

Symptoms of Posttraumatic Stress in Children After Hurricane Andrew: A Prospective Study

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The authors examined symptoms of posttraumatic stress in 3rd–5th grade children during the school year after Hurricane Andrew. From a conceptual model of the effects of traumatic events, 442 children were evaluated 3, 7, and 10 months postdisaster with respect to (a) their exposure to traumatic events during and after the disaster, (b) their preexisting demographic characteristics, (c) the occurrence of major life stressors, (d) the availability of social support, and (e) the type of coping strategies used to cope with disaster-related distress. Although symptoms of posttraumatic stress disorder (PTSD) declined over time, a substantial level of symptomatology was observed up to 10 months after the disaster. All 5 factors in the conceptual model were predictive of children's PTSD symptoms 7 and 10 months postdisaster. Findings are discussed in terms of the potential utility of the model for organizing thinking about factors that predict the emergence and persistence of PTSD symptoms in children.

The extent of pain, anguish, and suffering caused by Hurricane Andrew, one of the worst natural disasters ever to occur in the history of the United States, is difficult to convey. This Level 4 hurricane, with winds exceeding 160 miles per hour, destroyed or severely damaged over 125,000 homes in an area of 400 square miles, leaving 175,000 children and families temporarily homeless, bewildered, and without adequate food or supplies (Miami Herald Press, 1992). In the wake of such a devastating natural disaster, one could not help but wonder about the children. What were their reactions? Would their reactions persist over time? Can children who may show long-term reactions be identified? And, what factors influence changes in reactions over time? Unfortunately, no clear answers to these important questions could be drawn from the clinical research or disaster literature.

Regarding the initial effects of disasters on children, earlier findings suggested that symptoms of posttraumatic stress disorder (PTSD) were a common reaction to trauma. It is just recently, however, that this notion has been studied in children following natural disasters (Lonigan, Shannon, Finch, Daugherty, & Taylor, 1991; Shannon, Lonigan, Finch, & Taylor, 1994; Sullivan, Saylor, & Foster, 1991). PTSD symptoms can be very debilitating and interfere with children's functioning. Children with symptoms of posttraumatic stress experience intrusive thoughts or dreams of the disaster (i.e., reexperiencing symptoms), feelings of detachment or avoidance of disaster-related activities (i.e., psychic numbing or avoidance symptoms), and difficulty sleeping or concentrating (i.e., hyperarousal symptoms; *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed.; *DSM-IV*; American Psychiatric Association, 1994). Consonant with growing evidence that PTSD is a common reaction to natural disasters, we found a high prevalence of PTSD symptoms in a sample of 568 children surveyed 3 months after Hurricane Andrew (Vernberg, La Greca, Silverman, & Prinstein, 1996). Specifically, 30% of the children reported severe or very severe levels of PTSD symptomatology. In fact, 60% had "thought they might die" during the storm.

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In this study, we extend our previous work by addressing questions regarding the persistence of children's PTSD symptoms and the early identification of children who show reactions over time. In a recent review of the child disaster literature, Green (1991) identified only four studies that had examined the effects of natural disasters prospectively (Dollinger, 1985; Galante & Foa, 1986; Green et al., 1994; McFarlane, 1987). However, it is difficult to draw firm conclusions from these studies because they varied with respect to the types of disasters examined, the ages of the children studied, the length of the follow-up periods, and the types of outcomes measured. Fur-

thermore, none of the studies examined the impact of a major hurricane over time, and only one (Green et al., 1994) examined PTSD symptomatology among the child victims. Thus, it is unclear whether PTSD symptoms would persist over time following such a disaster.

Because of the paucity of prospective research, there is also little known about the identification of children who show persistent PTSD symptoms following a natural disaster or about the factors that contribute to changes in children's symptomatology. Such information might enable school or mental health professionals to intervene early in the recovery process, to reduce children's current distress and perhaps prevent future problems. Thus, this investigation identified several factors likely to be predictive of children's PTSD symptoms over the school year following Hurricane Andrew, as well as factors associated with changes in reactions over time.

This study was guided by an integrated conceptual model (Figure 1), derived from previous theory and research (e.g., Green, 1991; Green et al., 1991; Korol, 1990; Pynoos & Nader, 1988). The model assumes that the factors influencing children's postdisaster reactions are multiple and complex, and it includes characteristics of the stressor, the child, and the postdisaster environment. The utility of this conceptual model for understanding children's postdisaster reactions 3 months after Hurricane Andrew was demonstrated by Vernberg et al. (1996). Specifically, 62% of the variance in children's posttraumatic stress symptoms was accounted for by the primary factors in this conceptual model, and each factor improved overall prediction of PTSD symptoms when entered in the order specified by the model. These promising results justified further examination of the model's utility. Thus, the current investigation was

guided by this model, with refinements made for the prospective nature of the work.

There is general consensus that the first factor in the model, exposure to traumatic disaster-related experiences, is the most critical factor for the emergence of PTSD symptomatology (e.g., Eth & Pynoos, 1985; Green, 1991; Lonigan et al., 1991). Reports of frightening, life-threatening events that occur during natural disasters, and the loss and disruption that follow such disasters are two aspects of exposure most frequently associated with children's postdisaster reactions (e.g., Burke, Moccia, Borus, & Burns, 1986; Green et al., 1991; Lonigan et al., 1991). Indeed, both life-threatening experiences during Hurricane Andrew, and loss and disruption following the hurricane (primarily in the form of loss of possessions and housing, and disruption of familiar roles and routines) were strong predictors of children's posttraumatic stress symptomatology 3 months postdisaster (Vernberg et al., 1996). In the present study, we examined the extent to which children's exposure to the hurricane predicted their PTSD symptomatology over time and assessed exposure at two time points to capture the ongoing loss of personal property and life disruption that children encountered.

The second factor in the model, preexisting child characteristics, includes demographic variables such as gender, ethnicity, and age. Several studies, including Vernberg et al. (1996), found that girls report more distress following natural disasters than do boys (e.g., Burke et al., 1986; Green et al., 1991; Lonigan et al., 1991; Shannon et al., 1994); in general, these effects have been small. Although evidence on ethnicity is scarce, African American youth reported more PTSD symptoms than either White children or other minority youth following Hurricane

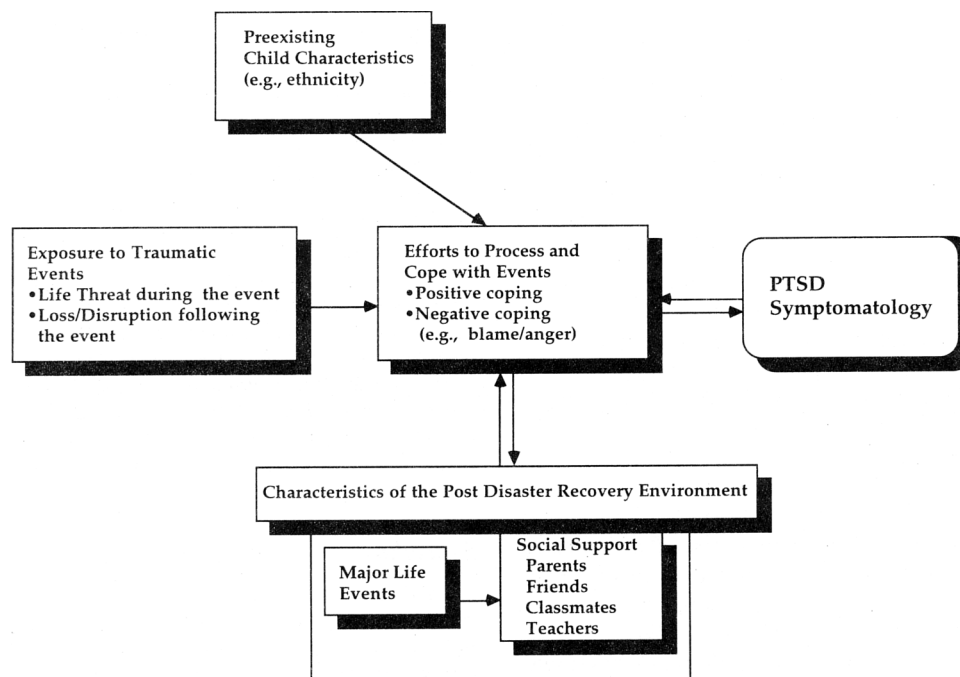


Figure 1. Conceptual model for predicting children's reactions to natural disasters. PTSD = posttraumatic stress disorder.

Hugo (Lonigan et al., 1991; Shannon et al., 1994). In addition, age differences in PTSD symptoms following natural disasters have been found in some studies (Lonigan et al., 1991; Shannon et al., 1994) but not others (e.g., Earls, Smith, Reich, & Jung, 1988; Green et al., 1991). In this study, we examined whether any of these preexisting child characteristics would be predictive of adjustment over time.

The third factor in the conceptual model deals with aspects of the postdisaster recovery environment that may either magnify or attenuate children's subsequent reactions. This complex factor may include the functioning of significant others in children's lives, the provision of disaster-related interventions, and children's access to supportive relationships. In this study, the availability of social support was examined as an aspect of the postdisaster environment because social support is viewed as critical for individuals' recovery (Kaniasty & Norris, 1993). Although social support has not been evaluated in the context of children's disaster reactions, individuals with strong social support are generally able to cope more effectively with life stressors than are those who lack such resources (see Cohen & Wills, 1985; Compas & Epping, 1993). Given the numerous stressors that accompany a major natural disaster, access to social support from a variety of sources should help to minimize children's postdisaster distress. This notion was supported by Vernberg et al. (1996), as children with high levels of social support from significant others (e.g., parents, teachers, peers) reported fewer PTSD symptoms 3 months after Hurricane Andrew than did those with less social support.

Coping skills were considered fourth in the conceptual model because coping is typically viewed as a product of the level of trauma suffered, personal characteristics, and situational characteristics (i.e., access to supportive others; Compas & Epping, 1993). The linkage between PTSD symptoms and coping efforts is viewed as bidirectional because the presence of postdisaster distress presumably contributes to the use of coping strategies as well as being influenced by them. Research has not addressed the impact of children's coping following a major natural disaster, with one exception. Vernberg et al. (1996) found that children who reported higher levels of coping in general also reported more PTSD symptomatology, presumably because they were processing disturbing events and dealing with ongoing life disruption related to the hurricane. In addition, the use of negative coping strategies, such as blame and anger, was a strong predictor of initial PTSD symptomatology. Because Hurricane Andrew represented a novel, intense, and ongoing stressor for most children, it was important to examine whether initial coping efforts would be predictive of posttraumatic stress symptoms later on in the recovery process.

Finally, given the prospective nature of this investigation, the conceptual model was extended by considering an additional aspect of the postdisaster recovery environment: intervening stressful life events. Major life events that arise after a disaster (e.g., death of family member, parental divorce) likely influence and magnify children's stress reactions, although these events are not necessarily related to the disaster itself (Green, 1991; McFarlane, 1988). The role of intervening life events has rarely been addressed in children. In one exception, McFarlane (1988) examined life events as a factor contributing to postdisaster reactions among child survivors of the 1983 Australian

brush fires. Although life events did not predict children's emotional and behavioral problems when other aspects of the recovery environment were considered (e.g., parents' psychological states), this preliminary finding bears further examination. In the present investigation, children's reports of major life events occurring after the initial recovery period were considered in the conceptual model as predictors of later PTSD symptoms. Because of the potential for major life events to influence the availability of social support or children's coping efforts, this factor was entered in the model prior to support or coping.

In summary, this study represents an extension of the research by Vernberg et al. (1996). The same cohort of children who were initially assessed after Hurricane Andrew were followed at two subsequent time points: during the spring and early summer (7 and 10 months postdisaster). Factors in the conceptual model (exposure, social support, coping skills) were assessed 3 months after the disaster: continuing loss/disruption due to the hurricane and major life events occurring during the recovery period were added to the predictive model and were assessed 7 months postdisaster. The ability of these factors to predict children's functioning later in the school year, as well as changes in their functioning, was evaluated.

Method

Participants

Participants were 442 children (187 boys, 255 girls) at three elementary schools located in southern Dade County, Florida, where the greatest path of destruction from Hurricane Andrew occurred (Miami Herald Press, 1992). The children were distributed fairly evenly across the grades, with 32.8% in Grade 3, 31.4% in Grade 4, and 35.7% in Grade 5. The ethnic composition of the sample was 45.7% White, 23.5% Hispanic American, 23.5% African American, and 3.4% Asian American.

At Time 1 (3 months postdisaster), 568 children were evaluated. Participant attrition at Time 2 (7 months postdisaster) was 8.3% ($n = 47$); an additional 12.6% ($n = 72$) were not available at Time 3 (10 months postdisaster). Information obtained from the schools revealed that attrition was due to a variety of factors, some of which were hurricane-related. Specifically, at Time 2, 22 (3.9%) of the Time 1 children had moved away, 17 (3.0%) were absent, and 14 (2.5%) declined to participate further. At Time 3, an additional 8 (1.4%) children had moved away, 37 (6.5%) were absent, and 28 (4.9%) declined to participate further. Thus, 442 children completed all three assessments.

Only data obtained from children who had participated at all three testing points were examined. To evaluate the representativeness of this sample, children who completed all three assessments were compared with those who did not. These two groups of children did not differ in their grade, gender, ethnicity, or initial PTSD symptomatology (as measured by the Reaction Index, described later). The characteristics of the children who completed all three assessments closely mirrored those of the participants at Time 1 (see Vernberg et al., 1996, for details).

Procedure

Children were evaluated in November 1992 (3 months posthurricane, Time 1); in March 1993 (7 months posthurricane, Time 2); and in June 1993 (10 months posthurricane, Time 3). Our objective was to evaluate children as early in the school year as possible and to follow them for two additional time points. The initial assessment occurred in November, in part because the start of the school year in Dade County was delayed for several weeks because of the enormous amount of dam-

age many schools had sustained. Obtaining school-board approval for the study and organizing the project within the schools (e.g., obtaining parental permissions) were also difficult and time-consuming given the circumstances. Following this initial assessment, we wished to reevaluate children near the end of the school year (i.e., June) and at one additional point approximately midway between the two assessments.

For all participants, parental permission was secured at the beginning of the school year for all aspects of the follow-up study (see Vernberg et al., 1996). Written child assent was obtained prior to administering measures at each time point. At Time 1 and Time 2, testing occurred in two separate 35- to 50-min sessions on two consecutive mornings. At Time 3, one 30-min session occurred. Children were assessed in groups ranging in size from 10 to 25, with a ratio of 1 adult for each 10 students. Measures were administered by us and a team of graduate and undergraduate assistants. All of the measures were self-reports with items read aloud by a research assistant while the children read along silently and marked their responses. Time 1 measures included a questionnaire assessing hurricane-related traumatic experiences (the HURTE), The Social Support Scale for Children, and the Kidcope. Time 2 measures included a life events scale and a supplementary version of the HURTE. The Reaction Index was administered at all three time points.

Measures

Posttraumatic Stress Disorder Reaction Index for Children (RI). This 20-item self-report measure of children's PTSD symptoms (Frederick, 1985) was initially developed as a semistructured interview and later revised for use in questionnaire format (Frederick, Pynoos, & Nader, 1992; Lonigan et al., 1991). To simplify its use with children, the original 5-point scale was reduced to a 3-point scale (i.e., *none of the time*, *some of the time*, *most of the time*.) These responses were scored 0, 2, 4, respectively, as in the original scale. Thus, RI total scores could range from 0 to 80.

The RI total score was the primary outcome measure used in this study. The correlation between total RI scores and established cases of PTSD has been reported to be .91 (Frederick, 1985). Total scores on the RI (self-report format) have good internal consistency ($\alpha = .83$, Lonigan et al., 1991; .89, Vernberg et al., 1996) and increase as exposure to trauma increases (Bradburn, 1991; Lonigan et al., 1991; Vernberg et al., 1996).

We also examined RI scores in several additional ways to provide a richer clinical description of the children's symptoms. First, we computed the severity of reported symptomatology, using the descriptors provided by Frederick et al. (1992): *doubtful* (scores of 0–10), *mild* (scores of 11–24), *moderate* (scores of 25–39), *severe* (scores of 40–59), and *very severe* (scores of 60–80).

Next, children's responses on the Reaction Index were used to calculate reported symptom clusters of posttraumatic stress: reexperiencing the event, psychic numbing/avoidance, and hyperarousal (American Psychiatric Association, 1987, 1994).¹ Two of us (La Greca and Silverman) independently selected items from the RI that reflected each PTSD symptom cluster, with 100% agreement in item placement. Re-experiencing symptoms were measured by four items (e.g., "Do thoughts about the hurricane come back to you even when you don't want them to?"); avoidance and psychic numbing by five items (e.g., "Have you felt so scared upset or sad that you couldn't even talk or cry?"); and hyperarousal by four items (e.g., "Do you startle more easily or feel more jumpy or nervous than before the hurricane?").² Mean scores for each symptom cluster were calculated to facilitate interpretation across clusters: cluster scores could range from 0 to 4.

We also determined whether children "met criteria" for reporting a symptom cluster. Children who endorsed at least one item from the reexperiencing cluster, at least three items from the psychic numbing/avoidance cluster, or at least two items from the hyperarousal cluster

were considered to "meet criteria" for that particular symptom cluster, respectively (American Psychiatric Association, 1994). The number of children who reported all three symptom clusters was also calculated. These calculations allowed us to examine the RI scores in a way that was clinically useful, in that the symptom clusters approximate the criteria used to determine the presence of a PTSD diagnosis. However, these reported symptom clusters should not be interpreted as substitutes for the PTSD diagnostic criteria or for the full diagnosis, which would require a more in-depth interview.

Hurricane-Related Traumatic Experiences (HURTE). Because of the critical role of exposure to trauma, the HURTE (Vernberg et al., 1996) was used to assess hurricane-related traumatic experiences. The Time 1 HURTE assessed children's reports of exposure to life-threatening events and to loss and disruption; children have served as informants for these types of events in previous disaster research (Shannon et al., 1994). All items were answered "yes" or "no." HURTE items³ were developed to reflect objective, potentially verifiable events, to minimize potential bias in reporting (Johnson, 1986). The one exception was an item pertaining to perceived life threat ("At any time during the hurricane, did you think you might die?"). Six additional items pertained to specific, observable events during the hurricane that reflected life-threatening experiences (e.g., "Did a door or window break in the place you stayed during the hurricane?" "Did you get hurt during the hurricane?"). These items were summed to obtain a score for *n* of life-threatening events during the hurricane. Ten HURTE items pertained to loss and disruption following the hurricane (e.g., "Did you move to a new place because of the hurricane?" "Did one of your parents lose his or her job because of the hurricane?"). These items were summed to obtain a score for *n* of loss/disruption events after the hurricane.

The Time 2 HURTE measure contained six items that assessed children's self-reports of continuing loss and disruption over the period between the Time 1 and Time 2 assessments (e.g., "Are you living in a house that still has a roof that leaks because of the hurricane?"). Five items were answered "yes" or "no." One item asked, "How many times have you moved since the hurricane?"; for this item responses of *two times* or more were scored as 1, and responses of *none* or *once* were scored as 0. These items were summed to obtain a score for *n* of loss/disruption events since the hurricane.

Social Support Scale for Children (SSSC). The SSSC (Harter, 1985) was used to assess youngsters' perceptions of social support from four sources: parents, classmates, teachers, and close friends. Each subscale contains six items scored on a 4-point scale. Average scores for each subscale were obtained, with higher values reflecting greater social support. Harter (1985) and others (e.g., Dubow & Ullman, 1989; East, Hess, & Lerner, 1987) have provided extensive reliability and validity data. For example, internal consistencies have ranged from .72 to .83 for the SSSC subscales in different samples of children and adolescents.

¹ *DSM-III-R* was in use at the time this study was conducted. However, the symptom clusters have remained the same in *DSM-IV*.

² The placement of RI items was as follows: reexperiencing (RI items 2, 3, 4, and 5), psychic numbing/avoidance (RI items 6, 7, 8, 9, and 15), and hyperarousal (RI items 10, 11, 14, and 16). The seven symptoms that were not placed in one of the symptom clusters either focused on symptoms not explicitly cited in the *DSM-III-R* criteria (e.g., somatic complaints, guilt) or could not be unambiguously assigned to only one cluster (e.g., "do thoughts or feelings about the event get in the way of remembering things, like what you learned at home or in school?").

³ See Vernberg et al. (1996) for a detailed description of this measure and its psychometric properties. Copies of the HURTE may be obtained from Eric M. Vernberg, Clinical Child Psychology Program, J.R. Pearson Hall, University of Kansas, Lawrence, KS 66045.

Kidcope. The Kidcope (Spirito, Stark, & Williams, 1988) is a 15-item checklist developed to assess the frequency of use of 10 different coping strategies. A specific stressor is named (in the current study, "the worst thing that happened to you because of the hurricane"). Then, the child rates the frequency of each coping strategy in dealing with the stressor, using a 4-point scale (1 = *not at all*, 2 = *sometimes*, 3 = *a lot*, 4 = *almost all of the time*). From a principal-components analysis of the Kidcope, Vernberg et al. (1996) identified four types of coping strategies: positive coping (6 items), blame/anger (3 items), social withdrawal (2 items), and wishful thinking (2 items).⁴ For each coping type, an average score was calculated.

Life Event Schedule (LES). A short form of the LES (Coddington, 1972a, 1972b) was administered at Time 2. The LES is the most widely used instrument for assessing life events in elementary school children (Johnson, 1986). This measure was used to assess major life events that occurred between the Time 1 and Time 2 assessments (i.e., between 3 and 7 months post-hurricane). The 13 items pertaining to major personal loss and life disruption were included (e.g., death of a parent or family member, divorce, birth of a sibling, hospitalization of child or family member).⁵ Children marked "yes" or "no" for each event's occurrence; totals were calculated (range = 0–13). Research supporting the validity of this scale has been provided by numerous studies examining the association between life events and child health and adjustment (see Johnson, 1986, for an extensive review).

Results

The findings are organized into two sections. The first presents a description of the variables, including an examination of posttraumatic stress symptoms at each of the posthurricane time points. The stability of children's PTSD symptoms and severity levels was also examined. The second section includes analyses of the prediction of posttraumatic stress symptoms over the course of the school year, using the conceptual model, as well as the prediction of changes in children's symptoms over time.

Description of the Variables

Posttraumatic stress symptoms over time. Our initial goal was to examine children's posttraumatic stress symptoms prospectively. As can be seen from Table 1, children's reports of these symptoms declined over time. However, a proportion of children continued to report high levels of PTSD symptoms at Time 2 and Time 3. Specifically, in terms of RI levels, 29.8% of the children reported severe or very severe levels of PTSD symptoms at Time 1, 18.1% at Time 2, and 12.5% at Time 3. To evaluate the stability of PTSD symptoms over time, correlations were computed for RI Total scores between the three time points. Children reporting high RI total scores at Time 1 also reported high scores at Time 2 ($r = .61, p < .0001$) and at Time 3 ($r = .49, p < .0001$). Symptom levels at Time 2 and Time 3 were also highly related ($r = .60, p < .0001$).

Posttraumatic stress symptoms did not differ by grade or gender at any time point. However, at each time point, Hispanic and African American children reported higher levels of PTSD symptoms than did White children ($ps < .01$). In general, the RI scores for Hispanic and African American children were very similar and averaged about half a standard deviation higher than scores for White children.⁶

When the three PTSD symptom clusters were examined, the

general trend was toward less symptom endorsement over time. Nevertheless, there were substantial numbers of children who reported these symptom clusters even 10 months after the hurricane. In particular, at Time 3, the reexperiencing cluster was reported by the greatest percentage of children in comparison to avoidance/psychic numbing and hyperarousal. The percentage of children who reported all three symptom clusters also declined, but it again was considerable at Time 3 (see Table 1).

Stability of PTSD severity levels. Table 2 depicts the initial PTSD severity level of children who were classified by their symptom levels at Time 2 and at Time 3, respectively. For example, of the 14 children reporting very severe levels of posttraumatic stress symptoms at Time 2, 50% of them had reported very severe levels at Time 1, and virtually all of them had reported at least moderate levels of symptom severity at Time 1.

In general, these data indicate that children reporting moderate to very severe levels of PTSD symptoms later on in the school year (Time 2 and Time 3) were showing problems early on. Specifically, for Time 2, 100% of the very severe, 88% of the severe, and 81% of the moderate groups had reported at least moderate symptom severity at Time 1. Similarly, for Time 3, 71.5% of the very severe, 85.7% of the severe, and 82.6% of the moderate groups had reported at least moderate severity at Time 1. In contrast, very few of the children with mild or doubtful symptoms at Time 1 reported high symptom severity later on in the school year. Specifically, of the children who reported doubtful symptom severity at Time 1, 95% of them ($n = 56$) were classified as doubtful or mild at Time 2, and 97% ($n = 60$) were so classified at Time 3. Of the children who reported mild symptom severity at Time 1, 81.3% ($n = 110$) were classified as doubtful or mild at Time 2, and 82.9% were so classified at Time 3. These data suggest that children with moderate to very severe

⁴ The items from the Kidcope were as follows: positive coping ("I tried to see the good side of things," "I tried to fix the problem by thinking of answers," "I tried to fix the problem by doing something or talking to someone," "I tried to calm myself down," "I did something like watch TV or play a game to forget it," "I tried to feel better by spending time with others"); wishful thinking ("I wished the problem had never happened," "I wished I could make things different"); social withdrawal ("I stayed by myself," "I kept quiet about the problem"); and blame/anger ("I blamed someone else for causing the problem," "I blamed myself or causing the problem," "I yelled, screamed, or got mad"). Vernberg et al. (1996) reported internal consistencies of .77 for positive coping, .67 for wishful thinking, .43 for social withdrawal, and .53 for blame/anger.

⁵ The 13 specific items from the Life Event Schedule were death of a parent, death of a brother or sister, parents' divorce, parents' marital separation, death of a grandparent, hospitalization of a parent, birth of a brother or sister, hospitalization of a brother or sister, parent's loss of job, change in parent's job, death of a pet, being hospitalized for illness or injury, and death of a close friend.

⁶ The RI Totals for the three ethnic groups, at each assessment point were as follows: Time 1: White, $M = 26.9, SD = 18.5$; African American, $M = 32.4, SD = 14.8$; Hispanic American, $M = 33.0, SD = 14.5$. Time 2: White, $M = 20.5, SD = 15.4$; African American, $M = 28.6, SD = 14.8$; Hispanic American, $M = 28.6, SD = 15.9$. Time 3: White, $M = 17.7, SD = 14.3$; African American, $M = 23.0, SD = 14.0$; Hispanic American, $M = 24.9, SD = 14.6$.

Table 1
PTSD Symptomatology (Based on the Reaction Index) Among Children
Who Participated at All Three Time Points (N = 442)

PTSD variable	Posthurricane time point		
	1 (3 months)	2 (7 months)	3 (10 months)
Mean (and SD) RI total score	29.5 (16.8)	24.4 (15.9)	20.8 (14.8)
<i>n</i> (and %) with PTSD severity level			
Doubtful	61 (13.8)	103 (23.3)	137 (31.0)
Mild	134 (30.3)	155 (35.1)	157 (35.5)
Moderate	118 (26.7)	103 (23.3)	93 (20.8)
Severe	112 (25.3)	67 (15.2)	49 (11.1)
Very severe	17 (3.8)	14 (3.2)	7 (1.6)
PTSD symptom clusters			
A. Recounting			
<i>n</i> (and %) that met criteria	397 (89.8)	360 (81.4)	346 (78.3)
<i>M</i> (and <i>SD</i>)	1.7 (1.1)	1.3 (1.1)	1.1 (0.95)
B. Avoidance-psyche numbing			
<i>n</i> (and %) that met criteria	218 (49.3)	142 (32.1)	107 (24.2)
<i>M</i> (and <i>SD</i>)	1.4 (0.98)	1.1 (0.89)	0.91 (0.83)
C. Hyperarousal			
<i>n</i> (and %) that met criteria	296 (67.0)	242 (54.8)	218 (49.3)
<i>M</i> (and <i>SD</i>)	1.4 (0.98)	1.2 (0.89)	1.1 (0.90)
All three symptom clusters			
<i>n</i> (and %) met criteria	173 (39.1)	106 (24.0)	80 (18.1)

Note. RI = reaction index; PTSD = posttraumatic stress disorder.

levels of PTSD symptoms early on in the postdisaster period are most at risk for persistent stress reactions over time.

Levels of exposure, social support, coping, and life events. (See Table 3 for means and standard deviations.) Of interest were children's reports of continued exposure to hurricane-related experiences at Time 2. On the average, children reported one event reflecting continued loss and disruption 7 months after the hurricane. Specifically, 27% of the children reported that

most of the damage to their homes was not yet fixed; 23% were still living in alternate housing. In addition, 44% of the children reported one to two continuing hurricane-related experiences (e.g., roof still leaking, parent out of work due to hurricane), and 10% reported three or more such experiences.

Children reported moderate levels of social support 3 months posthurricane, with the greatest support from parents and close friends and the lowest support from classmates. In terms of cop-

Table 2
Initial (Time 1) PTSD Symptom Severity of Children Classified by
Severity Level at Time 2 and Time 3

Severity level	<i>n</i>	PTSD severity level at Time 1				
		Doubtful (<i>n</i> = 61)	Mild (<i>n</i> = 134)	Moderate (<i>n</i> = 118)	Severe (<i>n</i> = 112)	Very severe (<i>n</i> = 17)
Time 2						
Doubtful	103	38.8	46.6	8.7	4.9	1.0
Mild	155	11.6	39.4	29.0	20.0	—
Moderate	103	2.9	16.5	35.9	41.7	2.9
Severe	67	—	11.9	35.8	43.3	9.0
Very severe	14	—	—	21.4	28.6	50.0
Time 3						
Doubtful	137	32.8	42.3	15.3	9.5	—
Mild	157	8.9	33.8	31.8	24.2	1.3
Moderate	93	—	17.4	40.2	35.9	6.5
Severe	49	4.1	10.2	18.4	51.0	16.3
Very severe	7	—	28.6	14.3	42.9	14.3

Note. The percentages of children who reported moderate to very severe symptom severity at each pair of time points are in boldface type, as are those who reported doubtful to mild symptom severity at each pair of time points. PTSD = posttraumatic stress disorder.

Table 3
*Means and Standard Deviations for Hurricane Exposure,
 Social Support, Coping, and Life Events*

Variable	<i>M</i>	<i>SD</i>
Hurricane exposure (HURTE)		
Life threat ^a		
Perceived life threat	0.63	0.5
<i>n</i> life threatening events during	1.2	1.2
Loss-disruption		
<i>n</i> loss-disruption events after ^a	3.0	1.9
<i>n</i> loss-disruption events since ^b	1.0	1.1
Social Support Scale for Children ^a		
Parents	3.6	0.6
Friends	3.4	0.7
Teacher	3.3	0.7
Classmates	3.1	0.7
Kidcope ^a		
Positive coping	2.3	0.7
Blame-anger	1.4	0.6
Social withdrawal	1.8	0.8
Wishful thinking	3.1	0.9
No. of major life events ^b	1.3	1.4

Note. HURTE = hurricane-related traumatic experiences.

^aAdministered at Time 1, 3 months posthurricane. ^bAdministered at Time 2, 7 months posthurricane.

ing, the most frequently reported strategy was wishful thinking, followed by positive coping, social withdrawal, and blame/anger; these means are similar to those reported by Vernberg et al. (1996).

Finally, on the average, children endorsed one major life event in the period from 3 to 7 months after the hurricane. Specifically, 31% of the children reported one major life event, 18% reported two major life events, and 15% reported three or more major life events.

Prediction of Posttraumatic Stress Symptoms Over Time

Time 2 (7 months postdisaster). Of primary interest was the prediction of posttraumatic stress symptoms over time using the conceptual model. This was accomplished by analysis of partial variance (APV), which uses hierarchical multiple regression. Using APV, the order of entry of variables into the regression equation was guided by the conceptual model, and the significance of each successive step was judged by explaining the variance remaining after partialing out variance accounted for by prior steps (Cohen & Cohen, 1983).

For the first analysis, RI Total scores at Time 2 served as the dependent variable. The variables reflecting children's exposure to life-threatening events (i.e., perceived life threat, *n* life-threatening events during hurricane) and loss/disruption events (i.e., *n* loss/disruption events after hurricane, *n* loss/disruption events since hurricane) were entered as the first two steps in the regression (see Table 4). The exposure variables reflecting life threat accounted for 15.1% of the variance in RI scores, and the exposure variables reflecting loss and disruption accounted for 5% additional unique variance in RI scores. Specifically, higher levels of PTSD symptomatology were reported by children who perceived their life to be threatened and who

experienced more life-threatening events during the hurricane, and by those who continued to experience loss/disruption events in the 7 months after the hurricane.

Following the conceptual model, child demographic characteristics (age, grade, ethnicity) were entered as a set on the next step, accounting for 3.6% of the remaining variance in RI scores. Hispanic and African American children reported higher levels of PTSD symptoms.

Major life events that occurred during the recovery period (3 to 7 months posthurricane) were next entered, and they accounted for 3% additional variance or 4.1% of the remaining variance in PTSD symptoms. Children who reported more major life events also reported more PTSD symptomatology.

The social support variables (parents, friends, classmates, teachers) were entered next as a set, accounting for 7% additional variance or 9.2% of the remaining variance. Most of this was shared variance among the sources of support. Follow-up analyses revealed that support from classmates and parents each accounted uniquely for small but statistically significant amounts of the remaining variance (about 1% each). Higher levels of support predicted lower levels of PTSD symptoms.

The coping variables were entered as the final set, and they accounted for 6% additional variance or 10.2% of the remaining variance in RI scores. Follow-up analyses revealed that higher levels of positive coping, blame/anger, and social withdrawal were associated with greater PTSD symptomatology (see Table 4). Of these strategies, blame/anger had the strongest effect, accounting for about 1% of the remaining variance in PTSD symptoms after all other variables in the conceptual model were considered. As a group, the variables in the conceptual model accounted for 39.1% of the total variance in Time 2 RI scores.

Time 3 (10 months postdisaster). For this analysis, RI Total scores at Time 3 served as the dependent variable. Using APV procedures, the two variable sets reflecting children's exposure to hurricane-related experiences (life threat, loss and disruption) were entered first. The variables reflecting life threat accounted for 9% of the variance in Time 3 RI scores, and those reflecting loss and disruption accounted for an additional 3% of the remaining variance (see Table 5.) These effects were partially due to shared variance among the exposure variables, although perceptions of life threat, life-threatening experiences during the hurricane, and initial loss and disruption following the hurricane each accounted for additional unique variance (2% to 5%).

Each of the remaining steps in the analysis were significant and in the expected direction. Of note, children from ethnic minorities reported higher levels of PTSD symptoms, as did children who reported more major life events. Lower levels of social support were associated with higher PTSD symptoms, and specifically, low support from teachers was uniquely predictive. Finally, greater use of coping strategies was apparent for children reporting higher PTSD symptomatology. However, by 10 months posthurricane, most of this effect was due to the use of blame and anger coping strategies. In other words, children who reported using blame and anger as a strategy for coping with hurricane-related stress early on in the recovery process had higher levels of PTSD symptoms at the end of the school year.

As a group, the variables in the conceptual model accounted

Table 4
*Posttraumatic Stress Symptoms at Time 2: Exposure, Child Demographics,
 Life Events, Social Support, and Coping as Predictors*

Predictor	Set statistics			Decomposition of set effect		
	ΔR^2	p	R^2	β	Unique ΔR^2	p
Step 1: Exposure (life threat)	.15	.0001	.15			
Perceived life threat				0.24	.05	.0001
No. of life threatening events during				0.25	.06	.0001
Step 2: Exposure (loss-disrupt)	.05	.0001	.20			
No. of loss-disruption events after				0.14	.01	.01
No. of loss-disruption events since				0.15	.02	.01
Step 3: Child demographics	.03	.01	.23			
Grade				-0.02	<.001	<i>ns</i>
Gender (female)				0.07	<.001	<i>ns</i>
Ethnicity: African American				0.15	.02	.01
Ethnicity: Hispanic American				0.14	.02	.01
Step 4: No. of life events	.03	.0001	.26	0.19		
Step 5: Social support	.07	.0001	.33			
Parents				-0.12	.009	.05
Friends				-0.03	<.001	<i>ns</i>
Classmates				-0.15	.01	.01
Teacher				-0.06	.002	<i>ns</i>
Step 6: Coping	.06	.0001	.39			
Positive				0.10	<.001	.05
Blame-anger				0.13	.01	.01
Social withdrawal				0.09	<.001	.05
Wishful thinking				0.08	<.001	<i>ns</i>

Note. Total equation, $F(17, 407) = 15.36, p < .0001$.

for 24% of the total variance in Time 3 RI scores. Thus, all the components of the conceptual model contributed to the prediction of children's PTSD symptoms near the end of the school year. The overall pattern of results was similar to the pattern obtained for Time 2 PTSD symptoms.

Changes in posttraumatic stress symptoms. Although the results thus far indicate that PTSD symptom levels declined over the school year, this was not uniformly the case. Therefore, it was also of interest to determine the factors that predicted changes in PTSD symptoms over time.

Regression analyses similar to those described earlier were conducted; however, RI scores at Time 1 were entered on the first step, prior to all other variables. When examining changes in PTSD symptoms from Time 1 to Time 2, as expected, Time 1 RI scores were a significant predictor of Time 2 RI scores, accounting for 36% of the variance. With the exception of children's coping strategy use, each of the other variable sets (exposure, child demographics, life events, social support) contributed significantly ($p < .05$) to changes in PTSD symptoms. Children who were less likely to recover (i.e., less likely to show decrements in PTSD symptoms) were those with higher exposure levels, more intervening life events, and less social support, and came from a minority ethnic group. Unique effects were observed for the n of loss and disruption events since the hurricane ($\beta = .11, p < .01$); African American ($\beta = .13, p < .01$) and Hispanic American ($\beta = .10, p < .05$) ethnicity; intervening life events ($\beta = .13, p < .001$); and low levels of support from parents ($\beta = -.10, p < .05$).

When examining changes in PTSD symptoms from Time 1 to Time 3, the variables in the conceptual model explained 7.8%

of the remaining variance in Time 3 RI scores after first entering Time 1 RI (which accounted for 23.6% of the variance). However, only child demographics ($p < .05$) and major life events ($p < .01$) predicted changes in PTSD symptoms. Specifically, children from African American and Hispanic American backgrounds ($\beta = .10, .15$, respectively, $ps < .05$) and children experiencing more major life events ($\beta = .12, p < .01$) were less likely to show improvements in posttraumatic stress symptoms.

Discussion

This study of the effects of Hurricane Andrew on school-aged children revealed several important findings. First, children's posttraumatic stress symptoms declined over time, although a substantial proportion of the children were still reporting high symptom levels at the end of the school year. Second, the results supported the utility of the conceptual model, adapted from Green and colleagues (Green et al., 1991; Korol, 1990), for predicting children's reactions over the year following a major natural disaster. In this regard, the investigation represents a critical step in identifying factors that are important for understanding children's postdisaster reactions. Finally, the results suggest that the factors in the conceptual model may also be useful for understanding changes in posttraumatic stress symptoms over time.

With respect to children's reactions to Hurricane Andrew, the results include some good news and some bad news. First, the good news. Over time, children reported fewer PTSD symptoms. In addition, the percentage of children reporting severe to very severe levels of PTSD, or who reported all three symptom

Table 5
Posttraumatic Stress Symptoms at Time 3: Exposure, Child Demographics, Life Events, Social Support, and Coping Strategies as Predictors

Predictor	Set statistics			Decomposition of set effect		
	ΔR^2	<i>p</i>	R^2	β	Unique ΔR^2	<i>p</i>
Step 1: Exposure (life threat)	.09	.0001	.09			
Perceived life threat				0.22	.05	.0001
No. of life-threatening events during				0.17	.03	.001
Step 2: Exposure (loss-disrupt)	.03	.01	.12			
No. of loss-disruption events after				0.15	.02	.01
No. of loss-disruption events since				0.07	.003	<i>ns</i>
Step 3: Child demographics	.03	.05	.15			
Grade				-0.06	.002	<i>ns</i>
Gender (female)				0.08	.005	<i>ns</i>
Ethnicity: African American				0.11	.01	.05
Ethnicity: Hispanic American				0.16	.02	.01
Step 4: Life events	.02	.001	.17	0.12		
Step 5: Social support	.04	.01	.21			
Parents				0.04	<.001	<i>ns</i>
Friends				-0.04	.001	<i>ns</i>
Classmates				-0.07	.003	<i>ns</i>
Teacher				-0.16	.02	.01
Step 6: Coping	.03	.01	.24			
Positive				0.06	.003	<i>ns</i>
Blame-anger				0.15	.02	.01
Social withdrawal				0.003	<.001	<i>ns</i>
Wishful thinking				0.04	.001	<i>ns</i>

Note. Total equation: $F(17, 407) = 7.56, p < .0001$.

clusters (reexperiencing, psychic numbing/avoidance, and hyperarousal), declined across time. Given this general tendency for PTSD symptoms to decline over time, the vast majority of children with mild symptom levels early on appeared to recover well.

Now the bad news. Despite the general trend toward diminished reactions, 12% of the children were reporting severe to very severe levels of PTSD symptoms at Time 3. Even more troubling, 18% reported all three PTSD symptoms clusters 10 months post-hurricane. Of the symptom clusters, the reexperiencing cluster was most frequently endorsed; more than three-quarters of the children reported at least one such symptom 10 months after the hurricane. Also troubling was the finding that almost all of the children who reported moderate to very severe PTSD symptoms at 10 months had shown problems early on. So, the bad news is that a portion of children do not appear to recover well.

Individuals who have not had firsthand experiences with a major natural disaster, like Hurricane Andrew, might be surprised by the high proportion of children still showing severe distress almost a year later. It may be difficult for those outside the situation to comprehend the full extent of the trauma and life disruption that ensues for an extended period of time following a major disaster. Media coverage dissipates not long after the event, and for those not directly involved, the disaster victims' trauma and anguish may soon be out of mind. The results of this study suggest, however, that continued attention to the reactions and needs of child disaster victims is important. More specifically, the results endorse the utility of early assessment of PTSD symptoms following disasters and suggest that interven-

tions might target children who display moderate to severe symptom levels early on.

In addition to these findings regarding the persistence of post-traumatic stress symptoms, the results support the utility of the conceptual model for organizing future research efforts in this area. It is noteworthy that each of the factors in the conceptual model was predictive of children's PTSD symptomatology over an extended time period. The first of these, children's exposure to disaster-related trauma in the form of life-threatening experiences during and loss and disruption after the disaster, was a major factor contributing to the prediction of PTSD symptomatology 7 and 10 months postdisaster. In interpreting these findings, it is important to keep in mind that very little loss of life occurred as a result of this disaster, although the tremendous destructive force of the hurricane contributed to frequent perceptions of life threat among the survivors. Overall, our findings further confirm and extend the role of exposure in predicting children's disaster reactions, not just initially (e.g., Lonigan et al., 1991; Shannon et al., 1994; Vernberg et al., 1996) but also over extended time periods. Moreover, the findings highlight the importance of high levels of both life threat and loss and disruption in a disaster of the magnitude of Hurricane Andrew. Clinically, these findings are important because they suggest that children with high levels of these types of exposure experiences are likely to show lingering symptomatology and may deserve particular attention and careful monitoring.

As noted earlier, many children still had to endure hardships and life disruption long after the hurricane was over. In many respects, the events that characterized the loss and disruption

aspect of the disaster (e.g., home destroyed or damaged, moving to a new place) are stressful events in and of themselves and may precipitate a series of recurring daily hassles and strains (e.g., having too many things to do; extra commuting time). Indeed, others have found that life stress may lead to increases in daily hassles (e.g., Compas, Howell, Phares, Williams, & Ledoux, 1989; Wagner, Compas, & Howell, 1988), which in turn contribute to symptoms of maladjustment. Thus, it may be productive to include measures of daily hassles or strains in future research, in order to gain a better understanding of potentially cascading effects of major disasters in children's lives. This line of inquiry would also help to elucidate the role that ongoing hassles and strains may play in the overall conceptual model.

In comparison to exposure, the role of child demographic characteristics in predicting children's posttraumatic stress symptoms over time was modest. Although girls have been found to report more PTSD symptoms than boys initially (e.g., Shannon et al., 1994; Vernberg et al., 1996), these gender effects did not persist over time. On the other hand, children from minority ethnic groups did report more symptoms of posttraumatic stress at each time point, and these effects were observed even after controlling for exposure. These ethnic differences in PTSD reporting may be related to other variables associated with minority status, such as the limited availability of financial resources. Considering that Hurricane Andrew still remains the most costly natural disaster in U.S. history, with insured losses exceeding \$15.5 billion (*The New York Times*, October 6, 1995), the devastating economic consequences of this particular disaster (e.g., loss of homes and possessions) may have been even more acutely experienced by families who were already troubled by and preoccupied with financial concerns. It will be important for future research to replicate these findings regarding minority status and to elucidate possible influencing factors and their implications.

Major life events (e.g., death or hospitalization of a family member) occurring in the months following the hurricane made significant contributions to children's continued postdisaster distress. These data provide a beginning point to further explore the role of life events as stressors affecting children's recovery from disasters. It may be the case, for example, that major life stressors have an additive effect and magnify children's postdisaster reactions, perhaps by further increasing ongoing daily hassles and strains. Indeed, in our study, life events also predicted increments in children's posttraumatic stress symptoms over the school year. As another example, major life stressors may serve to limit the social support available to child disaster victims. It was clear from our findings that support from significant others was important for understanding children's post-disaster reactions. These notions regarding the impact of life events following disasters await further investigation.

We recognize, however, that there are many complexities involved in understanding the impact of major life events on children's adjustment (Johnson, 1986). One of these is disentangling the occurrence of major life events from the sequelae of the disaster itself. Although the life events assessed in this study reflected events that were not directly tied to the hurricane, it is possible that some of the events could be related (e.g., "death of a grandparent" may have occurred as a result of shock the per-

son experienced during the hurricane). Notwithstanding such complexities, at a minimum our findings suggest that the study of life events is an important avenue of future disaster research.

Although major life events in the months following the hurricane contributed to PTSD symptomatology, in contrast, the availability of social support appeared to diminish the impact of this disaster over time. Children who reported high levels of support from significant others during the 3 months following the hurricane reported fewer PTSD symptoms at 7 and 10 months post-disaster. Social support has been identified as an important resource for children in dealing with stress (Compas & Epping, 1993), although it has not been studied previously among child disaster victims. The present findings highlight the role of social support for helping children to manage the distress associated with natural disasters. Efforts to target social support in postdisaster interventions for children (e.g., La Greca, Vernberg, Silverman, Vogel, & Prinstein, 1994) may be critical.

Enhancing children's social support may be especially challenging, however, in the wake of a natural disaster. Natural disasters affect entire communities, so there is a high likelihood that support providers (e.g., families, teachers, friends) are victims themselves (Kaniasty, Norris, & Murrell, 1990). Furthermore, disasters typically precipitate an initial rush of spontaneous helping, but over time they lead to a depletion of supportive resources (Kaniasty & Norris, 1993). These trends in the disaster literature, coupled with the present findings, suggest that efforts to provide support to child disaster survivors should extend beyond the acute phase of disaster recovery.

The last factor considered in the conceptual model was children's coping. These are the first data that examine prospectively the impact of children's disaster-related coping on their subsequent distress reactions, and they suggest that there may be different outcomes for different types of coping. Coping efforts were generally higher among children with greater postdisaster distress, although it was the use of certain negative strategies (i.e., blaming self or others, yelling, screaming, and getting mad) that best predicted posttraumatic stress symptoms over time. Because the hurricane was a unique stressor for most if not all the children, and because the hurricane precipitated a series of ongoing life disruptions, it may represent a particularly challenging stressor. In this context, the frequent use of negative strategies early on in the recovery process may not bode well for children's adjustment over time.

Finally, this study also used the conceptual model to guide our exploration of factors that predicted changes in children's PTSD symptoms over time. To our knowledge, this is the first study to examine this issue. The results indicated that several factors in the model were useful in understanding changes in children's postdisaster symptomatology. Over the course of the school year, children from Hispanic American and African American ethnic groups, as well as those with more intervening major life events, were less likely to demonstrate declines in PTSD symptomatology (i.e., less likely to recover). Although these findings require further replication, they suggest that mental health professionals may need to pay particular attention to the needs and reactions of children from ethnic minority groups and to those who experience major life events following a disaster, as these children may have greater difficulty in recovering from the impact of the initial event.

Despite the important contributions of this study, there are several limitations. One concerns the issue of clinical impairment; that is, children's PTSD symptoms could represent "normal" reactions rather than indexes of pathology, particularly if the symptoms are not debilitating. The distinction between a "normal" adaptive response and actual impairment needs further delineation. It is worth noting that "impairment in daily functioning" is now incorporated into the criteria for a PTSD diagnosis (American Psychiatric Association, 1994), although this was not the case at the time of this study.

Also important to evaluate in future investigations is the persistence of children's reactions over longer time periods. Green (1991) suggested that, in the absence of significant loss of human life, the effects of disasters are not likely to persist beyond 1 to 2 years. However, our findings highlight the role of both life threat and loss/disruption in predicting children's posttraumatic stress symptoms over the 10 months following Hurricane Andrew. In general, the course of PTSD symptoms in children over time and their associated outcomes are not yet known. Thus, child disaster victims who show persistent symptomatology warrant further study.

Given the school-based nature of this investigation, we focused on children's reports of symptomatology, as they were practical to obtain and appeared to be more accurate indicators of postdisaster distress than parent's or teacher's reports (Green, 1991). Despite the reliance on child self-reports, the pattern of obtained findings suggests that they are not simply the result of shared method variance. Nevertheless, it would be of interest in the future to gather data from multiple informants.

Also of interest are efforts to refine the conceptual model, as this model is still evolving. One potential direction for future inquiry are efforts to monitor daily hassles that may contribute to ongoing symptomatology. In addition, a more detailed appraisal of the complex aspects of the post-disaster recovery environment, including the functioning of significant others in the children's lives, would be useful. These are just some of the ways in which the conceptual model can be extended in the future.

Future research also might carefully document the impact of the informal interventions children receive following disasters. Indeed, many disaster-related programs took place in Dade County following Hurricane Andrew (e.g., school psychologists participated in a crisis-training program provided by the National Organization for Victim Assistance). Anecdotally, most of the teachers we had contact with indicated that they had spent class time discussing hurricane-related events. The contents and effects of these informal interventions are unclear. In the future, investigation of these efforts to help children recover from disasters is needed (Vernberg & Vogel, 1993).

Finally, the current findings may serve as a springboard for developing clinical interventions. Our results suggest that interventions extending beyond the acute phase of recovery are needed. Also, given the multiple, ongoing life disruptions that many child disaster victims encounter, it may be useful to focus on enhancing children's skills for dealing with ongoing stressors within a supportive context. School-based interventions may prove especially useful in this regard. Teacher- or counselor-led activities that emphasize coping with disaster-related problems could provide children with models of effective coping and

problem-solving, and might build close, supportive ties with teachers, classmates, and friends. From these ideas, as well as our clinical experiences, we developed a manual of school-based activities to enhance coping, problem-solving, and social support among child disaster victims (La Greca et al., 1994). The systematic evaluation of postdisaster interventions, especially ones based on a clear, validated conceptual model, offer the best hope of improving children's postdisaster psychological adjustment.

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