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Child disaster mental health interventions, part I

Techniques, outcomes, and methodological considerations

Betty Pfefferbaum[1,2,*], Jennifer L Sweeton[3], Elana Newman[4], Vandana Varma[1,2], Pascal Nitiéma[1,2], Jon A Shaw[5], Allan K Chrisman[6] and Mary A Noffsinger[7]

[1]Department of Psychiatry and Behavioral Sciences; College of Medicine; University of Oklahoma Health Sciences Center; Oklahoma City, OK USA; [2]Terrorism and Disaster Center; University of Oklahoma Health Sciences Center; Oklahoma City, OK USA; [3]Veterans Affairs Medical Center; Oklahoma City, OK USA; [4]Tulsa Institute of Trauma, Abuse and Neglect; Department of Psychology; University of Tulsa; Tulsa, OK USA; [5]Division of Child and Adolescent Psychiatry; University of Miami School of Medicine; Miami, FL USA; [6]Duke Child and Family Study Center; Department of Psychiatry and Behavioral Sciences; Duke University Medical Center; Durham, NC USA; [7]Courtroom Sciences, Inc.; Irving, TX USA

This review of child disaster mental health intervention studies describes the techniques used in the interventions and the outcomes addressed, and it provides a preliminary evaluation of the field. The interventions reviewed here used a variety of strategies such as cognitive behavioral approaches, exposure and narrative techniques, relaxation, coping skill development, social support, psychoeducation, eye movement desensitization and reprocessing, and debriefing. A diagnosis of posttraumatic stress disorder (PTSD) and/or posttraumatic stress reactions were the most commonly addressed outcomes although other reactions such as depression, anxiety, behavior problems, fear, and/or traumatic grief also were examined. Recommendations for future research are outlined.

Keywords: children, disaster, intervention, outcomes, posttraumatic stress, posttraumatic stress disorder, research, terrorism, therapy, treatment

*Correspondence to: Betty Pfefferbaum; Email: betty-pfefferbaum@ouhsc.edu

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Introduction

A well-developed research base documenting the deleterious emotional and behavioral effects of disasters and terrorism on children and adolescents[1-3] has led to the development, delivery, and evaluation of numerous child disaster mental health interventions. Several review papers describing child trauma interventions, including interventions used in the context of disasters and terrorism, have been published.[4-8] Few studies, however, have focused specifically on disasters and terrorism.[9-11] This systematic review summarizes the techniques used in child disaster and terrorism interventions, identifies the symptoms and conditions addressed by these interventions, presents a preliminary qualitative evaluation of the evidence base for interventions, and suggests directions for future research.

The Current Review

This report was guided by a literature search conducted in the winter of 2013 using EMBASE, ERIC, Medline, Ovid, PILOTS, PsycINFO, and Social Work Abstracts databases. A total of 47 papers were reviewed. One article described a two-stage trial with two different interventions.[12] The two interventions were analyzed separately. Hence, the final sample included 48 studies. **Figure 1** provides a flowchart of the literature search and results.

Five of the selected studies (10.4%), although war-related, were included in the review as the study participants had been exposed to repetitive terrorist attacks.[13-17] Three interventions (6.3%) were used in heterogeneous samples of which natural disasters[18,19] or terrorism[20] were among other traumas (**Table 1**).

The Samples

As evident in **Table 2**, the interventions reviewed for this report were provided to

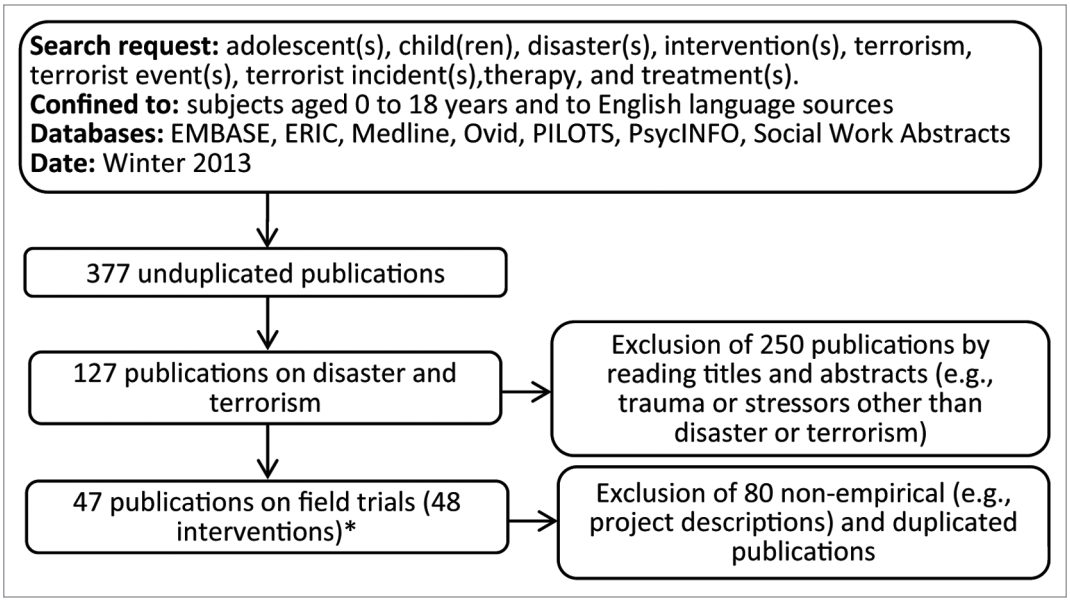

Figure 1. Flow diagram of the literature search and research reviewed. *Two stages of one study which described a two-phase trial[12] were analyzed separately, resulting in 48 interventions for review.

children across the age span following a variety of natural and human-caused disasters occurring around the world. Some studies included children representing a wide age range, from 4 or 5 y of age to adolescents or young adults.[21-23] One publication reported a case study of a five year old[24] and one studied a preschool sample.[19] Participants' disaster exposure was not consistently described and typically was not included in analysis of treatment effects in this body of work. Thus, age and exposure were not examined in the analysis conducted for this report.

Intervention Techniques

The interventions reviewed for this report used a variety of techniques to address children's disaster reactions, and many interventions utilized multiple techniques. The most commonly used techniques could be characterized as cognitive behavioral in nature. See **Table 2**. Some interventions used exposure[20,54] or narrative[22,26,34,48] techniques. Relaxation also was used commonly as one component among others or in combination with other techniques in the interventions studied.[12,21,24,33,34,38,39,41-43,48,50,54] For example, Catani and colleagues[26] found both narrative exposure and meditation-relaxation interventions to be effective in children following the 2004 Indian Ocean tsunami, with no significant difference between the two interventions in any outcome measure. Also, Weems and colleagues[54] used relaxation training coupled with gradual exposure to address test anxiety in ninth graders exposed to Hurricane Katrina.

Many interventions incorporated components to enhance coping[12,22,43,44,48] and some provided a social support component.[14,15,21,35,37,44,48] For example, using a cognitive behavioral approach, Brown and colleagues[12] helped children develop a coping "tool box" by teaching them a variety of coping techniques. Berger and Gelkopf[25] administered the ERASE Stress intervention which focused on teaching children coping skills to address anger, loss, fears, and other emotions. Some interventions used enhancement of social support as a type of coping skill. For example, ERASE Stress included a session on building social support and asking for help,[25] and Salloum and Overstreet[48] conceptualized "reconnection" as a coping strategy.

Psychoeducation was incorporated along with other techniques in numerous studies.[15,21,22,24,35,46] In some studies, psychoeducation was delivered repeatedly throughout the course of the intervention. For instance, Gelkopf and Berger's[15] ERASE Stress intervention included a psychoeducation component in every session. In another study, psychoeducation was used only early in the intervention. [24] One study examined an intervention in which psychoeducation was the primary component.[47]

Eye Movement Desensitization and Reprocessing (EMDR)[23,27,30] and dual attention tasks associated with EMDR techniques[33,50] were included in some studies. Debriefing was the key intervention examined in two studies.[53,57] Others included debriefing as one technique in their cognitive behavioral interventions but did not examine the debriefing component separate from other elements of their intervention.[41,42,50]

Several interventions used techniques not commonly studied. For example, nondirective, non-trauma-focused time-limited dynamic therapy was the control condition in a study of exposure.[20] Client centered treatment, involving empathy as an essential aspect of the therapy, was provided by Goodman and colleagues[36] in a case study of childhood traumatic grief after the September 11 World Trade Center attacks. One study evaluated massage therapy for classroom behavior problems in children after Hurricane Andrew[31] while another study examined spiritual hypnosis for the treatment of posttraumatic

Table 1. Traumatic Events of Studies Included in Current Review

Traumatic Event	Frequency Total = 48 (%)
Natural disaster	29 (60.4)
Single terrorist attack	6 (12.5)
Chronic terrorism	5 (10.4)
Heterogeneous	3 (6.3)
Technological disaster	3 (6.3)
Hostage	1 (2.1)
Preparedness	1 (2.1)

stress disorder (PTSD) in children after a terrorist attack.[40] Shooshtary and colleagues[50] used a kinesthetic technique with "touch, massage and movement" in their earthquake intervention.

Symptoms and Conditions Addressed in Interventions

Children's post-disaster adjustment reflects a wide range of emotional and behavioral reactions. The outcomes typically used in assessing the efficacy of interventions included PTSD and posttraumatic stress reactions, depression, anxiety, functioning, behavior problems, anger, somatic complaints, fear, and traumatic grief. Studies of intervention efficacy have used both pre/post assessment and controlled trials. Summary information on outcomes according to the research design of studies is presented in **Table 3** which displays the number of studies using pre/post and controlled design for each of the major outcomes examined. **Table 3** also identifies the number and percentage of studies demonstrating improvement, no change, and worse outcomes using pre/post assessment and those with superior outcomes, no significant differences, and inferior outcomes in controlled trials.

As evident in **Table 3**, posttraumatic stress reactions (n = 41, 85.4%) were the most commonly assessed mental health outcome for the intervention studies included in the present review. PTSD was examined in 16 (33.3%) of the studies. Some studies used terminology such as "caseness"[18] or "probable PTSD"[22,25] in describing outcomes to acknowledge that an actual diagnosis was not given but that empirically-derived thresholds and patterns were determined for trauma-related symptoms. Rather than focusing exclusively on posttraumatic stress reactions, outcomes must be appropriate for the intervention delivered. For example, Vijayakumar and colleagues[52] attributed their failure to find improvement in PTSD symptoms in children who participated in their intervention relative to a non-treatment control to the fact that the largely psychoeducational intervention was not intended to address trauma symptoms. Rather, it focused on other behaviors. The study revealed positive results for two outcomes—desisting smoking and the expression of positive emotions.

Given the high comorbidity of depression with PTSD in traumatized children,[3] it is not surprising that many interventions (n = 20, 41.7%) included depression as an outcome measure. Brown and colleagues[12] found that depression improved in children who received their September 11 classroom-based intervention. Interestingly, depression worsened in children who received an individualized intervention delivered to those who remained symptomatic following the classroom intervention. The authors suggested that perhaps the social support inherent in the classroom intervention was essential to improvement in depression.[12]

Behavioral problems were examined in nine studies (18.8%)[12,18,19,23,24,36,48,49,52] In addition to oppositional defiant disorder, Scheeringa and colleagues[19] assessed ADHD as an outcome finding improvement in symptoms of oppositional defiant disorder but not ADHD symptoms. Vijayakumar and colleagues[52] found the opposite—a reduction in hyperactivity but not in oppositional or conduct problems—in their controlled trial of a psychosocial intervention for children after the 2004 Indian Ocean tsunami. Children receiving the intervention were more likely than those in the control group to report that they could resist peer pressure and desist smoking.[52]

Four studies examined fear[32,39,45,57] One study found an activity-based cognitive fear-reduction intervention inferior to a placebo control group that provided structured activities and games in a small sample of children exposed to an earthquake.[39] The investigators implicated the brevity of the intervention and the lack of a parent component in the intervention's failure.[39] In general, the benefits of including parents in interventions have been understudied.[59]

Children and adolescents may experience concomitant trauma and grief symptoms if they lose loved ones as a result of a disaster. In their study of a teacher-mediated intervention for children after an earthquake in Turkey, Wolmer and colleagues[56] found improvement in PTSD symptoms while self-reported grief symptoms increased. Explanations for this finding are that the resolution of trauma allowed the grief process to begin, the intervention did not adequately address grief symptoms, and/or reporting bias. Three years later, grief symptoms, as reported by participants' parents, had improved in the treatment group, but there was no significant difference between the treatment and non-treatment control groups at follow up. The observed improvement in grief symptoms in the treatment group could be artifactual, however, and explained by the difference in informants. Salloum and Overstreet conducted two studies of grief and trauma interventions. In their first study published in 2008,[47] they found improvement in children's self-reported grief after the intervention, with no significant difference between those who received the intervention in individual vs. group format. In their 2012 study, these investigators found significant improvement in self-reported traumatic grief after a grief and trauma intervention that used a coping skills component as well as with one that used both the coping skills component and trauma narrative processing.[48]

Table 2. Description of Studies Included in Current Review

Author	Event	Design	Type of Intervention in Treatment Group	Type of Intervention in Control Group	Sample Size	Age Years/ Grades	Number of Sessions and Duration of the Intervention
Berger and Gelkopf (2009)[25]	Indian Ocean tsunami, Sri Lanka (2004)	CRC	Eclectic with CBT	WL	166	9–14/ Elementary school	12 weekly sessions
Berger et al. (2012)[13]	Chronic terrorism including multiple rocket attacks in Sderot, Israel (2000–2008)	CRC	Eclectic with CBT	WL	154	11–13/7–8	16 weekly sessions
Berger et al. (2007)[14]	Chronic terrorism including suicide bombings in Hadera, Israel (2000–2003)	CRC	Eclectic with CBT	WL	142	NS/2–6	8 sessions
Brown et al. (2006)[12] (Phase 1: Classroom intervention)	September 11 terrorist attack (2001)	NC	Strict CBT (group)	NA	62	8–13/3–7	10 weekly sessions
Brown et al. (2006)[12] (Phase 2: classroom + individual intervention vs. classroom intervention only)	September 11 terrorist attack (2001)	NRC	Strict CBT (individual)	Strict CBT (group) vs. Strict CBT (group + individual)	59	8–13/3–7	10 weekly group sessions in the classroom and 6 individual sessions
Brown et al[24] (2004)	September 11 terrorist attack (2001)	NC	CBT with Grief Interventions	NA	1	5	16 wk
Cain et al.[21] (2010)	Hurricane Katrina (2005)	NC	PFA	NA	99	5–15/ Elementary and middle school	6-wk intervention
Catani et al.[26] (2009)	Indian Ocean tsunami, Sri Lanka (2004)	RC	Narrative and exposure (KIDNET)	Meditation and relaxation (Med-Relax)	31	8–14/Middle school	6 sessions completed in 2 wk
CATS Consortium (2010)[22]	September 11 terrorist attack (2001)	NRC	Strict CBT	Strict CBT	306	5–21/NS	8–20 sessions for trauma-specific CBT and 4 sessions for brief-CBT skills
Chemtob et al. (2002)[27]	Hurricane Iniki (1992)	RC	EMDR	WL	32	6–12/NS	3 weekly sessions
Chemtob et al. (2002)[28]	Hurricane Iniki (1992)	RC	Eclectic with no CBT (group)	Eclectic with no CBT (individual)	248	6–12/2–6	4 weekly sessions
Cohen et al. (2009)[29]	Hurricane Katrina (2005)	NC	Strict CBT (CBITS and TF-CBT)	NA	2	8 and 11 (for case studies)/NS	10 group sessions and 1–3 individual sessions for CBITS and 12–16 individual sessions for TF-CBT
de Roos et al. (2011)[23]	Explosion at a fireworks factory in Enschede, Netherlands (2000)	RC	CBT	EMDR	52	4–18/NS	4 sessions over 4–8 wk
Fernandez (2007)[30]	Earthquake in Molise, Italy (2002)	NC	EMDR	NA	22	7–11/NS	Average of 6.5 sessions over 1 y
Field et al. (1996)[31]	Hurricane Andrew (1992)	RC	Massage	Placebo video attention control group	60	NS/1–5	8 sessions
Galante and Foa (1986)[32]	Earthquake in Central Italy (1980)	NC	Eclectic with no CBT	NA	300	NS/1–4	7 sessions

Table 2. Description of Studies Included in Current Review (continued)

Author	Event	Design	Type of Intervention in Treatment Group	Type of Intervention in Control Group	Sample Size	Age Years/ Grades	Number of Sessions and Duration of the Intervention
Gelkopf and Berger 2009)[15]	Chronic terrorism including multiple terror attacks in Beer Sheba, Israel (2000–2006)	RC	Eclectic with CBT	WL	107	NS/7–8	12 sessions
Giannopoulou et al. (2006)[33]	Earthquake in Athens, Greece (1999)	NRC[a]	Strict CBT	WL	17	8–12/NS	6 weekly sessions
Gilboa-Schechtman et al. (2010)[20]	Heterogeneous including terrorist attacks, motor vehicle accidents, and sexual and nonsexual assaults in Israel	RC	Exposure therapy (PE-A)	Psychodynamic therapy (TLDP-A)	38	12–18/NS	12–15 weekly sessions for PE-A and 15–18 sessions for TLDP-A
Goenjian et al. (1997)[34]	Earthquake in Spitak, Armenia (1988)	NRC	Eclectic with CBT	NTC	64	NS/6–7	4 group and 2 individual sessions over 3 wk
Goenjian et al. (2005)[35]	Earthquake in Spitak, Armenia (1988)	NRC	Eclectic with CBT	NTC	63	15–17/NS	4 group and 2 individual sessions over 3 wk
Goodman et al. (2004)[36]	September 11 terrorist attack (2001)	NC	Client centered therapy	NA	1	15/High school	5 mo
Hardin et al. (2002)[37]	Hurricane Hugo (1989)	CRC	Eclectic with CBT	NTC	1030	13–18/High school	3 sessions per year for 3 y
Jaycox et al. (2010)[38]	Hurricane Katrina (2005)	RC	Strict CBT (TF-CBT)	Strict CBT (CBITS)	118	NS/4–8	10 group sessions and 1–3 individual sessions for CBITS and 12 individual sessions or conjoint sessions with parent for TF-CBT
Karairmak and Aydin (2008)[39]	Earthquake in the Marmara region, Turkey (1999)	RC	Cognitive therapy	Placebo attention control group	20	NS/NS	9 sessions over 3 wk
Lesmana et al. (2009)[40]	Terrorist attack in Bali, Indonesia (2002)	RC	Spiritual hypnosis	NTC	226	6–12/NS	1 session
Mahmoudi-Gharaei et al. (2009)[41]	Earthquake in Bam, Iran (2003)	RC	Eclectic with CBT	WL	85	11–18/NS	4 weekly sessions
Mahmoudi-Gharaei et al. (2009)[42]	Earthquake in Bam, Iran (2003)	RC	Eclectic with CBT	Art and sport activities; Eclectic with CBT; WL	161	6–11/NS	4 sessions
March et al. (1998)[18]	Heterogeneous including car accidents, severe storms, accidental and gunshot injury, severe illness, and fires	NRC	Strict CBT	WL	17	10–15/4–9	18 weekly sessions
Plummer et al. (2009)[43]	Hurricane Katrina (2005)	NC	PFA	NA	12	6–13/ Elementary and middle school	6 wk

Table 2. Description of Studies Included in Current Review (continued)

Author	Event	Design	Type of Intervention in Treatment Group	Type of Intervention in Control Group	Sample Size	Age Years/ Grades	Number of Sessions and Duration of the Intervention
Ronan and Johnston (1999)[44]	Volcanic eruptions of Mount Ruapehu, New Zealand (1995)	CRC	Eclectic with CBT	Video based exposure and normalizing condition	112	7–13/NS	1 session
Ronan and Johnston (2003)[45]	Hazard education-preparedness, New Zealand	CRC	Emergency hazard education[b]	Usual hazard education[b]	219	11–13/NS	1 class period per day over six weeks for UC and NS for EM
Sahin et al. (2011)[46]	Earthquake in the Marmara region, Turkey (1999)	NRC	Psychoeducation	NTC	774	NS/NS	NS
Salloum and Overstreet (2008)[47]	Hurricane Katrina (2005)	RC	Eclectic with CBT (individual)	Eclectic with CBT (group)	56	7–12/NS	10 sessions
Salloum and Overstreet (2012)[48]	Hurricane Katrina (2005)	RC	Eclectic with CBT (GTI-CN)	Eclectic with CBT (GTI-C)	70	6–12/2–6	11 sessions
Scheeringa et al. (2011)[19]	Heterogeneous including Hurricane Katrina (2005), acute injury, and witness to domestic violence	RC	Strict CBT	WL	64	3–6/NS	12 sessions
Shen (2002)[49]	Earthquake in Taiwan (1999)	RC	Play therapy	NTC	30	8–12/3–6	10 sessions over 4 wk
Shooshtary et al. (2008)[50]	Earthquake in Bam, Iran (2003)	NRC	Eclectic with CBT	WL	168	11–20/NS	4 sessions over 4 wk
Taylor and Weems (2011)[51]	Hurricane Katrina (2005)	NC	Strict CBT	NA	6	8–13/NS	10 weekly sessions
Vijayakumar et al. (2006)[52]	Indian Ocean tsunami, Srinivasapuram, India (2004)	NRC	Eclectic with CBT	NTC	135	11–14/NS	6 sessions over 6 mo
Vila et al. (1999)[53]	School hostage crisis in Paris, France (1995)	NRC	Debriefing	NTC	26	6–9.5/1 and 3	Debriefing at 24 h and 6 wk post event
Weems et al. (2009)[54]	Hurricane Katrina (2005)	CRC	Eclectic with CBT	NTC	94	13–16/9	5 sessions over 4–5 wk
Wolmer et al. (2011)[16]	Second Lebanon War (Chronic terrorism) (2006)	NRC	Eclectic with CBT	WL	2135	8–12/3–6	15 weekly Modules
Wolmer et al. (2011)[17]	Chronic terrorism with preventive intervention before rocket attacks, Operation Cast Lead, Israel (2008–2009)	NRC	Eclectic with CBT	WL	1488	NS/4–5	14 weekly modules
Wolmer et al. (2005)[c, 55]	Earthquake in the Marmara region, Turkey (1999)	NRC	Eclectic with CBT	NTC	287	9–17/NS	8 twice-weekly sessions
Wolmer et al. (2003)[56]	Earthquake in the Marmara region, Turkey (1999)	NC	Eclectic with CBT	NA	202	NS/1–5	8 twice-weekly sessions

Table 2. Description of Studies Included in Current Review (continued)

Author	Event	Design	Type of Intervention in Treatment Group	Type of Intervention in Control Group	Sample Size	Age Years/ Grades	Number of Sessions and Duration of the Intervention
Yule (1992)[57]	Jupiter cruise ship sinking at the Greek port of Piraeus (1988)	NRC	Debriefing and CBT	NTC	39	14–16/NS	1 session of debriefing and 2 CBT group sessions
Yule and Udwin (1991)[58]	Jupiter cruise ship sinking at the Greek port of Piraeus (1988)	NC	Debriefing	NA	24	14–16/NS	1 session of debriefing

Notes: CBITS, Cognitive Behavioral Intervention for Trauma in Schools; CBT, cognitive behavioral therapy; CRC, cluster-randomized controlled study; EMDR, Eye Movement Desensitization and Reprocessing; GTI-C, Grief and Trauma Intervention with Coping Skills; GTI-CN, Grief and Trauma Intervention with Coping Skills and Trauma Narrative Processing; NA, not applicable; NC, non-controlled study; NRC, non-randomized controlled study; NS, not specified; NTC, non-treatment control; PE-A, Prolonged Exposure Therapy for Adolescents; PFA, Psychological First Aid; RC, randomized controlled study; TF-CBT, Trauma-Focused Cognitive Behavioral Therapy; TLDP-A, Time-Limited Dynamic Psychotherapy for Adolescents; WL, waitlist; [a]The two treatment groups (immediate treatment and delayed treatment) were merged for the analysis; [b]The usual hazard education included reading of hazard-related materials and classroom discussions. In addition to the readings and classroom discussions, children in the emergency management education condition were given additional material related to hazard adjustments and guided interactions through homework to be completed with their parents; [c]Wolmer and colleagues[55] is a follow-up to an earlier study by the same group.[56]

Functional impairment and/or clinically-significant distress is an essential criterion for a diagnosis of PTSD.[60] Only ten (20.8%) of the studies in this review examined functioning.[13-15,20,24-26,33,36,55] For example, Wolmer and colleagues[55] asked teachers who were blind to the children's participation in the intervention program to assess the children on three domains of daily functioning: academic performance, social behavior, and general conduct in the academic setting. Because it is a key criterion in the diagnosis of many psychological disorders, and because it is closely related to the child's quality of life, functional impairment should be studied routinely as an outcome. Another three studies examined mental[37] or global[47,48] distress which are not included in the counts in **Table 3**.

Course of recovery in treatment samples

The choice of an intervention must be matched to the child's reactions and to the course of symptom development and recovery following exposure to disasters. La Greca and colleagues[61] identified three trajectories of posttraumatic stress symptoms (resilient, recovery, and chronic) in children exposed to Hurricane Andrew over the course of one year with assessments at 3, 7 and 10 mo post disaster, and with no intervention delivered by the authors. Although mean posttraumatic stress symptom scores decreased significantly over time in all three trajectories, the mean posttraumatic stress symptom score for children in the chronic trajectory (20%) remained above the clinical cut-off beyond seven months. Intervention studies speak to the intractable nature of post-disaster pathology. For example, despite demonstrated efficacy for both a clinic- and a school-based cognitive behavioral intervention in children 15 mo after Hurricane Katrina, Jaycox and colleagues[38] found that 65% of the children in the school-based group and 43% in the clinic group scored in the "at risk" range of PTSD at a follow-up assessment 10 mo post intervention. Wolmer and colleagues[55] noted that symptoms will subside in most children while some will continue to have difficulty even after intervention. The authors suggested that children with moderate or subclinical PTSD, who are at risk due to exposure and/or prior traumatic experiences, be followed and reevaluated over time after the intervention.

While PTSD reactions and anxiety are likely to occur early in the post-disaster course and to continue if untreated, depression may have later onset and may persist.[34] The course of symptom development and recovery may affect the response to interventions. For example, Goenjian and colleagues[35] failed to demonstrate a change in depression with their earthquake intervention, but depression increased in the control group from pre to post treatment. Brown and colleagues[12] found that the effect of their September 11 classroom intervention on depression was not sustained even for children who received a subsequent individual intervention that was associated with improvement in posttraumatic stress symptoms. Speculating that social support, not a component in the individual intervention, may have accounted for the improvement in depression in the classroom intervention, the researchers called for future research regarding interventions for depression.[12] Thus, service providers should consider the trajectory of disaster reactions in selecting interventions. Comprehensive evaluation and intensive and traditional treatment along with enhanced attention to social support may be needed for children who are at elevated risk and for those who suffer enduring clinical problems.

Preliminary Evaluation of the Evidence Base

A preliminary evaluation of the evidence base for child disaster mental health interventions requires a review of the research design of extant studies. An essential next step in intervention development will be to dismantle and evaluate specific intervention components and to compare various intervention techniques and modalities.

Research design

Clinical practice guidelines have prioritized studies using randomized controlled trials at the highest level in establishing the evidence base for trauma interventions.[62-65] The use of control groups makes it possible to determine

Table 3. Number of Studies by Design for Each Major Outcome

	Outcome	PTSD	Posttraumatic Stress Reactions	Depression	Anxiety	Functioning	Behavior Problems[c]	Somatic complaints	Anger	Fear	Grief
Total number (%) of studies that measured the outcome (Total = 48)		16 (33.3)	41 (85.4)	20 (41.7)	17 (35.4)	10 (20.8)	9 (18.8)	6 (12.5)	4 (8.3)	4 (8.3)	4 (8.3)
Number (%) of studies with pre-/post intervention assessment	Improved	15 (100.0)	32 (86.5)	13 (68.4)	11 (73.3)	8 (88.9)	4 (44.4)	4 (66.7)	3 (75.0)	2 (100.0)	2 (66.7)
	No Change	0 (0.0)	5 (13.5)	4 (21.1)	3 (20.0)	1 (11.1)	5 (55.6)	2 (33.3)	1 (25.0)	0 (0.0)	0 (0.0)
	Worse	0 (0.0)	0 (0.0)	2 (10.5)	1 (6.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)
	Total	15[a]	37	19	15	9	9	6	4	2	3
Number (%) of controlled trials	Superior	7 (70.0)	17 (60.7)	6 (42.9)	6 (50.0)	6 (85.7)	0 (0.0)	4 (66.7)	0 (0.00	1 (33.3)	0 (0.0)
	NSD	3 (30.0)	11 (39.3)	8 (57.1)	6 (50.0)	1 (14.3)	6 (100.0)	2 (33.3)	1 (100.0)	1 (33.3)	3 (100.0)
	Inferior	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (33.3)	0 (0.0)
	Total	10[b]	28	14	12	7	6	6	1	3	3

Notes: NSD, Non significant difference; [a]For the purpose of this review, an exact McNemar test using the data presented by the authors was performed for a pre-/post assessment of the treatment effect on PTSD diagnosis in the intervention group in six studies where the authors did not perform such evaluation.[14,18,20,25,26,38]; [b]For the purpose of this review, an independent chi-square test using the data presented by the authors was performed for a between-group comparison of the treatment effect on PTSD diagnosis in two studies where the authors did not perform a statistical test for such assessment.[14,25]; [c]Behavioral difficulties did not include ADHD or hyperactivity disorder.

if observed changes can be attributed to the intervention rather than to unrelated factors such as the mere passage of time.[66] Thus, it is encouraging that more than three quarters of the studies (n = 37, 77.1%) in this review used a controlled design. The types of controls included other therapeutic interventions (n = 11, 29.7%), non-treatment controls (n = 11, 29.7%), waitlist controls (n = 12, 32.4%), and placebo controls (n = 2, 5.4%). See **Table 2**. In another study following an earthquake, Mahmoudi-Gharaei and colleagues[42] compared four group interventions: group behavioral therapy, group behavioral therapy with art and sport interventions, art and sport interventions, and a waitlist control group. While PTSD symptoms did not decrease significantly with any of the interventions, PTSD symptoms increased in the waitlist group that received no intervention.

Randomized controlled trials, the gold standard for experimental studies, require a controlled design with participants randomly assigned to treatment arms to balance the groups regarding known and unknown factors that may be associated with treatment outcome. While more than one half (n = 23, 62.2%) of the controlled trials in this review randomly assigned individual participants to treatment groups, greater adoption of random assignment is needed to perform rigorous comparisons between different types of treatments. See **Table 2**.

Only one study found an inferior result for the intervention condition relative to the control condition.[39] Karairmak and Aydin[39] reported higher levels of fear in their intervention group compared with the control group post treatment. Fear was the only outcome measured for the trial and no pre/post test results were reported. Additionally, as discussed by the authors, the treatment control, labeled as "placebo," which included structured activities and games, may have had a therapeutic effect. Moreover, the duration of the intervention may have been too brief to confer benefit, and the involvement of parents may have improved the outcome.[39]

Dismantling interventions and comparing interventions

Few studies have tried to dismantle interventions to better identify the specific

components or techniques responsible for benefit or to better understand the mechanism of action for interventions. In their study of elementary-school children three years post Hurricane Katrina, Salloum and Overstreet[48] questioned the need for a structured trauma narrative as part of a coping skill-enhancement trauma and grief intervention though the investigators acknowledged that the children in their study who did not receive the structured trauma narrative did engage in discussion about their experiences. A related issue is the importance of sequencing of intervention components. Future investigations should identify the types and order of techniques, procedures, and activities for children's optimal recovery.

Relatively few studies have compared interventions. de Roos and colleagues[23] compared the effectiveness of EMDR and cognitive behavioral therapy in the treatment of children with trauma-related psychological symptoms after a factory explosion in the Netherlands. Both interventions were effective in reducing the symptoms, and their effects were not statistically different. Analyses revealed, however, that the cognitive behavioral intervention required more treatment sessions than EMDR to obtain similar results.[23] Gilboa-Schechtman and colleagues[20] found that participants who completed prolonged exposure therapy and those who completed time-limited dynamic therapy experienced a decrease in depressive symptoms, but the exposure group reported more improvement than did the dynamic therapy group after treatment and at six-month follow up. The superiority of exposure was not maintained at 17-mo follow-up, however.[20] It is unclear how important the early superior benefits associated with exposure therapy were for the adolescents in this study as key developmental changes and milestones may occur over brief periods of months in youth. Other studies have failed to support one intervention over another[26,38,44,47] suggesting that perhaps common factors among interventions (e.g., aspects of the therapeutic relationship, focused attention on the trauma history and reactions, expectation of benefit) may account for at least some of the benefit. Thus, the field awaits studies that dismantle interventions and those that compare interventions to determine which components and mechanisms of action are responsible for general and specific benefits.

Placing disaster intervention studies in the larger context of child trauma

The American Academy of Child and Adolescent Psychiatry practice parameter on the assessment and treatment of posttraumatic stress disorder (PTSD)[62] in children voices support for the use of trauma-focused cognitive behavioral interventions in traumatized children. More formal studies, however, have identified limitations in the extant intervention research for various forms of trauma. For example, in his 2006 review of randomized controlled trials of child trauma interventions, which included primarily cognitive behavioral interventions for sexually abused girls, Stallard[7] concluded that "deconstruction studies" are needed to determine the effective ingredients of interventions and to match intervention components to specific symptoms or conditions and the various demographics, experiences, and exposures of the children receiving them. Seeking to match treatment modalities with outcomes in sexually-abused children, a meta-analytic investigation found play therapy most effective for social functioning; cognitive behavioral therapy, abuse-specific, and supportive therapy best for behavior problems; cognitive behavioral therapy, family, and individual therapy most effective for psychological distress; and abuse-specific therapy, cognitive behavioral therapy, and group therapy most effective for low self-concept.[67] In a review of psychosocial interventions for traumatized children, Silverman and colleagues[6] also found support for cognitive behavioral therapy for PTSD outcomes but called for more rigorous large-scale studies. In a recent Cochrane review, Gillies and colleagues[68] (p. 21) also concluded that while there is "fair evidence for the effectiveness of psychological therapies," especially cognitive behavioral therapy, for the treatment of PTSD in children exposed to a range of traumatic experiences, there is "no clear evidence" that any one therapy is superior to others. Thus, intervention research is needed across all forms of childhood trauma.

Conclusions and Future Directions

The current review using a descriptive approach suggests that a variety of interventions reduce posttraumatic stress, depression, anxiety, behavior problems, traumatic grief, and other psychological, behavioral, and somatic reactions. Most investigations examined posttraumatic stress reactions, depression, and anxiety with fewer studying behavior problems, somatic complaints, anger, traumatic grief, fear, and functional impairment. An overreliance on the assessment of PTSD and posttraumatic stress reactions is imprudent as it fails to address the complexity and the spectrum of stress responses (e.g., internalizing, externalizing, and somatic symptoms) that emerge over the months and years that follow children's exposure to a disaster and to the ensuing secondary adversities.

The specific techniques responsible for the positive outcomes in the intervention studies examined thus far remain unclear. Numerous investigations found no significant differences in the intervention and control conditions.[26,38,44,47,48] It is possible that natural recovery and/or some common factors among interventions accounted for the benefit found with some interventions. Moreover, not every traumatized child requires structured intensive mental health treatment.[52,69] Many children exposed to disasters will recover with basic public health interventions such as psychoeducation and social support. Moreover, some children and their families will not desire intervention services after a disaster.[69] Because of the diverse posttraumatic trajectories children experience, not every child will benefit from the same set of services. Thus, those planning services must match interventions with the specific reactions and conditions experienced by the children being served and should consider adopting a stepped care approach where some services, such as public health interventions, are provided to all children, and other techniques are offered to children as indicated by their

clinical status.[12,70] The next generation of research should help to clarify which children require intervention and match specific interventions to children's needs.

To ascertain the effects of disaster mental health interventions and natural recovery on children's posttraumatic reactions, it is recommended that studies include control groups as well as other elements of well-designed studies such as clearly defined target symptoms, reliable and valid measures, blinded evaluators, assessor training, replicable interventions, random assignment, and treatment adherence measures.[71] This review did not examine the types of controls used or other elements of well-designed studies, but that is also necessary. A host of factors have the potential to influence the results of intervention studies including: (1) characteristics of the children who receive interventions, their disaster exposures and experiences, and their family and social situations; (2) additional factors related to the interventions and the context of service delivery; and (3) other methodological issues. For example, this review did not examine the developmental, cultural, or experiential characteristics of the children studied. Taking an all-hazards approach, the analysis also did not compare interventions used in disaster situations and those used for terrorism. Some, but not all, aspects of the interventions and details of service delivery are covered in a related publication.[59] Other methodological issues await evaluation, including the timing of intervention delivery, the effects of attrition from study, and the use and length of follow-up assessment. Future review studies should conduct quantitative assessments of child disaster outcomes.

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