

# Children's Predisaster Functioning as a Predictor of Posttraumatic Stress Following Hurricane Andrew

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This study examined (a) children's predisaster behavioral and academic functioning as a predictor of posttraumatic stress (PTS) following Hurricane Andrew and (b) whether children who were exposed to the disaster would display a worsening of prior functioning. Fifteen months before the disaster, 92 4th through 6th graders provided self-reports of anxiety; peers and teachers rated behavior problems (anxiety, inattention, and conduct) and academic skills. Measures were repeated 3 months postdisaster; children also reported PTS symptoms and hurricane-related experiences (i.e., exposure). PTS symptoms were again assessed 7 months postdisaster. At 3 months postdisaster, children's exposure to the disaster, as well as predisaster ratings of anxiety, inattention, and academic skills, predicted PTS symptoms. By 7 months, only exposure, African American ethnicity, and predisaster anxiety predicted PTS. Prior anxiety levels also worsened as a result of exposure to the disaster. The findings have implications for identifying and treating children at risk for stress reactions following a catastrophic disaster.

After Hurricane Andrew struck southern Florida in the largest natural disaster in U.S. history (Jacobs, 1995), our research group embarked on a series of studies designed to systematically evaluate the effects—both short term (Prinstein, La Greca, Vernberg, & Silverman, 1996; Vernberg, La Greca, Silverman, & Prinstein, 1996) and long term (La Greca, Silverman, Vernberg, & Prinstein, 1996)—of this disaster on school children. The findings corroborated the work of others who have studied children's reactions to disasters (e.g., Green et al., 1991; Lonigan, Shannon, Finch, Daugherty, & Taylor, 1991; Shannon, Lonigan, Finch, & Taylor, 1994), including other investigators studying Hurricane Andrew (Shaw et al., 1995). Namely, exposure to a natural disaster is a traumatic event for children that results in the emergence of posttraumatic stress (PTS) reactions. For example, 3 months after Hurricane Andrew, Vernberg et al. (1996) found that one third of the 568 children who were evaluated reported severe to very severe levels of PTS; another third reported moderate levels of symptoms. Perhaps even more disturbing were prospective findings that revealed that children who

displayed moderate or higher levels of PTS at the first assessment point (3 months posthurricane) displayed persistent symptoms for almost a year after Hurricane Andrew (La Greca et al., 1996). These findings were disturbing because they suggested that children's reactions to natural disasters are not merely transitory events, but rather, they appear to linger and persist and, thus, have a potential to lead to distress in children and their families.

It would be an important move forward—conceptually and practically—if factors were identified that predispose children to persistent stress reactions. This information would broaden psychologists' understanding of trauma reactions and associated pathology in children and would be useful for the early identification of children who are likely to show persistent and severe PTS. Such children might benefit from intensive disaster-related intervention efforts (e.g., La Greca, Vernberg, Silverman, & Prinstein, 1994; Lonigan, Shannon, Taylor, Finch, & Sallee, 1994; Vernberg & Vogel, 1993), or, at the very least, such children would benefit from close monitoring following a major disaster. Thus, one main goal of the present investigation was to examine predisaster functioning as a predictor of children's PTS symptoms. We were in the unique and fortunate position of being able to examine this issue, as we had evaluated a cohort of children 15 months before Hurricane Andrew for a study of children's anxiety, worry, and behavior problems (La Greca & Silverman, 1993; Silverman, La Greca, & Wasserstein, 1995) and were able to reassess the children's functioning after the disaster.<sup>1</sup>

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<sup>1</sup> None of the children in our sample had participated in any previous studies of Hurricane Andrew (e.g., La Greca et al., 1996; Prinstein et al., 1996; Vernberg et al., 1996).

In examining factors that predispose children to persistent stress reactions, the present study serves to fill an important gap in the research literature. There is a dearth of information available on children's predisaster functioning as a predictor of PTS, and existing findings have been mixed (see Vogel & Vernberg, 1993). For example, a pilot investigation of 32 children and adolescents (aged 6 to 17 years), found that youth with prior psychiatric problems were likely to report symptoms of PTS 1 year after a severe flood (Earls, Smith, Reich, & Jung, 1988). In contrast, a study of 38 children (mostly 10 to 12 years of age) who witnessed a lightning strike that killed another child did not find that children's prior adjustment or learning problems played a role in their postdisaster reactions (Dollinger, 1985). In addition to equivocal findings, the few studies that have been conducted relied primarily on retrospective reports of the youngsters' predisaster functioning to identify prior adjustment problems.

Several investigations also have focused specifically on the role of anxiety in predicting children's postdisaster reactions. Anxiety has been the focus of attention in part because studies with adults have found that prevalence rates for general anxiety are high among disaster victims (Rubonis & Bickman, 1991). Studies with adults have also found that preexisting anxiety is a significant risk factor for the development of PTS (Breslau, Davis, Andreski, & Peterson, 1991). Similarly, studies have found that children with more severe postdisaster reactions report high levels of trait anxiety (e.g., Handford et al., 1986; Lonigan et al., 1991); however, these studies relied on children's postdisaster ratings of anxiety to draw inferences about predisaster functioning.

In addition to children's predisaster emotional and behavioral functioning, other work has suggested that children with preexisting academic difficulties may exhibit postdisaster problems (Vogel & Vernberg, 1993). For example, child survivors of a cruise ship sinking were reported to exhibit less PTS symptoms if they had higher academic achievement (Tsui, as cited in Udwin, 1993). On the basis of these findings, we examined children's predisaster functioning as a predictor of postdisaster reactions, using predisaster measures of emotional, behavioral, and academic functioning (i.e., anxiety, inattention, conduct problems, and academic skills).

The second main goal of our study was to fill another gap that exists in the research literature, namely, whether a traumatic event contributes to a worsening of children's behavioral and academic functioning. Teachers, parents, and mental health professionals frequently presume that children's emotional, behavioral, and academic difficulties worsen following a disaster (e.g., "Ever since the hurricane, my son/daughter has been more anxious" or "My son/daughter is not doing as well in school"). Despite this presumption that exposure to a traumatic event contributes to a worsening of children's functioning (e.g., Earls et al., 1988), this issue has not been addressed in a prospective manner. However, work by Shannon et al. (1994) suggested the importance of this issue. Three months after Hurricane Hugo, Shannon et al. assessed children's pre- and postdisaster academic functioning using child self-report and found that children with more severe PTS reported a greater decline in their academic performance than those with less PTS.

In examining the study's two main goals, we drew on the

conceptual model that was initially developed by Korol (1990) and Green et al. (1991) and further developed and supported in previous studies of Hurricane Andrew (La Greca et al., 1996; Vernberg et al., 1996). According to the model, the factors that influence children's postdisaster reactions are multiple and complex and include (a) characteristics of the stressor (e.g., life threat and loss, or disruption), (b) characteristics of the child (e.g., demographic characteristics and predisaster functioning), (c) characteristics of the postdisaster environment (e.g., social support and occurrence of major life stressors), and (d) the child's efforts to process and cope with disaster-related distress (see Figure 1).

Prior studies showed that each of the four factors in the model accounted uniquely for variance in PTS symptoms when entered in accordance with the model's conceptual framework (La Greca et al., 1996; Vernberg et al., 1996). Specifically, exposure to the traumatic event is first in the model because exposure is considered to be the primary and most critical factor for the emergence of PTS symptoms (e.g., American Psychiatric Association, 1994; Eth & Pynoos, 1985; Green, 1991). Child characteristics are second in the model because they are preexisting factors and cannot be affected by the disaster or the subsequent factors. Considering child characteristics after exposure also provides statistical control for the possibility that exposure is not distributed equally across all levels of child characteristics (e.g., Lonigan et al., 1991; see Vernberg et al., 1996, for more details). Aspects of the recovery environment (such as the availability of social support, the occurrence of additional life events, and parental reactions to the disaster) are third because they are more subjective compared with demographic variables and are likely to exert effects on PTS symptoms after the traumatic event. Finally, children's coping is fourth in the conceptual model because coping is typically viewed as the product of the level of trauma suffered, child characteristics, and situational characteristics (i.e., access to social support from others).

The first two factors in the conceptual model were the focus of our study. Specifically, we considered children's level of exposure in evaluating children's predisaster functioning as a predictor of PTS symptoms and in examining whether a traumatic event contributes to a worsening of children's behavioral and academic functioning. This is the first study to evaluate connections between children's predisaster behavioral functioning and postdisaster stress reactions, that uses a prospective research design, and that controls for levels of exposure to the disaster. Exposure was evaluated by children's reports of life-threatening events that they experienced during the hurricane, by their perceptions of life threat, and by the loss and disruption they experienced in the weeks following the hurricane. Frightening, life-threatening events during a disaster, perceptions of life threat, and loss or disruption resulting from a disaster are all aspects of exposure that frequently have been linked to psychological distress in children (Vogel & Vernberg, 1993). These aspects of exposure have been found to be important predictors of children's initial reactions to natural disasters (e.g., Lonigan et al., 1994; Shannon et al., 1994; Vernberg et al., 1996), as well as to persistent stress reactions (e.g., La Greca et al., 1996).

Although our primary interest was in children's predisaster levels of behavioral and academic functioning as predictors of postdisaster stress reactions, two demographic characteristics

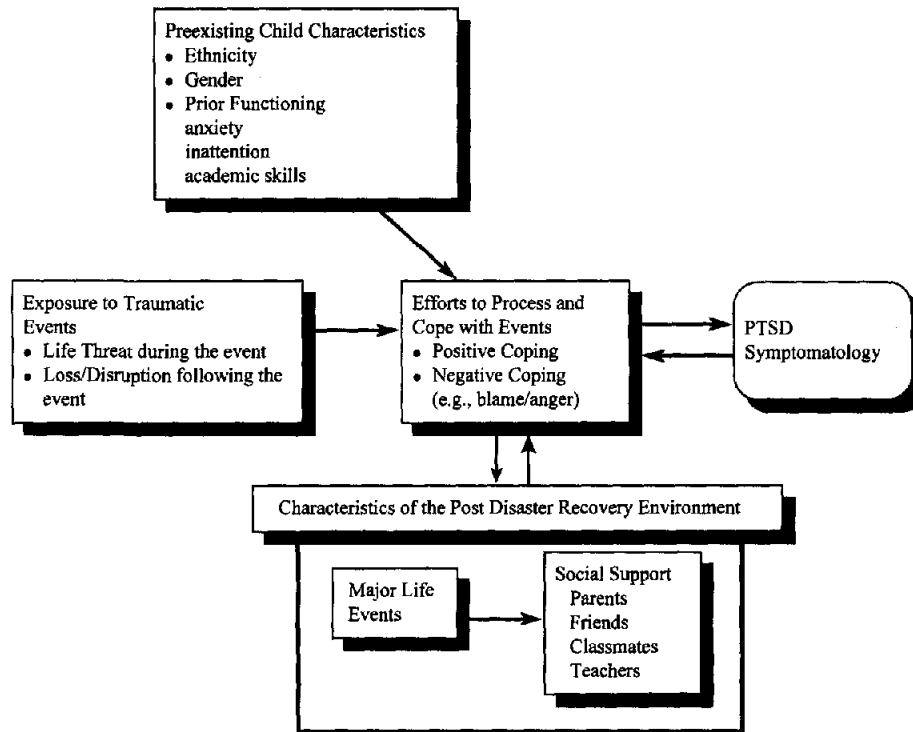


Figure 1. Conceptual model for predicting children's reaction to natural disaster. PTSD = posttraumatic stress disorder.

were also examined as predictors: gender and ethnicity. Past studies have found that girls report more PTS than boys (e.g., Green et al., 1991; Lonigan et al., 1991; Shannon et al., 1994; Vernberg et al., 1996). Although evidence on ethnicity is scant, research on children's reactions following Hurricane Hugo indicated that African American children reported more PTS symptoms in comparison with White or other minority children (Shannon et al., 1994). African American and Hispanic American youth also reported more persistent levels of PTS symptoms over the school year following Hurricane Andrew (La Greca et al., 1996) relative to White students.

In summary, this is the first study to evaluate connections between children's predisaster behavioral functioning and post-disaster stress reactions that uses a prospective research design and, guided by a conceptual model, controls for levels of exposure to the disaster. As noted previously, we were in a unique position to evaluate this issue because we had access to data on children's predisaster functioning, in contrast to previous studies of Hurricane Andrew for which children's predisaster functioning was not available (La Greca et al., 1996; Vernberg et al., 1996). Also, we obtained assessments of children's functioning from multiple informants (child, teacher, and peer) across several time points (predisaster and 3 and 7 months postdisaster).

## Method

### Participants

The sample consisted of 92 children: 50 boys (54%) and 42 girls (46%) in Grades 4 ( $n = 30$ ; 33%), 5 ( $n = 38$ ; 41%), and 6 ( $n = 24$ ;

26%). The children were from diverse ethnic backgrounds, with 49% White ( $n = 45$ ), 38% African American ( $n = 35$ ), 12% Hispanic American ( $n = 11$ ), and 1% Asian American ( $n = 1$ ).

All 92 children attended an elementary school that enrolls children from a broad geographic area in southern Miami-Dade County and from lower-class to upper-middle-class neighborhoods. This particular school was in a neighborhood that was moderately affected by the hurricane; substantial damage to the roof of the school and to the trees and landscaping surrounding the building was apparent. However, because the children attending the school lived in neighborhoods throughout Miami-Dade County, their degree of exposure to the disaster varied from mild to very severe.

All 92 children had participated in a study of children's anxiety, worry, and behavior problems in May 1991, 15 months before Hurricane Andrew and 18 months before the first postdisaster assessment was conducted (La Greca & Silverman, 1993; Silverman et al., 1995). These 92 children represented 67% of the fourth through sixth graders who were enrolled in the elementary school 3 months following Hurricane Andrew (Time 1). Baseline (i.e., predisaster) data were not available for the remaining 46 students who were tested at Time 1 because these students either were not enrolled in the school at baseline or were absent at the time of the baseline study. However, these two groups of children did not differ significantly with respect to grade, gender, ethnicity, or reports of PTS symptoms at Time 1. Thus, the follow-up sample appeared to be representative of the children who were evaluated at Time 1.

Data were also collected on 74 of these 92 children (80%) 7 months after Hurricane Andrew (Time 2). The 18 students not participating at Time 2 were absent during data collection; these children did not differ significantly from the other 74 children with respect to grade, gender, ethnicity, or reports of PTS symptoms at Time 1.

## Procedure

Children were evaluated at three time points. Baseline measures were obtained 15 months prior to Hurricane Andrew. The first postdisaster assessment (*Time 1*) was conducted in November 1992, 3 months after Hurricane Andrew. Efforts were made to conduct this assessment as close as possible to the beginning of the school year. However, the start of the school year was delayed for several weeks because of the extensive structural and community damage that resulted from the hurricane. Additional time was also necessary to secure permission for the study from school personnel and from the University of Miami's Internal Review Board. A second postdisaster assessment was conducted approximately 4 months later (*Time 2*), after the children had settled into the spring semester, to evaluate the persistence of PTS symptoms over time.

Both for the baseline study (Silverman et al., 1995) and for the present postdisaster assessments, we conducted research in a school setting in which parents had provided blanket permission for their children to participate in school-approved research (see La Greca & Silverman, 1993, for additional details). Research conducted in this particular school is given serious consideration before it is allowed to proceed. For the present study (as well as for the baseline assessments), school approval for the research project was obtained by submitting a written proposal describing the purpose of the study. This was reviewed by the principal and discussed with the teachers at the school. The investigators met with the principal and teachers, explained the goals of the study (i.e., linking predisaster functioning with children's postdisaster reactions), and answered any questions or concerns. Parents similarly were informed of the project's goals and were given the opportunity to rescind the approval for their child's participation. No parents rescinded their permission. In addition, the project was explained to the children, who were told that their participation was voluntary and that they could withdraw at any time. All the children assented.

An assessment of children's anxiety, behavior problems, and academic skills was conducted at baseline and at *Time 1*. Two child report measures of anxiety were administered in the classroom: the Revised Children's Manifest Anxiety Scale (RCMAS) and the Social Anxiety Scale for Children—Revised (SASC-R). At *Time 1*, children also completed the Hurricane-Related Traumatic Experiences (HURTE); at *Time 1* and *Time 2*, children completed the Posttraumatic Stress Disorder—Reaction Index for Children (PTSD-RI). For each instrument, instructions and items were read aloud by an experimenter, as children read along and completed the items. A second experimenter circulated through the classroom to answer questions or provide assistance. One week later, children were individually interviewed to obtain peer nominations of behavior and academic skills; teacher ratings were also obtained at this time.

## Measures

**RCMAS (Reynolds & Richmond, 1978).** This measure consists of 28 items that describe anxious symptoms to which the child responds "yes" or "no." Extensive psychometric support for this instrument is provided in the manual (Reynolds & Richmond, 1985). In the present investigation, the total score on the RCMAS was used as an indicator of anxiety; scores can range from 0 to 28.

**SASC-R (La Greca, 1998; La Greca & Stone, 1993).** This 18-item scale (plus 4 filler items) assesses children's feelings of social anxiety in situations involving peers. Each item is rated on a 5-point scale according to how true the item is for the child. Substantial support for the reliability as well as convergent and discriminant validity have been provided (La Greca, 1998; La Greca & Stone, 1993). In the present study, total scores for social anxiety were used, which could range from 18 to 90.

**Peer nominations.** Children completed a peer nomination inventory that assessed behavioral functioning (Coie, Dodge, & Coppotelli, 1982; La Greca & Silverman, 1993). Children nominated up to three same-gender classmates for each of several behavioral descriptors. Of primary interest were the nominations for anxious, inattentive, starts fights, and

good in school work. These descriptors were used to index peer reports of anxiety, inattention, conduct problems, and school performance, respectively (e.g., Coie et al., 1982; Pekarik, Prinz, Liebert, Weintraub, & Neale, 1976). As in other studies (Coie et al., 1982), peer nominations were standardized by classroom ( $M = 0.00$ ,  $SD = 1.00$ ), so that cross-class comparisons could be made. Peer nomination techniques have been found to have excellent psychometric properties, including high internal consistency, test-retest reliability, and predictive validity (Landau & Milich, 1990).

**Teachers' ratings.** Using a 5-point Likert scale, classroom teachers rated students on several behavioral problems, similar to those rated by peers but worded more generally. Specifically, the ratings included anxious (e.g., worries and anxious), attention problems (e.g., inattentive and impulsive), conduct problems (e.g., starts fights and disobeys rules), and academic achievement. Higher ratings reflected higher levels of the specific descriptor. Similar rating procedures were found to be reliable and valid in previous research with elementary school students (La Greca & Silverman, 1993; Wasserstein & La Greca, 1996).

**PTSD-RI (Frederick, 1985; Frederick, Pynoos, & Nader, 1992).** This 20-item self-rating scale assesses severity of PTS symptoms in children and was administered at *Time 1* and *Time 2*. All items were phrased with specific reference to the hurricane (e.g., "Do thoughts about the hurricane come back to you, even when you don't want them to?"). A 3-point response format was used (0 = none of the time, 2 = some of the time, 4 = most of the time), with total scores ranging from 0 to 80. The correlation between total PTSD-RI scores and established cases of PTSD has been reported to be .91 (Frederick, 1985). Total scores on the PTSD-RI also have good internal consistency ( $\alpha = .83$  [Lonigan et al., 1991];  $\alpha = .89$  [Vernberg et al., 1996]). In addition to total scores, Frederick et al. (1992) provided clinical descriptors for the severity of PTS as follows: doubtful (scores of 0–11), mild (scores of 12–24), moderate (scores of 25–39), severe (scores of 40–59), and very severe (scores of 60–80). These categories were used in our study to index the severity of PTS symptoms for descriptive purposes and for comparison with previous research (e.g., La Greca et al., 1996; Prinstein et al., 1996; Vernberg et al., 1996).

**HURTE (Vernberg et al., 1996).** Because of the critical role of exposure to trauma, the HURTE was administered at *Time 1* to assess hurricane-related traumatic experiences. Items were developed rationally from interviews with children and adults who experienced Hurricane Andrew and from inspection of the postdisaster supplement to the Diagnostic Interview Schedule (DIS; see Vernberg et al., 1996, for details). (Table 1 in the Results section contains a brief listing of the HURTE items). Six 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?"). These 6 items were summed to obtain a score for  $n$  of life-threatening events during the hurricane. One additional item, taken directly from the DIS (Robins & Smith, 1993), provided an assessment of perceived life threat ("At any time during the hurricane, did you think you might die?"). In addition, 10 HURTE items pertained to loss and disruption following the hurricane (e.g., "Did you move to a new place because of the hurricane?"). These items were answered "yes" or "no" and summed to obtain a total score for  $n$  of loss or disruption events after the hurricane. Children's exposure to the hurricane, as assessed by these three variables, have been found to be significant predictors of PTS symptoms over the year following Hurricane Andrew (La Greca et al., 1996; Vernberg, et al., 1996).

## Results

### Description of Sample Posthurricane

**Exposure variables.** With regard to exposure to hurricane-related events, as assessed by the HURTE, children reported approximately one life-threatening event during the disaster ( $M$

Table 1  
Number of Children Endorsing Exposure Items on the  
Hurricane-Related Traumatic Experiences

Item	<i>n</i>	%
Life-threatening events during the hurricane		
Doors or windows break	28	30
See anyone get hurt	15	16
Pet hurt or died	11	12
Hit by falling debris	9	10
Get hurt	4	4
Have to go outside during hurricane	4	4
Perceived life threat		
Thought I might die	23	25
Loss or disruption events after the hurricane		
Home damaged or destroyed	32	35
No food or water	27	29
Had to move	23	25
Clothes or toys ruined	19	21
Hard to see friends	17	19
Live away from parents	15	16
Parent lost job	5	5
Pet ran away or given away	4	4
Things stolen from home	4	4
Attend a new school	1	1

= 0.79, *SD* = 1.17). The most frequently endorsed item pertained to "windows or doors breaking in the house during the hurricane," which was reported by 30% of the children (see Table 1), followed by seeing someone get hurt (16%). In addition, 25% indicated that they thought they might die during the hurricane (i.e., perceived life threat).

Children reported between one and two loss or disruption events after the hurricane (*M* = 1.62, *SD* = 1.76). The most frequently endorsed item pertained to having homes that were damaged or destroyed because of the hurricane (35%), followed by not having food or water (29%) and having to move from their homes because of extensive damage (25%; see Table 1). Thus, for a substantial proportion of the children, the hurricane represented a significant disruption to their everyday lives.

**PTS symptoms.** In terms of PTS symptoms at Time 1 (3 months postdisaster), on average, the children's PTSD-RI total scores were in the mild range (*M* = 19.74, *SD* = 15.74). About one third of the sample reported moderate or greater levels of PTS. Specifically, 40% (*n* = 37) of the children reported doubtful levels of PTS, 27% (*n* = 25) reported mild levels, 20% (*n* = 18) reported moderate levels, and 13% (*n* = 12) reported severe to very severe levels.

Although children's PTS symptoms at Time 1 and Time 2 were related ( $r = .60, p < .001$ ), a significant decrease in symptoms was observed from Time 1 (*M* = 18.48, *SD* = 15.55) to Time 2 (*M* = 13.02, *SD* = 10.53),  $t(73) = 3.78, p < .001$ . By 7 months postdisaster, about 11% of the children reported moderate or greater levels of PTS. Specifically, 54% (*n* = 40) of the children reported doubtful levels of PTS, 35% (*n* = 26) reported mild levels, 8% (*n* = 6) reported moderate levels, and 3% (*n* = 2) reported severe to very severe levels.

### Predisaster Functioning as a Predictor of PTS

**3 months postdisaster (Time 1).** One main goal of this investigation was to determine whether children's predisaster functioning

was predictive of PTS symptoms. To address this issue, guided by the conceptual model, we conducted a series of hierarchical regression analyses, one for each behavioral or academic construct (i.e., anxiety, inattention, conduct problems, and academic achievement). For each analysis, Time 1 PTSD-RI scores served as the dependent variable (see Table 2). The order of entry for the predictor variables was based on the conceptual model that guided this and prior research efforts; predictor variables that represented the specific factors in the conceptual model were entered as a set (see Verberg et al., 1996).

For each analysis, children's exposure to the hurricane (i.e., *n* of life-threatening events during, perceived life threat, and *n* of loss or disruption events after) was entered on the first step. Together, the set of exposure variables predicted 32% of the variance in children's PTSD-RI scores at Time 1; greater levels of exposure were associated with more PTS symptoms (see Table 2).<sup>2</sup>

Next, children's predisaster demographic characteristics were entered on Step 2. Child gender and ethnicity did not predict additional variance in children's PTSD-RI levels after exposure was considered. (Even before controlling for exposure, no differences in Time 1 PTSD-RI scores were observed between the three ethnic groups,  $F[2, 90] = 1.98, p = .14$ , or between boys and girls,  $F[1, 90] = .81, p = .37$ .)

On the third step, other aspects of children's predisaster functioning were entered, with separate regressions for anxiety, attention problems, conduct problems, and academic achievement. In each case, teacher and peer reports for the variables were entered on Step 3 (see Table 2). In addition, as a conservative approach for the analysis of predisaster anxiety, children's self-reports were added after the teacher and peer reports (Step 4). After considering exposure and demographic characteristics, we found that predisaster anxiety levels significantly predicted Time 1 PTS, accounting for about 11% unique variance, or 16% of the variance remaining after partialing out the effects of exposure, gender, and ethnicity (see Steps 3 and 4). Specifically, children with higher levels of anxiety 15 months before Hurricane Andrew reported higher levels of PTS 3 months after the hurricane.

Predisaster attention problems were considered next. Predisaster levels of inattention accounted for 12% unique variance, or 18% of the remaining variance after partialing out the effects of exposure, gender, and ethnicity. Specifically, children who were rated by teachers and peers as more inattentive 15 months before Hurricane Andrew reported higher levels of PTS 3 months after the hurricane. In contrast, children's predisaster levels of conduct problems did not contribute significantly to the prediction of PTS, after exposure and demographics were taken into account. For academic skills, predisaster levels accounted for 14% unique variance, or 21% of the remaining variance. Children who were rated by teachers and peers as having better academic skills 15 months before Hurricane Andrew reported lower levels of PTS 3 months after the hurricane.<sup>3</sup>

<sup>2</sup> Although exposure variables were entered as a set in the regressions, the zero-order correlations also revealed that each of the exposure variables was significantly related to Time 1 PTSD-RI scores as follows: *n* of life threatening events = .35, perceived life threat = .43, and *n* of loss or disruption events = .41 (all *ps* < .001).

<sup>3</sup> Exposure variables remained significant in the final step of the regression analyses, even when all predisaster characteristics had been entered into the model. This is because, in general, the 10 variables

Table 2  
Regression Analyses Predicting Posttraumatic Stress at Time 1 From Predisaster Variables

Step and Predictor	$\beta$	$R^2$	$\Delta R^2$	$F(1, 92)$	$\Delta F$
1. Exposure		.32	.32	12.89***	12.89***
<i>n</i> of life-threatening events	-0.02				
<i>n</i> of loss or disruption events	0.36				
Perceived life threat	0.35				
2. Child demographics		.32	.00	6.29***	0.11
Gender	-0.02				
African American	0.03				
Hispanic American	0.05				
3. Anxiety		.38	.06	5.98***	3.76*
Teacher report	0.23				
Peer nominations	0.07				
4. Self-reported anxiety		.43	.05	5.81***	3.58*
RCMAS	0.21				
SASC-R	0.06				
3. Attention problems		.43	.12	7.58***	8.11***
Teacher report	0.32				
Peer nomination	0.07				
3. Conduct problems		.36	.04	5.53***	2.53
Teacher report	0.20				
Peer nominations	0.05				
3. Academics		.45	.14	8.21***	9.85***
Teacher report	-0.22				
Peer nominations	-0.21				

Note. RCMAS = Revised Children's Manifest Anxiety Scale; SASC-R = Social Anxiety Scale for Children-Revised.

\*  $p < .05$ . \*\*\*  $p < .001$ .

7 months postdisaster (Time 2). Following the conceptual model, similar regression analyses were conducted to examine whether children's predisaster functioning predicted PTS symptoms (PTSD-RI scores) at Time 2, 7 months after Hurricane Andrew. Prior research has indicated that high levels of PTS symptoms 7 to 10 months postdisaster are indicative of persistent disaster reactions (La Greca et al., 1996). Separate regressions were conducted for the various aspects of children's predisaster functioning (i.e., anxiety, inattention, conduct problems, and academic skills). In each equation, children's exposure to the hurricane was entered as a set of variables on Step 1. The three exposure variables predicted 20% of the variance in children's PTSD-RI scores at Time 2 (see Table 3).<sup>4</sup>

Similar to the Time 1 analyses, the demographic variables (gender and ethnicity) did not predict Time 2 PTSD-RI levels after exposure was controlled. However, unlike the previous analysis, the individual beta weight for African American ethnicity was significant (0.27,  $p < .05$ ), indicating that African American children reported more PTS symptoms than did chil-

dren from other backgrounds. (Even before controlling for exposure, we observed no differences between boys and girls,  $F[1, 73] = 1.43$ ,  $p = .235$ . However, ethnic differences were observed,  $F[1, 72] = 6.99$ ,  $p = .002$ , with African American children reporting more PTS symptoms than White or Hispanic American children.)

Next, children's predisaster psychological and academic characteristics were evaluated. After considering exposure and ethnicity, we found that children's predisaster levels of anxiety predicted 12% unique variance, or 16% remaining variance, in Time 2 PTSD-RI scores. Specifically, children who were more anxious prior to the hurricane reported higher levels of PTS, even 7 months after Hurricane Andrew.<sup>5</sup> In contrast, we found that predisaster ratings of inattention, conduct problems, and school performance did not significantly predict children's

that assessed various aspects of children's predisaster behavioral and academic functioning showed little or no relation with the 3 exposure variables. Zero-order correlations ranged from  $-.19$  to  $.21$ , and of these 30 correlations, only 2 were significant at the  $p < .05$  level. Specifically, children who reported higher levels of social anxiety (SASC-R) also reported more loss or disruption events after the hurricane and more perceived life threat during the hurricane ( $r_s = .21$ ,  $p < .05$ ).

<sup>4</sup> Although exposure variables were entered as a set in the regressions, zero-order correlations also revealed that the exposure variables were related to Time 2 PTSD-RI scores as follows: *n* of life threatening events = .39, perceived life threat = .33, and *n* of loss or disruption events = .27 ( $p_s < .05$ ).

<sup>5</sup> Even when controlling for the four anxiety variables, we found that each of the exposure variables was significantly correlated with Time 2 PTSD-RI scores. Partial correlations were *n* of life-threatening events = .37, perceived life threat = .31, and *n* of loss or disruption events = .34 ( $p_s < .01$ ).

Table 3  
Regression Analyses Predicting Posttraumatic Stress at Time 2 From Predisaster Variables

Step and Predictor	$\beta$	$R^2$	$\Delta R^2$	$F(1, 92)$	$\Delta F$
1. Exposure		.20	.20	5.37**	5.37**
<i>n</i> of life-threatening events	0.22				
<i>n</i> of loss or disruption events	0.10				
Perceived life threat	0.21				
2. Child demographics		.26	.06	3.68**	1.79
Gender	-0.04				
African American	0.27				
Hispanic American	-0.01				
3. Anxiety		.30	.04	3.29**	1.83
Teacher report	-0.04				
Peer nominations	0.21				
4. Self-reported anxiety		.38	.08	3.58***	3.61*
RCMAS	0.37				
SASC-R	-0.15				
3. Attention problems		.27	.01	2.76*	0.28
Teacher report	-0.02				
Peer nomination	0.10				
3. Conduct problems		.28	.02	3.01**	1.02
Teacher report	0.01				
Peer nominations	0.17				
3. Academics		.27	.01	2.78*	0.34
Teacher report	0.03				
Peer nominations	-0.11				

Note. RCMAS = Revised Children's Manifest Anxiety Scale; SASC-R = Social Anxiety Scale for Children-Revised.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

PTSD-RI scores at Time 2, after considering exposure, gender, and ethnicity (see Table 3).

### Preexisting Child Characteristics as Predictors of Change in PTS Symptoms

As another way of examining whether children's predisaster characteristics predict persistent PTS symptoms, we computed partial correlations between the variables that represented children's predisaster characteristics (gender, ethnicity, anxiety, inattention, conduct problems, and academic skills) and Time 2 PTSD-RI scores, first partialing out the effects of Time 1 PTSD-RI scores. Because, on average, children's reports of PTS symptoms significantly declined from Time 1 to Time 2, this analysis identifies the predisaster characteristics of children who do not change or recover quickly after the disaster (i.e., those whose symptoms persist).

After considering Time 1 PTSD-RI scores, we obtained significant partial correlations for African American ethnicity ( $r = .29, p < .01$ ) and for peer ratings of children's anxiety ( $r = .26, p < .02$ ). That is, children from African American backgrounds, and children with higher peer-rated levels of anxiety before the hurricane, were less likely to show declines in their PTS symptoms from Time 1 to Time 2 postdisaster. (All other partial correlations were less than .20 and were nonsignificant.)

### Exacerbation of Predisaster Problems

The second major aim of this study was to determine whether children who were exposed to a traumatic event evidenced a worsening of predisaster behavioral and academic functioning. To address this question, we computed partial correlations between the three exposure variables (*n* of life-threatening events, perceived life threat, and *n* of loss or disruption events) and the Time 1 variables that assessed children's behavioral and academic functioning, controlling for predisaster (baseline) levels of functioning. The results of these analyses are shown in Table 4, along with children's mean scores on the behavioral and academic variables at each time point.

As can be seen from Table 4, all aspects of exposure were significantly related to increases in children's anxiety levels, as assessed through self-reports. Similarly, children who had more loss or disruption events after the hurricane evidenced increases in peer-rated anxiety. In contrast, children who reported more life-threatening events during the hurricane were rated by teachers as less anxious after the hurricane but were rated by peers as having increased conduct problems. No changes were apparent in academic skills or attention problems as a result of exposure to the disaster.

### Discussion

Guided by a conceptual model, this study addressed two gaps in the literature on children and disasters. First, this prospective,

Table 4  
*Means and Standard Deviations of Children's Behavioral and Academic Functioning Over Time and Relations With Hurricane Exposure Variables*

Variable	Time of assessment				Partial correlations <sup>a</sup>		
	Predisaster		Time 1		Life threat during	Perceived life threat	Loss or disruption after
	M	SD	M	SD			
<b>Anxiety</b>							
RCMAS	11.18	6.60	10.10	6.60	.31***	.47***	.26**
SASC-R	47.68	12.70	41.21	15.00	.22*	.29**	.19*
Teacher report	2.16	1.20	2.03	0.79	-.18*	.07	-.05
Peer nominations <sup>b</sup>	0.06	1.00	0.08	1.00	.14	.04	.18*
<b>Attention problems</b>							
Teacher report	2.14	1.20	2.03	1.20	.00	.05	-.12
Peer nominations	-0.07	1.00	-0.16	0.80	.04	-.06	.04
<b>Conduct problems</b>							
Teacher report	2.00	1.20	1.92	1.10	.00	.01	-.12
Peer nominations	-0.06	0.90	-0.06	1.00	.25**	.05	.08
<b>Academic skills</b>							
Teacher report	3.39	1.20	3.45	1.30	.04	.01	-.10
Peer nominations	-0.02	0.98	0.09	1.00	.04	.07	.02

Note. RCMAS = Revised Children's Manifest Anxiety Scale; SASC-R = Social Anxiety Scale for Children—Revised.

<sup>a</sup> Correlations between the exposure variables and children's functioning at Time 1, partialing out predisaster functioning. <sup>b</sup> Peer nomination variables are standardized scores with  $M = 0.00$  and  $SD = 1.00$ .

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

multiwave study examined the postdisaster adjustment of children for whom predisaster self-, peer, and teacher ratings were available. Second, the study empirically examined the presumption that disaster exposure leads to a worsening of preexisting behavioral and academic functioning. Investigating these two issues provided the opportunity to further our conceptual and practical knowledge of disasters' effects on children.

The results indicate that across some of the most important areas of child emotional and behavioral functioning (i.e., anxiety, inattention, and academic achievement), these areas, if problematic before a hurricane, will most likely contribute to yet an additional difficulty after a hurricane—PTS reactions. Specifically, children who were more anxious, were more inattentive and had poorer academic skills 15 months before Hurricane Andrew reported more PTS symptoms 3 months after the disaster. Thus, children with these behavioral and academic problems appear to be at risk for PTS reactions following a disaster, at least during the initial recovery period. Perhaps the chaos, disorganization, and disruption of everyday activities that immediately follows a major, natural disaster made it difficult for children with these behavioral and academic characteristics to adjust to the dramatic change in daily events.

Over a longer period of time (7 months), however, only children's preexisting levels of anxiety were predictive of significant PTS reactions. Furthermore, children who were anxious before the hurricane were significantly less likely to recover from their initial levels of PTS by 7 months postdisaster. At this later point in the recovery period, about 11% of the children continued to report moderate to very severe levels of PTS symptoms.

The findings lend support to two key elements of the conceptual model that guided the examination of children's PTS reactions: exposure to the event and preexisting child characteristics. Exposure to the disaster, in terms of life-threatening events,

perceived life threat, and loss and disruption after the event, contributed to children's PTS reactions, providing additional evidence for the importance of exposure in the emergence of PTS (e.g., Lonigan et al., 1991; Vernberg et al., 1996). Further, a major contribution of the present study is the documentation of the importance of preexisting child characteristics, particularly anxiety, in the emergence and persistence of PTS symptoms. The findings are consistent with other work showing that a history of emotional or psychiatric problems can potentiate PTS reactions (e.g., Earls et al., 1988; Shannon et al., 1994).

Finding that both exposure and preexisting child characteristics are predictive of children's PTS reactions is important in terms of the evolution of the concept of PTS. It was not until the publication of the third edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-III)*; American Psychiatric Association, 1980) that PTS was codified; in this conceptualization, an individual's reaction to trauma was viewed as directly related to the intensity of exposure to the event (Fletcher, 1996). In contrast, earlier conceptualizations presumed that traumatic stress reactions would quickly dissipate unless some premorbid psychological vulnerability was present. For example, in the first edition of the *DSM*, reactions to traumatic stress were classified as gross stress reaction, a transient situational personality disorder. The present findings support key aspects of earlier as well as current conceptualizations of individuals' reactions to traumatic events. Specifically, the findings provide support for the role of exposure and for the role of premorbid pathology (i.e., anxiety).

Regardless of children's levels of exposure to the disaster, the findings clearly show that PTS can emerge and persist in children with high premorbid levels of anxiety. This finding calls attention to the role of premorbid characteristics in the emergence and maintenance of PTS, which, although important historically, has been largely ignored since the *DSM-III*



(Fletcher, 1996). It would be worthwhile to increase research efforts to examine the role of premorbid characteristics, despite some of the practical difficulties of this line of research; such information has the potential to advance knowledge about etiological issues of posttraumatic morbidity.

The finding that children's predisaster anxiety was important in predicting PTS symptoms is not merely due to shared variance between the measures of anxiety and PTS symptoms. Others have noted that scores on the PTSD-RI are not completely overlapping or redundant with the RCMAS (Lonigan et al., 1991). In fact, in the present sample, the RCMAS correlated modestly with Time 2 PTSD-RI scores ( $r = .37$ ). Further, the importance of preexisting anxiety as a risk factor for the development of PTS is consistent with prior work with children (e.g., Handford et al., 1986; Lonigan et al., 1991), as well as adults (Breslau et al., 1991). One interpretation of these findings is that children with high levels of premorbid anxiety may be at risk for experiencing increased arousal following a disaster and, therefore, may be more prone to being resensitized on exposure to reminders of the disaster (Lonigan et al., 1994). In addition, children's problems with anxiety are not easily observed by adults (e.g., Earls et al., 1988). Thus, anxiety-related problems may have been overlooked by significant adults and left untreated, thereby contributing to anxiety's continued role as a predictor of PTS symptoms over time.

In the present study, demographic characteristics were not strong predictors of children's PTS symptoms. Although girls have been found to report more PTS symptoms than boys initially (Shannon et al., 1994; Vernberg et al., 1996), this has not consistently been the case (Earls et al., 1988; Handford et al., 1986; La Greca et al., 1996) and this gender difference was not observed in the present sample. Similar to previous findings (e.g., La Greca et al., 1996; Shannon et al., 1994), children from African American backgrounds reported more persistent PTS symptoms than other youth. However, it was only after a more extended time period (7 months postdisaster) that this distinction was observed. Similar to the findings of Shannon et al. (1994), ethnic differences could not be explained by greater exposure to the traumatic event among African American children, as they reported more PTS symptoms than other ethnic groups, even after controlling for exposure. Overall, the role of sociodemographic characteristics and their associated factors in predicting children's responses to traumatic events are not well understood and should be examined more closely.

In addition to gaining a better understanding of predisaster child characteristics that represent risk factors for PTS, our study examined the presumption that exposure to a traumatic event would contribute to a worsening of children's behavioral and academic functioning. There is scant literature on this topic, and previous studies have not addressed this issue in a prospective manner. In the present study, the most consistent pattern of results was obtained for the linkages between exposure and anxiety, in that exposure to the hurricane contributed to a worsening of children's anxiety levels (by child and peer report). This is not surprising, as studies of adults have found anxiety to be the most prevalent type of psychopathology following disasters. At the same time, sufficient caution is needed in interpreting these results, as variability estimates for postdisaster anxiety appear to be high (Rubonis & Bickman, 1991). In fact, work with children indicates that measures of anxiety are not ele-

vated after all disasters that result in elevations in PTS symptoms (Jones, Ribbe, & Cunningham, 1994; Lonigan et al., 1991). Methodological differences across studies, such as differences in measures of anxiety, timing of the assessments, types of disaster characteristics, and sample sizes, make it difficult to draw general conclusions regarding disasters' effects on children's anxiety levels (Rubonis & Bickman, 1991; Vogel & Vernberg, 1993).

Clinically, the findings suggest that it may be possible to identify children who are experiencing moderate to severe PTS reactions following a natural disaster. From a preventive perspective, children with preexisting emotional, behavioral, and academic problems may be important targets for disaster preparation efforts. In addition, such children should be monitored closely in the first few months following a major disaster.

Over the longer term, however, anxious children, as well as those with high levels of exposure to a traumatic event, and possibly youth with certain sociodemographic characteristics, appear to be important target populations for postdisaster intervention efforts (e.g., La Greca et al., 1994; Lonigan et al., 1994; Vernberg & Vogel, 1993). At the very least, these children bear careful monitoring during the first several months following a major, traumatic disaster, as they are likely to display more persistent PTS symptoms over time.

Despite the important contributions of the present study, there are several limitations and directions for future research that should be considered. One issue concerns the degree of clinical impairment evidenced by the children. Available evidence suggests that children's levels of behavioral and academic functioning were quite normal—both before and after the disaster. Children's levels of PTS were, overall, in the mild range. It is possible that PTS symptoms represent appropriate reactions to the disaster, rather than clinical dysfunction. Indeed, since the time of this study, "impairment in daily functioning" was incorporated into the criteria for PTSD (American Psychiatric Association, 1994).

Although general levels of PTS symptoms were in the mild range, a significant proportion of the children reported high PTS levels. In the future, it would be desirable to evaluate the long-term course of PTS symptoms among children with more severe near-term PTS reactions. In fact, recent evidence (Vincent, 1997) suggests that, among children with high levels of PTS symptoms 1 year after a disaster, about 40% continue to report substantial PTS symptoms, as well as clinical impairment, up to 4 years postdisaster. In addition, because ours was a school-based study, children's, teachers' and peers' reports were obtained; it would also be of interest to gather input from parents.

In conclusion, our study makes an important contribution to the literature on children and disasters by building on previous work in using a conceptual model to understand the emergence and persistence of children's PTS symptoms (La Greca et al., 1996; Vernberg et al., 1996). Specifically, the results suggest that information on children's predisaster functioning, and knowledge of children's level of exposure to the disaster and its aftermath, should help to guide clinicians, parents, and school personnel in identifying, early on, children who may show severe or lingering PTS reactions. The results may prove useful in developing systematic, empirically based interventions for children who survive catastrophic natural disasters.

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