

Children's Reactions to the 2010 Chilean Earthquake: The Role of Trauma Exposure, Family Context, and School-Based Mental Health Programming

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Theoretically derived factors (preexisting child characteristics, trauma exposure, caregiver-child relationship, and school-based mental health programming) were examined as potential correlates of distress in children residing in the region closest to the epicenter of the 2010 Chilean earthquake. One year before the earthquake, 2nd-grade students who attended 9 schools that provide government-run mental health intervention programs were assessed via parent and teacher reports for pre-intervention psychosocial difficulties. Between 3–6 months after the earthquake, a preexisting non-trauma focused, school-based intervention was delivered. Approximately 9 months post-earthquake, 117 of these children (randomly selected; mean age = 7.59), were interviewed about their experiences during the earthquake and their subsequent psychological responses. Children were exposed to multiple disaster-related traumatic events ($M = 4.90$; $SD = 1.78$); most reported posttraumatic stress (PTS) symptoms and 25.6% met criteria for the *Diagnostic and Statistical Manual of Mental Disorders*-defined (*DSM-IV-TR*; APA, 2000) probable PTSD. Female gender and exposure to violent, injurious, or death-related postdisaster traumas were correlated with PTS symptoms. Children's reports of characteristics of the home environment (conflict with their caregiver, caregiver unavailability to discuss the earthquake) were positively associated with PTS symptoms. Children's perceptions of caregiver unavailability to discuss the earthquake were associated with higher ongoing earthquake-related worry. Participation in the mental health intervention was associated with significantly lower earthquake-related worry and appeared to protect at-risk youth from elevated PTS symptomatology. Results suggest that participation in school-based mental health programs may be protective for children postdisaster and a negative family environment may be associated with increased postdisaster distress. Implications and potential applications of findings are discussed.

Keywords: children, earthquake, natural disaster, posttraumatic stress, school intervention

Children who experience a natural disaster frequently exhibit distress, including posttraumatic stress (PTS) symptomatology (Norris et al., 2002). Conceptual models of children's postdisaster adjustment, such as those proposed by Vernberg, La Greca, Sil-

verman, and Prinstein (1996), identify several important predictors of psychological outcomes, including preexisting child characteristics (Felix et al., 2011; Weems et al., 2007), qualities of the disaster experience (Vogel & Vernberg, 1993), and contextual

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factors in the social environment (i.e., home and school; Gil-Rivas, Kilmer, Hypes, & Roof, 2010; McFarlane, 1987). The current project integrated such constructs to explore factors associated with distress versus positive adaptation in children following a devastating set of disasters that hit a community in Latin America.

On February 27, 2010, an 8.8 magnitude earthquake struck off the coast of Concepción, Chile. This was the sixth strongest earthquake ever recorded; more than one million Chileans were impacted, over 500 people died, 12,000 experienced injury, and over 800,000 were displaced (United States Geological Survey, 2012). Similar to many other natural disasters (e.g., Hurricane Katrina, Superstorm Sandy), the earthquake was followed by a series of associated traumatic events: a destructive tsunami, which occurred without warning, and several days of looting in the regions closest to the epicenter. The tsunami was particularly devastating, as the earthquake occurred during a Chilean national holiday when many community members were camping near the coast.

Several preexisting childhood characteristics have been linked with postdisaster adjustment, including prior psychological difficulties (Asarnow et al., 1999; Lonigan, Shannon, Finch, Daugherty, & Taylor, 1991; Weems et al., 2007) and gender: females tend to be more at-risk (Furr, Comer, Edmunds, & Kendall, 2010; Lonigan et al., 1991; Vernberg et al., 1996), although not all research has supported this association (La Greca, Silverman, & Wasserstein, 1998). In addition, certain components of a disaster, such as threat to life (Green et al., 1991), personal loss (Lonigan et al., 1991), or morbid experiences such as having friends or family members die (Pfefferbaum et al., 2006), have been associated with significant psychological distress postdisaster. In a multifaceted community trauma (e.g., earthquake followed by community looting), such experiences may be particularly potent predictors of deleterious outcomes. In addition, cumulative exposure to disaster-related experiences (e.g., relocation only vs. relocation plus family-member death) can play an important role in postdisaster adjustment (Asarnow et al., 1999; Norris et al., 2002; Wu et al., 2006).

The Family Environment in Postdisaster Settings

Postdisaster outcomes may also be associated with characteristics of the home environment. Discussions with primary caregivers may provide children with social support and facilitate positive coping strategies, yet such interactions could be detrimental if distressed caregivers are unable to support their children's ability to express and process painful trauma-related emotions (Alisic, Boeije, Jongmans, & Kleber, 2012; Scheeringa & Zeanah, 2001). Indeed, parental distress after the 1983 Australian bushfire was a stronger predictor of child distress than the child's direct exposure to the disaster (McFarlane, 1987). Because caregivers are generally the child's primary resource for support (Robinson & Garber, 1995), a strained caregiver-child relationship might leave a child under-equipped to manage his or her distress. For example, an irritable and depressed family atmosphere predicted PTS in children assessed 2 years after the Buffalo Creek, West Virginia dam collapse (Green et al., 1991). Similarly, parent-child conflict and parental unavailability to discuss the trauma have been linked with children's poorer postdisaster outcomes (Gil-Rivas, Silver, Holman, McIntosh, & Poulin, 2007). Conversely, high quality fami-

lial communication may be protective. For example, 11 years after the Chernobyl nuclear disaster, children's perceptions of high-quality communication with caregivers (e.g., caregiver availability to discuss problems in general, fast and effective conflict resolution) appeared to protect families from negative psychological outcomes (Bromet et al., 2000). This study addressed familial communication in general, rather than disaster-related discussions specifically. However, after 9/11, adolescents reported that specific types of caregiver-child communication about the disaster (e.g., providing encouragement, emotional expression) appeared to be protective (Gil-Rivas et al., 2007).

The Importance of Schools After Community Disasters

The school setting is another important component of the child's social environment. After a disaster, when family resources are overburdened, schools may offer a critical platform for both distributing necessities (e.g., medical care) and providing a sense of safety and security in a physically and emotionally devastated community (Kilmer, Gil-Rivas, & MacDonald, 2010). A recent review suggested that school personnel (e.g., teachers, mental health professionals) may be efficacious at administering general, school-based, mental health interventions (Franklin, Kim, Ryan, Kelly, & Montgomery, 2012). Research on disasters has also indicated that schools may offer an effective and feasible setting to implement large scale postdisaster interventions for children (Chemtob, Nakashima, & Hamada, 2002). As such, there has been an increased interest in examining the benefits of mental health programs targeting children and their school teachers. For example, some school-based interventions train teachers in techniques to help mitigate distress and increase resilience in their pupils following community traumas (e.g., Berger, Gelkopf, & Heineberg, 2012; Wolmer, Hamiel, & Laor, 2011), or help teachers manage their own distress, a variable linked with negative post-disaster outcomes in students (Seyle, Widyatmoko, & Silver, 2013). Emerging research suggests that school-based mental health programs in place before a traumatic event may be efficacious at increasing resiliency and decreasing PTS symptoms in children (Wolmer et al., 2011). More research may help provide a framework for continued development of these programs, which may be particularly relevant in areas at high risk for future community disasters.

The Current Project

After the Chilean earthquake, the Junta Nacional de Auxilio Escolar y Becas (JUNAEB; translated as the Chilean Board of Assistantships and Scholarships), a government organization that runs school-based programs, invited our research team to explore correlates of postdisaster psychological outcomes in elementary school students. Of particular interest was an examination of the possible benefits of a preexisting, non-trauma focused, school-based mental health program on reducing postdisaster distress.

“Habilidades Para la Vida” (Skills for Life)

Since 1995, JUNAEB has run a government-funded mental health program for children, Skills for Life (SFL; “Habilidades para la Vida”), which is administered nationwide through a series

of activities conducted in the school setting. The programs are available in approximately 20% of the country's elementary schools and eligibility is based on school- and district-level risk factors such as low neighborhood socioeconomic status. Specifically, the Chilean Ministry of Social Development uses a survey that assigns family socioeconomic status according to quintiles of the population through an assessment of the family's revenue-generating capacity, combined family income, and family economic need (determined by family size and family member age and health status; Herrera, Larrañaga, & Telias, 2010). Of the JUNAEB students, 85% belong to the lower quintiles of the Chilean population.

The SFL program's design draws heavily on a three-tiered model recommended by the World Health Organization (WHO) and the U.S. National Academy of Sciences (NAS) guidelines for enhancing mental health in children (O'Connell, Boat, & Warner, 2009). SFL programming typically provides three tiers of activity sequences to children, their teachers, and families. In the first tier, children, teachers, and parents in participating schools receive mental health promotion or *universal prevention intervention* activities, which are designed to help any child enhance resiliency and build skills to improve functioning (e.g., time-management skills, effective conflict resolution, study skills). Supplemental specialized prevention programs—or *indicated (i.e., selective) prevention intervention* activities—are targeted toward children who are identified through a screening process as being vulnerable to future psychopathology. These activities, led by psychologists, social workers, and educators trained by JUNAEB, include 15 sessions for each at-risk student (two group sessions for teachers, three sessions for parents, and 10 for students). Teachers, typically 12 to a group, learn how to foster healthy behaviors to enhance their own wellbeing (e.g., stress-reduction activities), support students in their problem areas, and facilitate a more supportive classroom environment. Parents participate in three sessions (average group size is 15–20 parents), during the start, middle, and end of the intervention, in which they learn to understand and diminish their child's exposure to common family-level risk factors. Parents learn how to more effectively communicate with their children and their children's teachers, foster positive identity formation, and reduce stigma. These goals are accomplished through a variety of activities, including lectures, role playing, and group processing. In the third tier, children with severe risk are referred to outside mental health professionals for individual evaluation and treatment.

The 10 student sessions are 2 hr each and typically include 6–10 children. These workshops involve activities to enhance components of mental health, including self-efficacy, self-esteem, self-control, social skills, conflict resolution, and empathy. Workshop leaders may draw from a variety of activities designed by SFL program directors. Examples include teaching children to look at a mandala for a few minutes to calm down and keep quiet in the classroom, role playing a difficult situation, drawing pictures of painful emotions and then discussing healthy coping strategies, or having the group of children act out a conflict situation and then “freezing” the scene to explore an effective and nonhostile solution. Of note, activities are structured as game-like activities to keep children interested and engaged. Each session begins with a 10 minute introduction, followed by 2–3 activities, and ends with time for group processing and evaluation, where children express

what they learned in the session as individuals and as a group (see Guzman et al., 2011, for more detailed descriptions of the workshops). SFL has published several manuals that guide the interventions, although some flexibility and creativity is allowed in order to adapt to the needs of the individual school and/or child. Research has indicated that SFL programs are efficacious at improving school-wide academic achievement (George, Guzmán, Hartley, & Squicciarini, 2005). However, previous studies have not examined the benefit of SFL programs at improving children's mental health outcomes in general or in response to specific traumatic events.

In late 2009, as in previous years, JUNAEB screened approximately 50,000 first grade students across Chile for potential problems using the Teacher Observation of Classroom Adaptation—Revised (TOCA-RR); teachers rated each child on dimensions of hyperactivity, aggression, and emotional maturity (Kellam, Rebok, Mayer, Ialongo, & Kalodner, 1994). During the first part of second grade, local SFL teams worked with students identified as high-risk for psychosocial difficulties according to TOCA-RR teacher ratings, through the series of indicated prevention activities. As noted above, all first grade students in participating schools were offered universal prevention activities that focused on enhancing general abilities.

After the earthquake, the SFL activities near the epicenter were delayed, as the earthquake occurred the weekend before the start of the Chilean school year. In the most devastated areas, schools were closed from several days to several months. Immediately after the disaster, program staff provided basic support (e.g., crisis intervention, support groups, information on coping strategies) to children as a first response. The standardized, unmodified SFL universal and indicated prevention activities commenced when schools regained adequate administrative functioning (approximately 3–6 months after the earthquake).

Approximately 9 months after the earthquake, we sought to examine predictors of PTS symptomatology and ongoing distress, measured as earthquake-related worry, in children who lived near the epicenter. In addition to examining preexisting child characteristics and qualities of the disaster experience, we were particularly interested in exploring characteristics of the caregiver–child relationship that might be harmful or helpful, and in examining the potential ameliorative effects of children's participation in the SFL school-based mental health intervention. Based on prior disaster literature, we hypothesized that

Hypothesis 1: Personal characteristics of the child (i.e., female gender) would be associated with more PTS symptoms and earthquake-related worry.

Hypothesis 2: Qualities and frequency of exposure to violent and/or morbid experiences surrounding the earthquake would be associated with greater PTS symptomatology and earthquake-related worry.

Hypothesis 3: Contextual features of the postdisaster home environment, including child reports of caregiver–child conflict and caregiver unavailability to talk about the earthquake, would be associated with greater PTS symptomatology and earthquake-related worry.

Hypothesis 4: Participation in school-based mental health indicated intervention activities would buffer at-risk children

from experiencing greater PTS symptoms and earthquake-related worry compared with children who participated in universal prevention activities *only*. While past research suggests that predisaster mental health should predict postdisaster distress, given our sample's participation in the SFL activities, we hypothesized that children with predisaster vulnerability for psychosocial difficulties would not experience greater PTS and earthquake-related worry.

Method

Participants

About 9 months post-earthquake, a letter from JUNAEB and the Universidad de Concepción was sent home to caregivers of a randomly selected group of second-grade students ($N = 119$) from nine elementary schools in the Bío-Bío region of Chile (the site of the greatest devastation during and following the earthquake, tsunami, and proximate looting) inviting their child's participation in a study of responses to the disaster. Because all caregivers had previously provided consent for their children to participate in JUNAEB activities and ongoing assessments, passive consent was obtained from caregivers for this specific study. Only second-grade students were selected as these were the students who most recently participated in the SFL mental health programs. Approximately 35–40 second-grade students attended each school; we recruited from a variety of schools in order to increase community representativeness and minimize school and/or teacher effects that might bias results. One caregiver declined and one child was deemed ineligible due to cognitive deficits, yielding a 99.2% participation rate. All students had participated in the immediate crisis interventions and, approximately 3–6 months after the earthquake, the SFL universal prevention activities; 28.2% ($N = 33$) who were identified as at-risk by their 2009 TOCA-RR scores also participated in the indicated prevention activities.

The mean age of children was 7.59 ($SD = 0.65$), most (93.16%) were 7–8 years old; 57.26% ($n = 67$) were male.¹ A majority were either in Concepción (45.15%, $n = 54$) or Talcahuano (44.30%, $n = 53$) at the time of the earthquake (both located approximately 60 miles southeast of the earthquake's offshore geological epicenter); 3.42% ($n = 4$) were in the rural area immediately surrounding Concepción, 2.56% ($n = 3$) were in the Santiago area, and 2.56% ($n = 3$) did not know or declined to report their location. All children were from a similar economic background as low SES is a key selection criteria for SFL school eligibility; male and female children were equally likely to be assigned participation in SFL indicated prevention activities, $\chi^2(1) = 0.11, p = .744$.

Procedure

Chilean psychology graduate students interviewed all students individually between November 30 and December 29, 2010 at a private location in the children's school. Children provided verbal assent; none declined participation. Interviews were conducted in Spanish and took approximately 30 minutes to complete. All instruments were translated and back-translated and checked for linguistic and cultural accuracy by bilingual researchers fluent in Chilean Spanish and were modified accordingly. Interviewers were blind to the results of the 2009 JUNAEB screening of

behavioral and emotional difficulties and to the risk profiles of the children assessed by teachers and parents (see below), although these results were subsequently linked to postdisaster outcomes.

All procedures for this study were approved by the institutional review boards of the University of California, Irvine, and the Universidad de Concepción.

Materials/Measures

Teacher Observation of Classroom Behavior Revised for Chile (TOCA-RR). The TOCA is a brief structured interview administered by a trained assessor. Teachers respond to items regarding students' adaptation to classroom task demands as a way to identify those with psychosocial problems. Items are scored on a seven-point Likert scale from 0 (*never*) to 6 (*always*) and consist of six problem-specific subscales: acceptance of authority (AA; e.g., frequent lying, protests rules, fights with classmates, reacts negatively to criticism or failure), social contact (CS; e.g., overly inhibited or shy, has few friends), cognitive achievement (LC; e.g., not interested in learning, not able to work alone), concentration problems (AC; e.g., does not pay attention in class, easily distracted), emotional maturity (ME; e.g., needs constant attention from teacher, clings to peers), and hyperactivity (NA; e.g., unable to sit still, gets up to walk around during class). The TOCA-RR measure was translated, adapted twice and validated for the Chilean context (de la Barra, Toledo, & Rodríguez, 2005; Guzman et al., 2011). Mental health risk is determined by cut-off scores on the six problem-specific subscales (for details see Guzman et al., 2011). The TOCA-RR was validated in Chile in 1999 in a sample of 3,539 first grade students from 59 different JUNAEB-affiliated schools. Reliability on the subscales was excellent or very good: $\alpha = .95$ (AA); $\alpha = .95$ (CS); $\alpha = .81$ (LC); $\alpha = .74$ (ME); $\alpha = .90$ (AC); and $\alpha = .84$ (NA; George et al., 2004). First-grade TOCA-RR cut-offs are determined by percentile ranks based on Chilean national samples to determine children's risk profiles and thus to assign children to the universal prevention versus universal plus indicated prevention activities administered in the second grade. Children who are above the 75th percentile on AA, CS, LC, or ME, or above the 85th percentile on AC or NA, are considered at risk for problems and are assigned to the indicated prevention activities.

Pediatric Symptom Checklist for Chile (PSC-CL). The PSC (Jellinek, Murphy, & Burns, 1986) is a widely implemented psychosocial screen used as a proxy for overall child mental health (Kelleher, McInerney, Gardner, Childs, & Wasserman, 2000) and has indicated a high correlation with psychosocial problems and psychopathology (cf. Guzman et al., 2011). The 33-item PSC-CL was extensively adapted for the Chilean context through an iterative process involving parents, psychologists, and education professionals (de la Barra et al., 2005; George et al., 1995). Field studies indicated good reliability of the PSC-CL ($\alpha = .85$); in our sample reliability was excellent ($\alpha = .94$). The PSC assesses problematic behaviors (e.g., stealing) and emotional problems (e.g., cries easily, feels worthless). Caregivers rate the frequency of these symptoms as 1 (*never*), 2 (*sometimes*), or 3 (*frequently*). Parents completed this measure when their children were in first

¹ Unequal gender distribution was due to random selection of participants.

grade at a parent–teacher conference or in special circumstances at home with detailed instructions. Scores were totaled to create a continuous measure of child emotional and behavioral problems.

Disaster-related trauma exposure. Trauma exposure was assessed with a modified child-specific version of Part 1 of the UCLA-Posttraumatic Stress Reaction Index Revision 1, Spanish adaption (UCLA-PTSD RI-1; Pynoos, Rodriguez, Steinberg, Stuber, & Frederick, 1998), which was tailored to assess exposure to 12 potentially traumatic events associated with the Chilean earthquake and its aftermath. A continuous measure of disaster-related trauma exposure was created by summing all 12 items. Previous studies have used Spanish versions to assess trauma exposure (Loeb, Stettler, Gavila, Stein, & Chinitz, 2011).

Caregiver–child conflict. The nature and frequency of caregiver–child conflict was assessed by a 7-item scale developed for young children (Gil-Rivas et al., 2010; Greenberger & Chen, 1996). Children reported how often they argued or fought with their primary caregivers about schoolwork, chores, routines, appearance, respect, obedience, and relationships with other family members. Children answered on a scale of 0 (*never*) to 3 (*almost always*); reliability was adequate ($\alpha = .74$). Because this variable was not normally distributed, a dichotomous variable was created, with scores in the highest tertile classified as “high conflict.”

Caregiver unavailability to discuss the earthquake. Children were asked to report how often in the past month their caregiver did not want to talk with them about the earthquake and its aftermath (Gil-Rivas et al., 2010; Gil-Rivas et al., 2007). Responses ranged from 0 (*never*) to 3 (*almost every day*).

Posttraumatic stress symptoms. Twenty numbing/avoidance, re-experiencing, and arousal symptoms were assessed with the Spanish version of the child UCLA PTSD RI-1 (Pynoos et al., 1998) on a scale from 0 (*none of the time*) to 4 (*most of the time*). Scores were computed according to standardized scoring instructions (Steinberg, Brymer, Decker, & Pynoos, 2004): (a) by the recommended cutoff of 38 (Rodriguez, Steinberg, Saltzman, & Pynoos, 2001), and (b) by symptom-cluster scoring method based on *DSM-IV* diagnostic criteria (American Psychiatric Association, 2000); responses with a score of 2 or greater were counted as present. Numerous studies have indicated high psychometric properties of the UCLA-PTSD RI-1; Cronbach's alpha is typically greater than .90 and the measure demonstrates high test–retest interitem agreement with *DSM* criteria (Steinberg et al., 2004). Reliability in our sample was good ($\alpha = .85$). The UCLA-PTSD RI-1 was designed for use with children aged 7–18 and should be verbally administered to children under 12 (Steinberg et al., 2004); Spanish versions have been used in prior research (e.g., Mintzer et al., 2005). A continuous measure of PTS symptomatology was used in inferential statistics in order to best incorporate data from children whose scores were close to the diagnostic cutoff point (cf. MacCallum, Zhang, Preacher, & Rucker, 2002).

Ongoing earthquake-related worry. This two-item measure, modified from the Vaughan Perceived Risk scale (see Silver, Holman, McIntosh, Poulin, & Gil-Rivas, 2002), asked children to report from 0 (*never*) to 4 (*all of the time*) how often in the past month they had experienced worry and fear about aftershocks and future earthquakes. Interitem correlation was excellent ($\alpha = .86$); the two items were averaged. An indicator of high versus low worry was also generated by dichotomizing the measure at the midpoint (scores of 2 or greater were considered high worry).

Analytic Strategy

All analyses were conducted using STATA, Version 11.0 (STATA Corp., College Station, TX). Descriptive statistics were used to examine exposure to the earthquake and identify percentages of children who met criteria for probable PTSD and high levels of earthquake-related worry. Bivariate correlations between each of 12 potential disaster-related exposures and continuous levels of PTS symptoms and ongoing earthquake-related worry were conducted.

Multiple regression analyses were then used to identify significant contributors to these outcomes using a hierarchical variable entry strategy. Variables were analyzed in the following conceptually meaningful blocks: 1) preexisting characteristics of the child (gender, parent reports of pre-earthquake mental health), 2) number of disaster-related trauma exposures, and 3) student reports of the post-earthquake caregiver relationship and school context variables (i.e., participation in universal vs. universal plus indicated prevention school-based programming). As teacher reports (i.e., TOCA-RR scores) were used to obtain child risk profiles that established assignment to the indicated prevention activities, they were not included in inferential statistics.

Results

Table 1 depicts children's exposure to disaster-related traumas; mean traumatic events reported was 4.90 ($SD = 1.78$; range = 0–9). Continuous scores of PTS symptoms ranged from 3–61 ($M = 28.21$, $SD = 13.66$); most children reported some PTS symptomatology and a substantial percentage met criteria for probable PTSD (55.56% based on *DSM-IV* criteria (APA, 2000) and 25.64% based on a 38-summed score cutoff point; see Table 2). As Table 2 illustrates, children who participated in the indicated prevention activities exhibited lower rates of probable PTSD and higher levels of ongoing earthquake-related worry when compared with children who participated in the universal prevention activities only, although these differences were not statistically significant. Mean worry for children assigned to indicated prevention activities was 1.58 ($SD = 0.98$) and for children assigned to universal prevention activities only was 2.06 ($SD = 1.24$); this difference was statistically significant $t(115) = 2.07$, $p = .025$. In bivariate correlation analyses, four disaster-related traumas were significantly associated with PTS symptomatology: witnessing the

Table 1
Disaster-Related Exposure ($N = 117$)

Event	%	Yes	No
Felt earthquake	86.3	101	16
Awakened by earthquake	67.5	79	38
Saw destruction of earthquake	76.1	89	28
Saw destruction of tsunami	59.8	70	47
Witnessed rioting	59.8	70	47
Temporary relocation	39.3	46	71
Permanent relocation	12.0	14	103
Familial material loss	30.8	36	81
Injury to self	7.7	9	108
Knew injured person	17.1	20	97
Knew someone who died	11.1	13	104
Saw a dead body	22.2	26	91

Table 2
Posttraumatic Stress Symptomatology and Ongoing Earthquake-Related Worry (N = 117)

Symptom	N	%	SE
Re-experiencing (1 or more symptoms)	103	88.03	.03
Avoidance (3 or more symptoms)	73	62.42	.04
Arousal/Worry (2 or more symptoms)	90	76.90	.05
Total % with probable PTSD based on <i>DSM-IV</i> criteria	66	56.41	.05
% of children in SFL indicated prevention programs	19	51.53	.08
% of children in SFL universal prevention programs	47	58.75	.05
Total % with probable PTSD based on 38 cutpoint	30	25.64	.04
% of children in SFL indicated prevention programs	7	18.92	.05
% of children in SFL universal prevention programs	23	28.75	.05
Total % of children who reported high ongoing worry	66	56.91	.05
% of children in SFL indicated prevention programs	16	43.24	.08
% of children in SFL universal prevention programs	50	62.50	.05

Note. SFL = Skills for Life.

riots ($b = 5.93$, $SE = 2.53$, $p = .021$), experiencing earthquake-related injury ($b = 13.50$, $SE = 4.59$, $p = .004$), knowing someone who was injured ($b = 8.31$, $SE = 3.28$, $p = .013$), and seeing a dead body ($b = 7.65$, $SE = 2.97$, $p = .011$). When combined in a multiple regression, witnessing the riots ($b = 4.98$, $SE = 2.43$, $p = .043$) and personally experiencing earthquake-related injury ($b = 9.90$, $SE = 4.62$, $p = .034$) were most strongly associated with PTSD symptoms.

Table 3 presents standardized and unstandardized regression coefficients for predictors of PTSD symptoms. Female gender, disaster-related trauma exposure, caregiver-child conflict and caregiver unavailability to discuss the earthquake and its aftermath were positively associated with PTSD symptoms; gender effects were not significant after adjusting for home and school context variables (see Step 3). At-risk children who participated in the

universal plus indicated prevention programming did not report significantly more PTSD symptoms compared with children not "at-risk" who participated in universal prevention activities only.

Table 4 presents standardized and unstandardized regression coefficients for predictors of ongoing earthquake-related worry. Ongoing earthquake-related worry was positively associated with female gender (see Step 1) and disaster-related trauma exposure (see Step 2); these effects were not significant in the final model (see Step 3). Participation in indicated prevention activities was significantly associated with less earthquake-related worry in a bivariate regression ($b = -.48$, $SE = .23$, $p = .041$). These differences were significant after adjusting for all other variables in the final model (see Step 3). Child reports of caregiver unwillingness to discuss the earthquake and its aftermath predicted increased ongoing worry (see Step 3). Ongoing earthquake-related worry was strongly correlated with PTSD symptoms ($r = .57$).

Discussion

Natural disasters can have devastating consequences for children's mental health. Most children in our sample reported high levels of PTSD symptomatology and a substantial portion met criteria for probable PTSD. Variables in the three key domains (child characteristics, trauma exposure, and factors in the home and school) were associated with postdisaster responses. Trauma exposure and characteristics of the caregiver-child relationship were associated with increased PTSD, after controlling for other predictors. Ongoing earthquake-related worry was positively associated with caregiver unavailability to discuss the disaster; participation in the SFL indicated prevention activities was associated with lower levels of ongoing worry. Caregiver reports of child mental health collected pre-earthquake were not significantly associated with postdisaster outcomes, potentially a consequence of the ameliorative effects of the SFL indicated prevention programming. Given that research has indicated long-term deleterious effects of exposure to natural disasters (see Garfin & Silver, in press, for a review), such findings could be particularly relevant in terms of promoting positive adjustment over time.

Our findings are consistent with research indicating differential emotional expression and behavioral symptoms between boys and

Table 3
Predictors of Posttraumatic Stress Symptomatology (N = 117)

Variable	Step 1			Step 2			Step 3		
	β (SE)	b (SE)	p	β (SE)	b (SE)	p	β (SE)	b (SE)	p
Gender ^a	0.42 (0.19)	5.74 (2.58)	.028	0.38 (0.18)	5.19 (2.50)	.040	0.34 (0.18)	4.65 (2.40)	.056
Pre-earthquake PSC ^b	0.07 (0.08)	0.09 (0.13)	.472	0.02 (0.09)	0.03 (0.13)	.829	-0.01 (0.09)	-0.01 (0.12)	.956
Disaster-related trauma exposure				0.28 (0.09)	2.17 (0.72)	.003	0.24 (0.09)	1.88 (0.71)	.009
Participation in SFL indicated prevention activities ^c							-0.18 (0.20)	-2.42 (2.78)	.387
Caregiver-child conflict ^d							0.44 (0.20)	5.96 (2.68)	.028
Caregiver unavailability to discuss the earthquake							0.21 (0.08)	2.89 (1.07)	.008
Model statistics	$R^2 = .05$, $F(2, 111) = 2.66$, $p = .074$			$R^2 = .119$, $F(3, 110) = 4.97$, $p = .003$			$R^2 = .21$, $F(6, 107) = 4.77$, $p = .002$		
Incremental R^2 change				$\Delta R^2 = 0.07$, $F(1, 110) = 9.20$, $p = .003$			$\Delta R^2 = 0.09$, $F(3, 107) = 4.14$, $p = .008$		

Note. SFL = skills for life.

^a Gender coded 0 = male, 1 = female. ^b Parent reported emotional and behavioral problems. ^c Participation in SFL indicated prevention activities coded 0 = no, 1 = yes. ^d Conflict coded 0 = low conflict, 1 = higher conflict.

Table 4
Predictors of Ongoing Earthquake-Related Worry (N = 114)

Variable	Step 1			Step 2			Step 3		
	β (SE)	b (SE)	p	β (SE)	b (SE)	p	β (SE)	b (SE)	p
Gender ^a	0.38 (0.19)	0.45 (0.23)	.046	0.35 (0.19)	0.42 (0.22)	.063	0.31 (0.18)	0.37 (0.21)	.085
Pre-earthquake PSC ^b	0.03 (0.09)	0.00 (0.01)	.773	-0.10 (0.01)	-0.00 (0.01)	.908	-0.01 (0.09)	-0.00 (0.01)	.938
Disaster-related trauma exposure				0.23 (0.10)	0.15 (0.06)	.020	0.17 (0.09)	0.11 (0.06)	.078
Participation in SFL-indicated prevention activities ^c							-0.43 (0.21)	-0.15 (0.25)	.038
Caregiver-child conflict ^d							0.34 (0.20)	0.41 (0.24)	.089
Caregiver unavailability to discuss the earthquake							0.22 (0.08)	0.26 (0.09)	.007
Model statistics	$F(2, 111) = 2.05, p = .133, R^2 = .036$			$F(3, 110) = 3.29, p = .023, R^2 = .082$			$F(6, 107) = 4.15, p < .002, R^2 = .188$		
Incremental R^2 change				$\Delta R^2 = 0.047, F(1, 110) = 5.61, p = .004$			$\Delta R^2 = 0.106, F(3, 107) = 4.68, p = .004$		

Note. SFL = skills for life.

^a Gender coded 0 = male, 1 = female. ^b Parent-reported emotional and behavioral problems. ^c Participation in SFL-indicated prevention activities coded 0 = no, 1 = yes. ^d Conflict coded 0 = low conflict, 1 = higher conflict. *N* differs due to missing data.

girls. In general, the literature on developmental psychopathology has indicated that girls are more likely to express submissive emotions such as sadness and anxiety, while males are more likely to express anger and to show overt aggression (Fivush & Buckner, 2000). These differences in emotional expression have been shown to contribute to the development during childhood of externalizing problems (e.g., aggressive and disruptive behaviors, hyperactivity) among boys and internalizing difficulties (e.g., depression, anxiety) among girls (Chaplin, Cole, & Zahn-Waxler, 2005). Furthermore, girls are more likely to ruminate or focus on the causes and negative consequences of stressful or traumatic experiences compared with boys (Broderick & Korteland, 2002). Such processes likely contribute to girls' reports of higher worry and PTS symptoms in the wake of a traumatic or stressful event. Of course, this does not mean that boys will not report worry and anxiety after a disaster; indeed, many boys in our sample reported distress symptoms. Nonetheless, such differences support the need for further development of gender-specific interventions following traumatic events. A program like the indicated prevention activities in SFL may be beneficial toward this end, as the program offers a variety of therapeutic tools and allows for creativity and adaptation as they are administered.

Children's Exposure to Disaster-Related Traumas

Witnessing the post-earthquake looting, seeing a dead body, and injury to self or others, were most strongly associated with PTS, suggesting that community violence, disturbing images, and physical trauma may be particularly distressing to children after disasters. These experiences may remind children of threats to their life, one of the strongest predictors of PTSD in children (Furr et al., 2010). Such findings emphasize the importance of maintaining a feeling of safety in the aftermath of a disaster and of protecting children from unnecessary visual exposure to community destruction (e.g., closely monitoring children's whereabouts, restricting access to highly damaged areas, limiting exposure to disaster-related media coverage). In general, increased exposure to disaster-related traumatic events was associated with higher PTS symptoms, bolstering research regarding the cumulative effects of

multiple stressors on postdisaster PTS (e.g., Furr et al., 2010; Norris et al., 2002).

Importance of Family Communication

The present study highlights the importance of familial communication after a community trauma. Our work extends previous postdisaster research and indicates that children's perceptions of their caregivers' availability to discuss a collective trauma in the short-term aftermath may be protective against children's distress (Bromet et al., 2000; Gil-Rivas et al., 2007). Through open communication, caregivers may be able to help their children make meaning of negative events, feel more connected to their community, or find hope in the wake of a disturbing situation, all factors that may contribute to positive postdisaster outcomes (cf. Walsh, 2007). When designing postdisaster interventions, policymakers and clinicians should consider the value of training caregivers in effective ways to communicate with their children. Caregivers should be told how to answer questions honestly, provide information to children in an age-appropriate manner, and instill in their children an understanding that some distress is normative (Kar, 2009). Other examples of beneficial communication strategies may include teaching the caregiver how to more effectively listen to the child's concerns and find hope and optimism in the wake of a traumatic event (Boss, Beaulieu, Wieling, Turner, & LaCruz, 2003). Qualitative research after 9/11 indicated that community-based approaches that focus on the family system as a means to help children deal with loss have been endorsed as effective and helpful by participants (Boss et al., 2003). Such interventions may be particularly important after community traumas when caregivers must manage their own distress in addition to that of their children. A school-based platform may be a useful mechanism for distributing such resources to families in afflicted communities (e.g., Kilmer et al., 2010; Pynoos, & Nader, 1988).

Postdisaster School-Based Interventions

Although children who participated in the supplemental indicated prevention activities were at-risk for mental health problems

according to their teacher assessments in the year prior to the earthquake, these children reported less earthquake-related worry and did not report significantly higher levels of PTS relative to children who had not been classified at risk in first grade. These findings suggest that a low-cost, school-based program, especially one with a focus on developing enhanced emotion regulation and academic capabilities, may have helped lessen the severity of postdisaster psychological distress in children at risk for psychopathology. These findings are congruent with emerging work suggesting that improved cognitive abilities and self-regulation skills in children may be protective against psychological distress after disasters (see Masten & Narayan, 2012, for a discussion). Although we were not able to randomly assign students to these programs as eligibility was predetermined by preexisting criteria established prior to the earthquake, our findings support the benefit of future research on the efficacy of such programs for enhancing postdisaster resiliency. In Chile specifically, JUNAEB programs, which have a strong presence in many communities, may also be an effective way to distribute postdisaster resources. More generally, these findings are relevant to the call for community-based psychological intervention capabilities to be in place before a disaster (i.e., Kilmer et al., 2010), especially in areas with a high likelihood of future catastrophes.

We note here that some components of the pre-existing indicated prevention activities administered in the Chilean school system (e.g., being mindful of the present moment, learning to express feelings, formulating more positive relationships, building skills to manage maladaptive cognitive and emotional patterns) share features with interventions designed specifically for children posttrauma (see American Academy of Child & Adolescent Psychiatry, 1998; Chemtob et al., 2002; Vernberg et al., 2008). Participation in these activities may have decreased the higher levels of postdisaster distress typically exhibited by at-risk children. Programming developed to enhance children's educational outcomes in general may be readily modified to include trauma-specific components. Expanding extant school programs to include such elements may be an effective way to reach—and assist—children in the aftermath of disasters.

Strengths and Limitations

Three different informants (child, parent, and teacher) reported on child mental health in the domain where each could provide the most reliable evaluation. Meta-analyses (Achenbach, McConaughy, & Howell, 1987; Duhig, Renk, Epstein, & Phares, 2000) have indicated low concordance of child, teacher, and caregiver reports of child behavior and mental health problems. Furthermore, the validity of informant report may be both setting- (e.g., school vs. home) and outcome- (e.g., behavioral problems vs. internalizing symptoms) dependent. In the present study, teachers provided assessments of classroom behavior (used to assign placement in universal prevention vs. universal prevention plus supplemental indicated prevention activities), caregivers provided assessments of adjustment in the home, and each child was interviewed about his or her PTS symptoms and ongoing worry about future earthquakes. Ascertaining children's symptoms via child interviews is valuable after a community disaster as this method allows for direct child reports of symptomatology rather than relying on caregivers for symptom reports. This is important because parents'

own postdisaster distress may bias interpretations of their child's adjustment (Eisenberg & Silver, 2011). Moreover, the use of interviews allowed us to collect data from children who might not be able to accurately report on their symptoms and experiences using a paper and pencil measure. Thus, the collection of data via interviews of children within a school setting postdisaster is a methodological strength of our study, given the dearth of postdisaster studies conducted in schools that assess children's distress in this fashion.

Of note, our study was conducted in Latin America in a seismically active region of the world likely to experience future earthquakes. Although six of the 12 strongest recorded earthquakes have occurred near South America's Pacific Coast (United States Geological Survey, 2012), very few postdisaster studies have been conducted in the region. It is important to conduct research in international contexts, as North American and European models of distress responses and community intervention may vary from those in other cultures (see Draguns & Tanaka-Matsumi, 2003, for a review). Furthermore, given the vulnerability of low socioeconomic populations to increased psychopathology after disasters (e.g., Foa, Stein, & McFarlane, 2006; Kar et al., 2007), our study highlights a potential way that communities can protect children with affordable, effective, school-based interventions, even in areas with limited financial resources.

Several limitations of this study must be acknowledged. First, although our study helps elucidate disaster responses in children ages 7–9, the truncated age range limits generalizability and we are unable to test for developmental differences by age. Future studies should include a wider age range given evidence that children of different ages may be differentially impacted by features of the postdisaster environment (e.g., caregiver–child conflict, witnessing traumatic images) (Eisenberg & Silver, 2011; Masten & Narayan, 2012). Second, all child reports of earthquake exposure were collected retrospectively. Third, our study is limited by a small sample size that did not allow for testing complex potential interactions between variables. However, random selection of students from classrooms and our exceptionally high participation rate (99%) minimizes potential confounds typically associated with volunteer samples and nonresponse. Fourth, we did not collect postdisaster data from parents or teachers. This would have strengthened our study as parents, teachers, and children may have divergent assessments of a child's emotional distress and important nuances in the family dynamic could not be evaluated. While the use of different informants is a strength of our study, it may also offer an explanation for the nonsignificant relationship between pre-event parent-reported distress and children's reports of their own postdisaster distress. Fifth, caregiver unavailability to discuss the earthquake was assessed by a single item measure, albeit one that had been used in prior disaster studies. Nonetheless, future research should explore the development of a multi-item scale of this construct. Likewise, our measure of ongoing earthquake-related worry was only a two-item measure. Finally, as noted above, students were not randomly assigned to participate in the school-based universal versus indicated prevention activities as the indicated prevention activities were only administered to “at-risk” children (see Collins, Woolfson, & Durkin, 2014, for a discussion of this methodological challenge). Future research examining SFL programming in the postdisaster context should include a control group or matched comparison sample. Given the

extremely high rates of PTS exhibited by children in our sample, this would also help rule out a ceiling effect (i.e., high level of overall child distress minimized differences between risk categories) as a potential confound.

Overall, the present study supports theoretical models that posit that postdisaster child distress is impacted via a variety of risk factors in multiple domains of the child's life. Our project is unique in that we interviewed children highly exposed to a multifaceted community disaster and included prospective assessments of their pre-earthquake mental health. This study highlights the components of the disaster experience that may be particularly traumatizing to children and indicates specific caregiver-child relationship characteristics that may be associated with distress. Results suggest that school-based mental health programming may be a promising avenue for alleviating distress in children exposed to natural disasters and other community-wide traumas. Our study underscores the multidimensional context of the disaster experience for children and may help inform the design of disaster-specific programs for schools located in high-risk areas.

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