	323	21.7	-
Roussos et al[7]	Greece 99	3-4	CPTSD-RI	All students in 13 schools (81.3% of all schools), in a district close to the epicenter and a convenience sample from 3 schools located in a district not affected by the earthquake (response rate: 99%)	9-18	1937	4.5	13.9
Giannopoulou et al[8]	Greece 99	6-7	CRIES	All students from randomly selected 24 schools in a district close to the epicenter (response rate: 95%)	9-17			-
				Low exposure: exposure to earthquake's aftermath only		284	20.1	
				High exposure: direct exposure at the epicenter		1752	35.7	
Bulut et al[9]	Turkey 99	11	OSU-CPTSDI[‡]	Random sampling from 4 schools in a city located 37 km from the epicenter	10-11			-
				Low exposure: neighborhood with low damage		101	73.7	
				High exposure: neighborhood with high damage		99	73.2	
Şahin et al (a)[10]	Turkey 99	8/11	PA	Longitudinal study based on a convenience sample selected from 13 schools in 9 cities in the entire region affected by the earthquake	6-11	420	13/6[§]	-
Şahin et al (b)[10]	Turkey 99	8/11	IES-R	Longitudinal study based on a convenience sample selected from 13 schools in 9 cities in the entire region affected by the earthquake	12-16	275	7/7[§]	-
Kolaitis et al[11]	Greece 99	6	CPTSD-RI	Convenience sampling from 2 randomly selected schools in the epicenter area	10-12	115	16.5[‖]	-
Pynoos et al[12]	Armenia 88	18	CI	Randomly selected classrooms in 8 schools in 3 cities located at increasing distances from the epicenter	8-16	111	70.3	-
Goenjian et al[13]	Armenia 88	18	CPTSD-RI DRS	Convenience sampling	8-16			
				Low exposure: 75 km to the epicenter		61	26	28
				Moderate exposure: 35 km to the epicenter		94	71	50
				High exposure: epicenter		63	95	76
Bal & Jensen[14]	Turkey 99	≈36	CPTSD-RI	Convenience sampling in 8 schools in a city close to the epicenter	8-15	293	28[‖]	-

CAPS: clinician administered PTSD scale; ChIPS: children's interview for psychiatric syndromes; CI: clinical interview based on DSM-III-R PTSD criteria; CPTSD-RI: child PTSD reaction index; CRIES: children's revised impact of events scale; DRS: depression rating scale; IES-R: impact of events scale revised; PA: parental assessment of PTSD symptoms (omitting re-experiencing symptoms); OSU-CPTSDI: OSU-child PTSD inventory. *: studies are ordered in ascending order according to time since trauma; †: prevalence rate relates to acute stress disorder; ‡: this is the original title of the scale[15] used in this study, which was renamed by the authors without permission;[16] §: prevalence rates on the same cohort at 8 months and 11 months, respectively; ‖: rate of PTSD estimated on the basis of 'severe/very severe PTSD' categories of the CPTSD-RI, as in Goenjian et al.[13]

replicate this finding. While some studies reported female gender,[7,8,12,13,23] younger age,[7,8] physical injury,[6,11] loss of family members,[6,12,13] injury to family members/relatives,[11] witnessing death,[5] and parental reaction to trauma[5] as risk factors, in other studies, gender,[6,11,23] age,[6,12] injury to family members/relatives,[6] witnessing injury/death,[6] or parental reaction to trauma[11] were not associated with PTSD.

Several methodological limitations preclude a definitive conclusion based on these findings. Most importantly, in many studies risk factors were examined in a post hoc fashion without recourse to a sound theory, thereby limiting the usefulness of findings for effective care policies for survivors. Few studies examined the psychological processes that mediate traumatic stress. Those that examined the impact of earthquake stressors often measured exposure to particular stressor events categorically, despite growing evidence suggesting that perceived severity of a stressor is more strongly associated with PTSD than mere exposure to the event.[25-27] Furthermore, most studies used bivariate rather than multivariate analyses in examining the impact of particular stressor events. This is potentially misleading because earthquake stressors often occur concurrently, leading to highly inter-correlated variables in assessment.[28] Loss of close ones, for example, is often associated with collapse of the house and being trapped under rubble.

In two studies that examined both objective and subjective impact of earthquake trauma using multivariate methods in fairly representative samples of schoolchildren, perceived threat to safety explained more variance in PTSD symptoms than objective measures of trauma severity, such as proximity to the epicenter, level of damage to home, or injury.[7,8] This is consistent with findings pointing to earthquake-induced fear as a more important risk factor than other earthquake-related stressor events in adult survivors.[18-21,29-32] This finding implies that fear-focused interventions are likely to facilitate recovery from earthquake trauma. It also has important policy implications in showing that survivors who have not experienced the devastating impact of the disaster may require as much attention as those with such an experience.

Treatment studies with children

Among treatments for PTSD cognitive-behavioral treatment (CBT) is regarded as the treatment of choice for both adult and child trauma survivors.[33] Although methodologically sound randomized controlled trials of CBT in children are scarce, available evidence

suggests that it is effective in children.[34] However, there are yet no randomized controlled trials of CBT in child earthquake survivors. In two studies[35,36] school children treated with a 'school-based intervention program' that involved in part cognitive-behavioral interventions showed more improvement in PTSD than a comparison group selected from another school. The improvement rates were, however, rather modest (13% and 29%). Although treatment effects were maintained for a long-term in one of these studies, children still had elevated PTSD scores at follow-up.[22] In the other study, improvement was maintained for a long-term, but the treatment effects were no longer significant, due to improvement in the comparison group.[37] In a recent study,[38] CBT delivered in groups over 7 sessions achieved a 60% reduction in PTSD, depressive symptoms and significant improvement in psychosocial functioning. Although these studies are encouraging, their methodological limitations preclude definitive conclusions about the efficacy of CBT. There is considerable variability across studies in CBT effects,[34] which may well reflect the diversity of interventions included in CBT programs. CBT often involves a mixed bag of various interventions, such as psycho-education, 'imagery techniques', anxiety or stress management (e.g., breathing retraining, progressive relaxation, distraction, etc.), encouragement of emotional expression, and sharing of trauma experiences with others. The theoretical basis of most of these interventions is unclear and their relative contribution to overall improvement is uncertain. Furthermore, these programs do not appear to place sufficient emphasis on the most potent ingredient of CBT, i.e., live exposure to trauma cues.

Some other treatments given to children, such as play therapy,[39,40] art therapy,[41,42] and family therapy,[43] also involve a mixture of techniques without a sound theoretical basis and uncertain usefulness. Most of these interventions have not been tested in randomized controlled trials. Finally, although eye movement desensitization and reprocessing (EMDR) is said to be a viable option for treatment of children,[44,45] it is not yet tested with earthquake survivors. EMDR is a controversial technique without an explained mechanism of action. Dismantling studies have shown no benefit arising from eye movements,[46,47] suggesting that any improvement observed with EMDR could be attributed to imaginal exposure.

Considering large numbers of the people affected by devastating earthquakes mental health care of survivors poses a formidable task. Such a task could only be undertaken using a mental health care model involving interventions that are (a) based on a sound theory, (b) demonstrated to be effective, (c) brief, and (d)

suitable for dissemination to large numbers of survivors on a self-help basis using manuals and other such media.[48] When judged against these criteria, none of the currently available treatments for trauma survivors in the western world have the potential to address the needs of large survivor populations.

Development of brief interventions for earthquake survivors

Extensive research with survivors of the 1999 earthquakes in Turkey led to the development of brief and effective interventions for earthquake survivors based on contemporary learning models of anxiety.[49] Evidence from experimental models of anxiety show that unpredictable and uncontrollable stressors are associated with helplessness (fear) and hopelessness (depression) effects in humans, as well as in animals.[49,50] Evidence from our studies shows that exposure to unpredictable and uncontrollable earthquakes and subsequent aftershocks lead to pervasive conditioned fears in more than 70% earthquake survivors,[18-20] which rapidly generalize to a wide range of situations, activities, and objects (e.g., entering and staying in concrete buildings, being alone at home, sleeping alone or in the dark, taking a bath alone at home, etc). Pervasive fears and extensive avoidance are strongly associated with helplessness, which constitutes the critical mechanism for the development and maintenance of PTSD symptoms, and hopelessness, which is the mediating factor in depression comorbid to PTSD.[48,51,52]

With this formulation, we developed a control-focused behavioral treatment (CFBT) to enhance sense of control over traumatic stressors through exposure to either conditioned trauma reminders or unconditioned traumatic stressors in a safe and controlled environment (e.g., earthquake tremors in an earthquake simulator). The treatment aims at enhancing a person's ability to tolerate and control the distress or fear evoked by trauma cues. Such focus on resilience processes distinguishes CFBT from traditional CBT or other exposure-based treatments, where the primary aim is merely to reduce distress or fear. Although an increase in sense of control with CFBT often leads to a reduction in anxiety, the latter is not a prerequisite for general improvement. Indeed, evidence suggests that fear reduction during exposure does not relate to therapeutic outcome.[53] CFBT involves no systematic cognitive interventions, as our studies suggest that certain cognitive effects of trauma, such as beliefs about self, others, and justice and attributions of blame, do not play a role in traumatic stress disorders.[52,54]

Procedurally, CFBT is a relatively simple intervention that involves three steps: (1) identify trauma cues that trigger distress or fear and help the survivor understand how fear and avoidance contribute to helplessness, depression, and impairment in social, work (or school in children), and family functioning, (2) explain the treatment rationale, (3) define treatment goals and encourage self-exposure to trauma cues until sense of control develops. Explanation of the treatment rationale is a critical aspect of the intervention, given that the main aim is to convey sufficient sense of control and engage the person in the idea of self-exposure to trauma cues. Accordingly, fear is personified by presenting it as an adversary that needs fighting back. Avoidance is presented as a form of 'surrender', the consequence of which is living one's life in fear and helplessness. Once the survivor understands how fear and avoidance impair life functioning, they are presented with a choice: "*fight fear to take control over life or surrender and live your life in fear and helplessness.*"

In a child who has fear of sleeping alone or in the dark, staying alone at home, and entering buildings, for example, treatment would be presented as a means of testing their courage and beating their fear. Once the most disabling avoidance behaviors are identified and treatment rationale explained, treatment targets are defined in relation to these avoidance behaviors in agreement with the child. In this example, the targets would be (1) to sleep alone and in the dark, (2) to stay alone at home, and (3) to enter safe buildings. The child is then given exposure homework tasks to achieve these targets. The parents are instructed to provide encouragement and support during this process. Each subsequent monitoring session involves evaluation of progress, verbal praise for any progress, troubleshooting for problems encountered, and setting of new homework tasks in relation to the treatment targets.

Several variants of CFBT were tested in a series of uncontrolled and randomized controlled studies altogether involving 339 adult earthquake survivors with PTSD. Full course (4 sessions) CFBT achieved improvement in 88% of the cases after two sessions.[55] A randomized controlled study found improvement in 80% of the survivors when the treatment was delivered in a single session.[56] In this study early reduction in behavioral avoidance predicted subsequent improvement in PTSD symptoms.[57] To maximize the efficacy of single-session CFBT, earthquake simulation treatment was developed, which involves a single-session of exposure to simulated earthquake tremors in an earthquake simulator. This intervention was more potent in reducing PTSD than self-exposure instructions alone. In two clinical trials earthquake

simulation treatment achieved a 79% reduction in PTSD symptoms, leading to general improvement in 90% of the cases.[58,59] In all studies improvement generalized to all PTSD and depression symptoms, with marked improvement in social and occupational disability. Relapse was very rare (3 cases), despite exposure to further earthquakes in some cases, suggesting that treatment enhances resilience against traumatic effects of earthquakes. In addition, a fifth study[60] suggested that the intervention can be effectively delivered through a self-help manual.

The effectiveness of CFBT in children was tested using a pilot study (manuscript in preparation) involving 23 school age children with PTSD at 20 months post-disaster. Treatment was delivered bi-weekly in groups across 6 sessions after a variable waiting period ranging from 1 to 18 weeks. While no significant improvement was found during the waiting period, the children showed a 50% reduction in PTSD and a 55% reduction in earthquake-related fears after treatment (Cohen's d adjusted for a small sample 1.5 and 1.2, respectively). These findings suggested that CFBT has promise in treatment of child earthquake survivors. This is not surprising, given that earthquake-induced PTSD in children is mediated by the same process as in adults, i.e., loss of control over fear. Thus, encouraging children to overcome their fear through self-exposure (e.g., sleeping alone or in the dark, staying alone at home, entering buildings, etc) helps them recover from posttraumatic stress. Children relate very well to the rationale of the treatment (e.g., 'beat fear') and generally comply better with self-exposure instructions than do adults.

The therapeutic effects of exposure to feared situations in children were indeed observed in another pilot study (manuscript in preparation) involving earthquake simulation treatment. This study involved a series of 8 multiple-baseline experimental case studies with 4 boys and 4 girls (aged 8 to 13) treated in the same session. While no significant improvement was noted during an initial 2 to 5 weeks of waiting period, both fear/avoidance and PTSD symptoms showed significant changes (reduced by 52%; Cohen's d adjusted for small sample 1.0) after the exposure session at a 1–2-month follow-up. On a self-rated global improvement measure, 5 children (63%) reported much/very much improvement, 2 slight improvement and 1 no change. Parental assessment indicated similar improvement in school and family functioning. Interestingly, a 13-year old girl who had developed obsessive-compulsive disorder (i.e., hand-washing and checking rituals) in addition to earthquake-related fears, the compulsive symptoms disappeared at follow-up, even though these symptoms were not specifically targeted with additional behavioral treatment.

A mental health care model for earthquake survivors

Based on four variants of CFBT so far, we developed a mental health care model that envisions treatment dissemination through all possible means, including therapists, other media, such as self-help manuals, audio or video cassettes, and even mass media channels. This is conceivable, given that CFBT is a largely self-help intervention, with the therapist's role limited only to delivery of the treatment rationale and self-exposure instructions. Indeed, much of the improvement that occurs in therapy is due to self-exposure exercises after the session. Evidence shows that the critical process in recovery is the delivery of self-exposure instructions, rather than the medium of delivery.

An outreach program based on experience with more than 5000 survivors in Turkey is also an integral component of the model. This program is useful in delivering care to particular survivor populations, in schools, survivor shelters, or various community groups, though it could also be implemented in primary and secondary care settings. Briefly, this is a 3-stage program involving the use of the four variants of CFBT in a particular sequence to maximize the recovery rates, while minimizing involvement of the therapist. The treatment is delivered in a single session together with the self-help manual at stage 1. Non-responders to this intervention (e.g., those unable to initiate self-exposure by themselves) are given a therapist-administered session, involving exposure to feared and avoided situations in natural environment (or simulated tremors when an earthquake simulator is available) at stage 2. Non-responders to this intervention are provided full-course (4-session) CFBT at the final stage. Based on over 80% recovery rates at each stage, this strategy achieves improvement in 90% of the survivors with as little therapist input as 0.4 sessions per case in large survivor groups.[48]

We used this outreach program with adult as well as child survivors with good results. It is worth noting that we often treated children together with their family, because some other members of the family were also traumatized by the earthquake. Indeed, it is difficult to treat children when they observe signs of intense fear and extensive avoidance behaviors in their parents or other family members. In addition, treatment requires the cooperation of the parents, who need to understand the treatment rationale, encourage children to confront feared situations, monitor and provide

reward and reinforcement for any progress achieved. Such cooperation with fearful and avoidant parents is difficult, unless they are part of the same treatment.

Conclusions

The most important aspect of our research is the discovery of an association between increased sense of control over fear and recovery from PTSD. Self-exposure to feared situations appears to be highly effective in enhancing sense of control over fear. This process could be initiated by simply encouraging survivors not to avoid feared situations. Although controlled studies are needed to confirm this point, our clinical experience, and some preliminary evidence suggests that CFBT is promising in treating earthquake-related PTSD in children.

It is also worth emphasizing once again the fact that there is an urgent need—not just for effective interventions for earthquake trauma—but also interventions that are suitable for dissemination through media other than therapists. In a developing country context even the most effective treatment is of limited usefulness, if it cannot be cost-effectively disseminated to large survivor populations on a self-help basis. This issue is of great importance in determining public mental health policies for survivors after major disasters, such as the recent earthquake in China and its aftermath.

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170

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