Reconsideration of Harm's Way: Onsets and Comorbidity Patterns of Disorders in Preschool Children and Their Caregivers Following Hurricane Katrina

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This study examined posttraumatic stress disorder (PTSD) and comorbid disorders in 70 preschool children (ages 3–6) and their caregivers following Hurricane Katrina. Children's rate of PTSD was 50.0% using age-modified criteria. The rate of PTSD was 62.5% for those who stayed in the city and 43.5% in those who evacuated. Of those with PTSD, 88.6% had at least one comorbid disorder, with oppositional defiant disorder and separation anxiety disorder being most common. Caregivers' rate of PTSD was 35.6%, of which 47.6% was new post-Katrina. No children and only 2 caregivers developed new non-PTSD disorders in the absence of new PTSD symptoms. Differences by race and gender were largely nonsignificant. Children's new PTSD symptoms correlated more strongly to caregivers with new symptoms compared to caregivers with old or no symptoms.

Research on how very young children respond to life-threatening traumatic events has lagged behind research with other age groups. Early studies were limited in their ability to assess disorders accurately because there had been no empirical validation of diagnostic criteria and no standardized diagnostic measures for this age group. Therefore, the earliest studies relied on broad measures of problematic domains, not disorders (Cornely & Bromet, 1986; Laor, Wolmer, Mayes, & Gershon, 1997). Alternatively, when checklists were used, they suffered from the disadvantages inherent when there was no interviewer to explain, clarify, probe, and follow up to make sure caregivers understood the items (Levendosky, Huth-Bocks, Semel, & Shapiro, 2002; Saylor, Swenson, & Powell, 1992).

The emergence of standardized diagnostic interviews for young children (Egger et al., 2006; Scheeringa, Zeanah, Myers, & Putnam, 2003) and empirical validation of alternative diagnostic criteria for posttraumatic stress disorder (PTSD) that are more developmentally sensitive than *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text rev. [*DSM–IV–TR*]; American Psychiatric Association [APA], 2000) criteria (Scheeringa et al., 2003) have increased the accuracy of prevalence rates of PTSD and comorbid disorders in young children following traumatic events. Using standardized measures and the alternative PTSD criteria for young children, the rate of PTSD in nonclinical samples (non-help-seeking) from a gas explosion in Japan was 25% (Ohmi et al., 2002) and from a variety of traumatic events (mainly auto accidents and witnessing domestic violence) was 26% (Scheeringa et al., 2003), whereas the rates of PTSD using the *DSM–IV* criteria in these studies were zero. The rates of PTSD in clinic-referred children who had witnessed domestic violence were more than 40% (Ghosh-Ippen, Briscoe-Smith, & Lieberman, 2004) and from a variety of traumas in two small clinic studies were 69% (Scheeringa, Zeanah, Drell, & Larrieu, 1995) and 60% (Scheeringa, Peebles, Cook, & Zeanah, 2001), but the rates by the *DSM–IV* criteria were approximately 2%, 13%, and 20%, respectively. These results indicate that figures for young children are generally in line with rates found

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in older populations when developmentally sensitive measures and criteria are used. There have been no previous studies of preschool children following a natural disaster using standardized diagnostic measures.

Only one study has examined comorbidity patterns in young children with PTSD. Scheeringa and colleagues (2003) found that preschool children diagnosed with PTSD showed rates of 75% for oppositional defiant disorder and 63% for separation anxiety disorder, which were significantly higher than a group of traumatized children who were symptomatic but did not have full PTSD. However, in contrast to the usual finding in adults, comorbid major depression was only 6% in young children and not significantly higher than traumatized young children without PTSD. Of interest, attention deficit/hyperactivity disorder (ADHD) was comorbid 38% of the time with PTSD, which was slightly but nonsignificantly higher than the non-PTSD group (22%), providing some empirical support to the clinically observed notion that children with PTSD may be misdiagnosed with ADHD because of the overlap in concentration difficulties. However, this study did not report on how many of these comorbid disorders arose de novo after the trauma, as opposed to existed prior to the trauma and perhaps served as vulnerability factors for the development of PTSD.

Several studies of adult trauma survivors have shown that non-PTSD disorders arose after trauma, but mostly with PTSD. Shalev et al. (1998) showed that 19% of trauma victims recruited from an emergency room developed both full PTSD and major depression, and only 8% developed major depression without full PTSD. North et al. (1999) showed that only 9% of a sample of Oklahoma City bombing survivors developed a new non-PTSD disorder in the absence of full PTSD. However, McMillen, North, Mosley, and Smith (2002) noted that these studies considered non-PTSD disorders only in the context of full PTSD and not subdisorder PTSD symptomatology that fails to meet the full diagnostic algorithm. McMillen tracked the onset of symptomatology more precisely and found that all of the survivors diagnosed with a new non-PTSD disorder also had substantial PTSD symptoms that did not meet the diagnostic algorithm. This raises an important question for children as to whether non-PTSD disorders arise in the absence of substantial PTSD symptomatology following traumas. Because the comorbid conditions seen with childhood PTSD (oppositional defiant disorder, separation anxiety disorder, ADHD, and depression) are more observable than the situationally triggered or highly internalized symptoms of PTSD, these conditions may be erroneously targeted for treatment without full appreciation of the concurrent PTSD symptomatology.

The Hurricane Katrina disaster was unique in that an entire city had to evacuate, watch the disaster unfold on television, and then return to homes, approximately 80% of which had flooded. There is little previous research on the impact of massive disruption of the environment that results from displacement and damaged homes on young children. A pioneering study of children who were evacuated from London during aerial bombing in World War II suggested that young children, as opposed to the older children, who were displaced had more persisting problems than those who stayed through the bombing (Carey-Trefzer, 1949). However, this finding was confounded by the displaced children being evacuated without their mothers. In addition, the study did not use standardized measures and an age effect was not statistically tested. A study of Israeli preschool children who experienced Scud missile bombing from Iraq in 1991 showed that those whose homes were destroyed had significantly more poststress problems compared to those whose homes were not destroyed, but these groups did not differ on Child Behavior Checklist Internalizing or Externalizing domains (Laor et al., 1997). Any effect of displacement in the Laor et al. study was potentially confounded by the displaced children having destroyed homes, whereas the nondisplaced children's homes were intact. The Hurricane Katrina disaster provided an opportunity to compare the reactions of children who evacuated and had destroyed homes to children who directly experienced the disaster and had destroyed homes on a large scale.

An additional aspect of understanding young children's adaptation is that the caregiving context has been considered uniquely important for general social and emotional development (Crockenberg & Leerkes, 2000), attachment security, and the development of emotional and behavior problems (Linares et al., 2001; Schore, 2002; Zeanah, Boris, & Larrieu, 1997). In a review of 17 studies that simultaneously assessed children of all ages and parents following a wide range of traumas, an enormously consistent pattern was found that the children with the most trauma-related psychopathology had parents with the most trauma-related psychopathology (Scheeringa & Zeanah, 2001). This finding has often led to speculation about a causal chain wherein the parental psychopathology contributed to maladaptive changes in the quality of parent–child relationships, which served as the crucial mechanistic link that contributed to severity of child psychopathology.

However, none of these previous studies tracked whether the caregiver disorders were new onset or preexisted the traumatic events. If the caregiver disorders pre-existed the traumatic events, then this could suggest that the disorders contributed to maladaptive parenting styles that, acting over the long term, could be viewed as agents to produce vulnerability to psychiatric disorders in the children. If the caregiver disorders were instead new onset after the traumas, then this could suggest that

the immediate and trauma-specific responses of care-givers were relatively more salient for children's adaptations than long-term parenting styles. Therefore, the hypothesis of a trauma-specific parent–child relational disturbance (whatever various forms that might take) that negatively impacts children would be strengthened if new onset parental symptomatology, as opposed to preexisting parental symptomatology, were more strongly related to new onset children's symptomatology. It is also possible that both of these scenarios could be accounted for by a shared genetic vulnerability hypothesis to explain similar reactions to life stress in both caregivers and children. Unfortunately, studies have not yet incorporated genetic analyses.

The goals of the study presented here were to address these aforementioned gaps by assessing preschool children victims of the Hurricane Katrina disaster with a developmentally sensitive standardized diagnostic interview for a range of disorders, assess onset of comorbid disorders, and measure a range of disorders in their caregivers while tracking times of onsets. The first aim was to characterize the type and severity of psychiatric symptomatology in preschool children who experienced the Hurricane Katrina disaster. This included descriptive details on prevalence of comorbid disorders and whether new non-PTSD disorders developed in the absence of PTSD. Because a unique aspect of the Hurricane Katrina disaster was that many people evacuated safely but then returned to entirely devastated homes and communities, the second aim was to test the directional hypothesis that those children who stayed through the storm would be more symptomatic than those who evacuated beforehand. The third aim was to track the onsets of the caregivers' disorders to understand whether new onset caregiver disorders associated more strongly with their children's symptomatology than preexisting caregiver disorders. If new (post-Katrina) onset symptomatology in caregivers was more strongly associated with new onset symptomatology in children, this would suggest a temporally related association between new disturbances in caregivers and children.

METHOD

Participants

Inclusion criteria included being (a) age 3 through 6 years of age, (b) English speaking, and (c) an inhabitant of the New Orleans metropolitan area at the time of Hurricane Katrina. Children could not participate if they had moderate or greater mental retardation, autistic disorder, or limitations in sight or hearing. These conditions were screened with questions for the caregiver over the phone during intake and a second level review of videotape of the children by an experienced child psychiatrist (MS). Mental retardation was screened as a Peabody Picture Vocabulary Test score below 50. No children met these exclusion criteria. The primary female caregiver of each child participated with the children.

Participants were recruited primarily from weekly newspaper advertisements. A minority were recruited from flyers in a pediatrician's office and contacts at community events. The first participant was assessed in February 2006, and recruitment is ongoing. This analysis reports on the first 70 participants.

The demographics of the group are shown in Table 1. It can be seen that the majority of the children were Black, the biological fathers were not living in the home, and most mothers did not have a college education. However, the sample contains a wide range of these demographic variables.

Measures

Disaster experiences questionnaire (DEQ). This 21-item interview was created for this study to capture descriptive data about the unique experiences of the Hurricane Katrina disaster. The measure was not designed as a set of equivalent items, so the item responses are not aggregated into one or more summed scores. It included seven questions about experiences of being trapped in the city (e.g., trapped in house, helicopter rescue, time in Superdome, saw dead bodies, etc.) and separation from caregivers during the evacuation. The evacuation period was considered to be 2 days before the storm to approximately 6 days after. It also covered displacement living conditions (two questions), witnessed damage to their own homes, deaths, new schools, TV exposure, witnessed parents cry, changes in routine, changes in time spent with parents, new health problems (two questions), status of returning home, and separations from caregivers. The displacement period was considered as the time from when they had arrived in their first new overnight residence (hotel, shelter, relative, etc.) after leaving the city until they returned to their original or new permanent residences.

Preschool age psychiatric assessment (PAPA) (Egger et al., 2006). This is a structured psychiatric interview with the caregiver about the child. This study used the modules for PTSD, major depressive disorder (MDD), ADHD, oppositional defiant disorder (ODD), and separation anxiety disorder (SAD). Test–retest reliability kappas have been comparable to other instruments for older populations: PTSD = .73, MDD = .73, ADHD = .74, ODD = .57, and SAD = .60. Diagnostic algorithms for ADHD, ODD, and SAD were based

TABLE 1
Demographic Characteristics of Sample

Children	Total[a]	Stayed Group[b]	Evacuated Group[c]
Age (M)	5.1 years	4.7 years	5.4[d]
Age Range	3.1–6.8 years	3.2–6.7 years	3.1–6.8 years
Gender Male	57.1%[e]	58.3%	56.5%
Ethnicity	Black = 57.1%	83.3%	43.5%[f]
	White = 31.4%	8.3%	43.5%[f]
	B–W mix = 8.6%	8.3%	8.7%
	Other = 2.9%	0%	4.4%
Disaster Experiences			
Trapped in Flooded City	34.2%[g]	100%	0%
Separated During Evacuation	20%[h]	29.2%	15.2%
Duration of Evacuation Separations (M)	79.4 hr	88.6 hr	70.3 hr
	(range = 1–168 hr)	(Mdn = 105 hr)	(Mdn = 105 hr)
Separated During Displacement	37.1%[i]	33.3%	39.1%
Duration of Displacement Separations (M)	31.3 days	68.4 days	13.4 days[j]
	(range = 1–248)	(Mdn = 21)	(Mdn = 5.5)
Death of Family Member	8.6%[k]	16.7%	4.4%
Death of Pet	21.4%[l]	20.8%	21.7%
Death of Family Friend	4.3%[m]	4.2%	4.4%
Loss of All Toys	90%[n]	95.8%	87.0%
Female Caregivers			
Age (M)	33.9 years	30.3	35.7[o]
Age Range	19–60 years	21–48 years	19–60 years
Education	14.1 years	12.4 years	15.0 years[p]
Employed	48.6%	50%	47.8%
Biological Father Absent in Home	67.1%	91.7%	54.5%[q]

[a] $N = 70$. [b] $n = 24$. [c] $n = 46$. [d] $t(70) = 2.8$, $p < .01$. [e] $n = 40$. [f] Black versus non-Black, Fisher's exact test(1, 70), $p < .01$. [g] $n = 24$. [h] $n = 14$. [i] $n = 26$. [j] Wilcoxon rank sum test, $z(26) = 2.5$, $p < .05$. [k] $n = 6$. [l] $n = 15$. [m] $n = 3$. [n] $n = 63$. [o] $t(70) = 2.5$, $p < .05$. [p] $t = 4.8$, $p < .0001$. [q] Fisher's exact test (1, 70), $p < .01$.

solely on *DSM–IV–TR* (APA, 2000) criteria. The diagnostic algorithm for MDD included the empirically validated developmental modification that sad mood and diminished interest in significant activities can be endorsed if they were present at least 8 days out of 2 consecutive weeks, as opposed to the *DSM–IV–TR* requirement of nearly every day (Luby et al., 2002). Because of research that has suggested that *DSM–IV–TR* criteria need substantial modifications to be valid for young children, we diagnosed PTSD by both the *DSM–IV–TR* algorithm and by the empirically validated alternative algorithm for young children (Scheeringa et al., 2003; Task Force on Research Diagnostic Criteria: Infancy and Preschool, 2003). The alternative algorithm required only one of the seven symptoms in criterion C (avoidance and numbing symptoms), instead of the three symptoms required by *DSM–IV–TR*.

Diagnostic interview schedule (DIS) (Robins, Helzer, & Croughan, 1981). This is a well-established diagnostic interview that we used for the caregivers. This interview has shown adequate interrater reliability kappas for more than 20 diagnoses, ranging from .40 for panic disorder to 1.0 for anorexia nervosa. Using the clinician's rating as the standard, lay interviews had mean sensitivity for making the diagnoses of 75% and mean specificity of 94% (Robins et al., 1981). Our study used the modules for PTSD, MDD, specific phobia, panic disorder, agoraphobia, generalized anxiety disorder, and alcohol abuse/dependence.

Training of each interviewer for the PAPA and DIS involved observing experienced interviewers give three interviews, then coding two interviews while observing experienced interviewers and comparing codes afterward, then administering their first interview of each measure while being observed by a trainer, and then the coding of every symptom of their next three interviews was completed with the advice of an experienced interviewer. Throughout the entire study, the PI watched the most symptomatic interviews of the PAPA PTSD module on videotape with every interviewer weekly in order to prevent drift, critique technique, and correct coding errors.

Procedure

This study was approved by the Tulane University Institutional Review Board. Written and informed consent was obtained from the primary caregivers. Because these measures did not involve the participation of the

children as informants, their assent was not requested. After being screened for inclusion and exclusion criteria over the phone, caregivers arrived alone at the lab for the first session in which the DEQ and PAPA were collected. Caregivers came with their children for the second session, typically 1 week apart, in which the DIS was collected. Participants were monetarily compensated for their participation. Eleven participants did not return for the second visit, so data were available on the DIS for only 59 caregivers.

Data Analysis

Differences between groups (stayed/evacuated, separated/not separated, Black/non-Black, and boy/girl) were tested with chi-square tests or Fisher's exact tests when variables were dichotomous (rates of disorders). The continuous outcomes of numbers of symptoms were not normally distributed and group sizes were not large, so nonparametric tests were used. Differences between groups were tested with Wilcoxon rank sum tests and associations between the number of parental symptoms, and the number of children's symptoms were estimated with Spearman correlations. Comparisons of two correlation coefficients were tested by transforming Spearman correlations coefficients with Fisher's Z transformation and then comparing with z tests.

RESULTS

The Hurricane Katrina-related experiences of these children measured with the DEQ are listed in Table 1. It can be seen that 34.2% were trapped in the flooded city (stayed group) and 65.8% had evacuated before the storm (evacuated group). Only one child had a home that was not damaged and was able to return to it. Four other children had homes with little or no damage, but they did not return to their homes for other reasons. The homes of all the other children were flooded or damaged. Fourteen children (20%) were separated from their primary caregiver during the evacuation period (the 1-week period from a few days before the storm to about 6 days after the storm), typically because the parent had to work through the storm and the child was cared for by a relative. In addition, 26 children (37.1%) were separated during the displacement period (from approximately 1 week after the storm until returning to original homes or new permanent homes), typically because the child had to live in another city while the parent worked elsewhere or traveled to New Orleans to take care of their homes. The duration of separations varied widely as can be seen from the ranges listed. Eight children were separated during both the evacuation and

separation periods. All total, 32 children (45.7%) experienced some type of separation (separated group).

Children's Disorders and Symptomatology

To address the first aim, the rates of diagnoses and the number of symptoms for the five disorders of interest are listed in Table 2. The rates of PTSD by both the *DSM–IV–TR* criteria and the alternative criteria are presented for comparison. The alternative criteria diagnosed more individuals (50%) compared to the *DSM–IV–TR* criteria (15.7%), consistent with past research. Cases diagnosed by the alternative algorithm ($n = 35$) had a mean of 7.8 symptoms, compared to 3.5 symptoms in those without the full diagnosis ($n = 35$). Cases diagnosed by the *DSM–IV–TR* algorithm ($n = 11$) had a mean of 9.6 symptoms, compared to 4.9 symptoms in those without the full diagnosis ($n = 59$).

The vast majority of PTSD cases were attributed to Hurricane Katrina (94.3%). ODD was the most common disorder (33.8%) after PTSD. Girls had a higher rate of ADHD (41%) compared to boys (13%), $\chi^2(1, n = 68) = 7.2$, $p < .01$. Otherwise, there were no differences in rates of individual disorders by race or gender.

Forty-six children had experienced at least one other type of potential life-threat experience besides (and all prior to) Hurricane Katrina: trip to emergency room or surgery ($n = 29$), motor vehicle accidents ($n = 12$), minor burns ($n = 9$), witnessed domestic violence ($n = 7$), house fire ($n = 5$), dog bites ($n = 4$), sexual assault by peer ($n = 2$), near drowning ($n = 1$). Of these 46 children, the mean number of episodes experienced was .99 ($SD = 1.35$). Spearman correlations between the number of pre-Katrina adverse events and post-Katrina number of symptoms for each of the five disorders were all nonsignificant: PTSD $r_s = -.002$ ($p = .98$), MDD $r_s = -.12$ ($p = .34$), ADHD $r_s = .01$ ($p = .96$), ODD $r_s = -.05$ ($p = .66$), and SAD $r_s = -.13$ ($p = .27$). Age at the time of the earliest adverse event prior to Katrina was also not significant for predicting degree of symptomatology for each of the five disorders post-Katrina. These are conservative tests of these issues because the instrument was not designed to track worsening of pre-existing symptoms or relapses of disappeared symptoms.

The rates of comorbidity between disorders are also presented in Table 2. Of the 35 children with PTSD (diagnosed by the alternative criteria), 20 also had ODD (60.6% overlap), the most common comorbid disorder. It is noteworthy that although MDD was slightly less common overall (21.4%) than ADHD (25%), there was a trend for MDD to overlap with PTSD (42.9%) relatively more than ADHD overlapped with PTSD (33.3%). Overall, PTSD was comorbid with at least one of the four disorders that were measured 88.6% of the time.

TABLE 2
Children's and Caregivers' Rates of Disorder

Children[a]	% Rates of Disorders (n)	No. of Symptoms	% of PTSD With Comorbid Disorder (n)	% of Disorders With Onset post-Katrina (n)
PTSD (Alternative Criteria)	50 (35)	5.6	n/a	94.3 (33)
PTSD (DSM–IV–TR)	15.7 (11)	5.6	n/a	100 (11)
MDD	21.4 (15)	2.6	42.9 (15)	60.0 (9)
ADHD[b]	25 (17)	5.0	33.3 (11)	29.4 (5)
ODD[b]	33.8 (23)	3.1	60.6 (20)	56.5 (13)
SAD[b]	14.7 (10)	1.7	21.2 (7)	50.0 (5)
Any Disorder	62.9 (44)	n/a	n/a	77.2 (34)
Caregivers[c] PTSD	35.6 (21)	6.6	n/a	47.6 (10)
MDD	25.4 (15)	3.3	57.1 (12)	27.7 (4)
Panic Disorder	13.6 (8)	n/a	33.3 (7)	62.5 (5)
Agoraphobia	5.1 (3)	n/a	4.8 (1)	66.7 (2)
GAD	3.4 (2)	n/a	9.5 (2)	100 (2)
Specific Phobia	1.7 (1)	n/a	0	0
Any Anxiety Disorder	16.9 (10)	n/a	38.1 (8)	70 (7)
Alcohol Abuse	6.9 (4)	n/a	4.8 (1)	25 (1)
Alcohol Dependence	3.4 (2)	n/a	0	50 (1)
Any Disorder	47.5 (28)	n/a	n/a	53.6 (15)

Note: PTSD = Posttraumatic Stress Disorder; MDD = major depressive disorder; ADHD = attention deficit hyperactivity disorder; ODD = oppositional defiant disorder; SAD = separation anxiety disorder; GAD = generalized anxiety disorder.
[a] N = 70. [b] n = 68. [c] N = 59.

Because we tracked the onsets of symptoms for all disorders, we determined whether the onset of a disorder was before Hurricane Katrina or after. Table 2 lists the percentages of children diagnosed with each disorder for which the onset was Hurricane Katrina. MDD showed the highest rate among the comorbid disorders of onset following traumatic events, with 60.0% following Hurricane Katrina. ADHD showed the lowest relationship to trauma, as would be expected, with 29.4% following Hurricane Katrina. Most noteworthy, no child developed a new non-PTSD disorder in the absence of new PTSD symptoms.

Post hoc analyses were undertaken to explore the unexpected finding that girls had a higher rate of ADHD (41%) compared to boys (13%). Eleven boys had six or more symptoms of ADHD, of which seven (64%) had onsets after the hurricane. Fourteen girls had six or more symptoms of ADHD, of which six (43%) had onsets after the hurricane. This was not a significant difference in rates of posthurricane onsets, so it does not appear that trauma was a salient influence in the differential manifestations of ADHD in genders. However, because ADHD is typically more common in boys, it may be that caregivers were more likely to participate in research with girl children who showed ADHD symptomatology.

Stayed Versus Evacuated: Children

To test the second aim, the group was then divided into a stayed group who stayed through the storm and flood

(n = 24) and an evacuated group who evacuated beforehand (n = 46). The stayed group was significantly younger, was more often Black, had longer separations from caregivers during the week of evacuation, had longer separations from caregivers during the displacement period after the 1st week, had maternal caregivers who were younger and had fewer years of education, and had fathers who were more often absent from the homes compared to the evacuated group (Table 1). The groups did not differ by gender of the children, rates of separations during the evacuation or displacement periods, deaths, loss of toys, or maternal caregiver employment.

Table 3 lists the rates of disorders and the number of symptoms for each disorder by group. The stayed group showed a significantly greater number of symptoms of PTSD (M = 6.7 symptoms) compared to the evacuated group (M = 5.1 symptoms), Wilcoxon rank sum test, z(70) = 1.90, p < .05 one-sided. The stayed group also had significantly more SAD symptoms (M = 2.2 symptoms) compared to the evacuated group (M = 1.5 symptoms), Wilcoxon rank sum test, z(68) = 1.87, p < .05, one-sided. Despite these two group differences, most comparisons were nonsignificant between groups, indicating an unexpectedly high severity in the evacuated group, including a 43.5% rate of PTSD.

Potential interactions between stayed/evacuated status and race and gender were explored since disproportionately more Blacks in this sample stayed (50.0%) than non-Blacks (13.3%), and the positive findings were few. Non-Blacks who stayed (n = 4) had a higher

TABLE 3
Comparison of Children's Symptomatology for Stayed
Versus Evacuated Groups

	Stayed[a]	Evacuated[b]
Diagnosis (%)		
PTSD	62.5	43.5
MDD	12.5	26.1
ADHD	34.8	20.0
ODD	30.4	35.6
SAD	17.4	13.3
No. of Symptoms		
PTSD	6.7*	5.1
MDD	2.7	2.5
ADHD	6.0	4.5
ODD	3.4	3.0
SAD	2.2*	1.5

Note: PTSD = posttraumatic stress disorder; MDD = major depressive disorder; ADHD = attention deficit hyperactivity disorder; ODD = oppositional defiant disorder; SAD = separation anxiety disorder.
[a]$n = 24$. [b]$n = 46$.
*Wilcoxon signed-rank test between groups, $p < .05$.

rate PTSD (100%) compared to the non-Blacks who evacuated ($n = 26$, 38.5%), $\chi^2(1, n = 30) = x$, $p < .05$. However, this finding for non-Blacks needs to be interpreted cautiously because of small numbers of individuals. The non-Blacks who stayed also had more mean symptoms of SAD ($M = 3.0$ symptoms) compared to the non-Blacks who evacuated ($M = 1.4$ symptoms), Wilcoxon rank sum test, $z(29) = 1.8$, $p < .05$, one-sided. There were no other significant differences in rates of the other disorders or number of symptoms between the stayed and evacuated groups by race.

Boys who were in the stayed group ($n = 14$) had significantly more symptoms of SAD ($M = 2.5$ symptoms) compared to the boys who were in the evacuated group ($n = 25$, $M = 1.4$ symptoms), Wilcoxon rank sum test, $z(39) = 2.0$, $p < .05$. Girls who were in the stayed group ($n = 10$) had significantly higher rates of ADHD (78%) and number of ADHD symptoms ($M = 9.1$ symptoms), compared to girls who were in the evacuated group who had a lower rate of ADHD (25%), Fisher's exact test (29), $p < .05$, and fewer number of ADHD symptoms ($M = 4.3$ symptoms), Wilcoxon rank sum test, $z(29) = 2.3$, $p < .05$. No other comparisons of rates of disorders or number of symptoms between the stayed and evacuated groups by gender were significant.

There is evidence suggesting that existing predispositions for emotional problems may place individuals at risk for the development of posttrauma problems, although the effect tends to be small and overshadowed by the greater effects of peritraumatic psychological processes (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003). Noting the relevance of this issue for the evacuated group that was assumed to have

relatively less direct exposure compared to the stayed group, we conducted a post hoc analysis to test whether the evacuated group had greater burdens of pre-Katrina symptomatology compared to the stayed group.

The evacuated group had a marginally significantly greater number of pre-Katrina disorders per child ($M = .61$) compared to the stayed group ($M = .29$), Wilcoxon rank sum test, $z(70) = -1.66$, $p = .096$, two-sided, $p < .05$, one-sided. However, the evacuated group did not have significantly more symptoms of all disorders with pre-Katrina onsets ($M = 6.17$) compared to the evacuated group ($M = 5.21$), Wilcoxon rank sum test, $p = .70$, two-sided. This does not represent strong evidence that the evacuated group possessed a vulnerability that the stayed group did not possess.

Separated From Caregivers Versus Not Separated From Caregivers

Thirty-two children were separated from their primary female caregivers for either 1 or more hr during the week of evacuation or for 1 or more days during the ensuing period of displacement. These designations of separated/not separated were not highly intercorrelated with the stayed/evacuated designations. Of the 24 stayed children, 42% were in the separated group. Of the 46 evacuated children, 48% were in the separated group. There were no significant differences between the separated and not separated groups on any rates of disorders or number of symptoms. There were also no differences when examined separately by gender.

Surprisingly, the duration of separation during the week of evacuation was negatively significantly correlated with the number of children's PTSD symptoms ($r_s = -.25$, $p < .05$) and with the number of caregivers' PTSD symptoms ($r_s = -.27$, $p < .05$). The number of days of separation during the displacement period after the first week was not significantly correlated to either child's or caregiver's PTSD symptoms. This means that the longer the separation during the first week, the fewer PTSD symptoms for both child and caregiver.

Caregiver Symptomatology

The percentages of eight disorders in the primary female caregivers were calculated (Table 2). The rate of PTSD by the *DSM–IV–TR* criteria was 35.6%, with a group mean of 6.6 PTSD symptoms. Cases with the PTSD diagnosis ($n = 21$) had a mean of 11.3 symptoms, compared to 3.9 symptoms in those without the full diagnosis ($n = 38$). Of those with the PTSD diagnosis, 47.6% of the onsets were from Hurricane Katrina. Similarly, of those caregivers with any PTSD symptoms ($n = 52$), 46.2% of the onsets were from Hurricane Katrina. This is likely an underestimate of the overall

impact of Katrina on caregivers because those with pre-Katrina PTSD symptomatology may have worsened after Katrina but the DIS did not track worsening of symptomatology that precisely. Of those with PTSD, 81.0% had at least one comorbid disorder.

Overall, approximately half of the caregivers (47.5%) had at least one of the eight disorders (including PTSD), but only about half of these individuals (53.6%) developed one or more of these disorders following Katrina, meaning that only about one fourth (25.4%) qualified for a new disorder of any kind post-Katrina. Only three caregivers developed a new, non-PTSD disorder without a new, full PTSD diagnosis. One of these had two new symptoms of PTSD, meaning that only two of these caregivers had an absence of new PTSD symptomatology. Caregivers who stayed ($n = 19$) showed significantly more symptoms of PTSD ($M = 8.6$ symptoms) compared to caregivers who evacuated ($n = 40$; $M = 5.6$ symptoms), Wilcoxon rank sum test, $z(59) = 2.4$, $p < .05$. These groups did not significantly differ on the number of MDD symptoms or on the rates of diagnosis of eight disorders.

Parent–Child Correlations

The children's number of symptoms for PTSD, MDD, ODD, and SAD were each significantly positively correlated with the number of caregivers' PTSD and MDD symptoms (Table 4). In many of these cases, these were fairly large correlations and highly significant. However, children's ADHD symptoms were not significantly related to caregivers' symptomatology. To test the third aim, these correlations were rerun twice with the sample divided into those with caregivers whose PTSD started post-Katrina ($n = 26$) and those with caregivers who either had PTSD that started pre-Katrina or had no PTSD ($n = 33$). The purpose of this was to estimate if

children's symptomatology was more strongly related to onset of new trauma-related symptomatology in caregivers or related to children's symptomatology regardless of time of onset.

For caregivers with old or no PTSD symptoms, correlations were significant only between caregivers' PTSD and children's PTSD ($r_s = .49$) and children's MDD ($r_s = .43$). Caregivers' MDD was significantly correlated only with children's SAD ($r_s = .43$). In contrast, for caregivers with new PTSD symptoms, correlations were significant between caregivers' PTSD and all children's disorders except ADHD. Caregivers' MDD was significantly correlated with all children's disorders except ADHD and SAD. The correlations were generally larger for caregivers with new PTSD symptoms compared to those for caregivers with old or no PTSD symptoms (Table 4). Despite this trend, only two direct statistical comparisons between subsets of caregivers were significant. The correlation of children's PTSD symptoms with MDD symptoms of caregivers' with new PTSD symptoms was significantly larger than the correlation of children's PTSD symptoms with MDD symptoms of caregivers' with old or no PTSD symptoms, $z(59) = 3.63$, $p < .001$. The correlation of children's MDD symptoms with MDD symptoms of caregivers' with new PTSD symptoms was significantly larger than the correlation of children's MDD symptoms with MDD symptoms of caregivers' with old or no PTSD symptoms, $z(59) = 2.17$, $p < .05$. Overall, this is suggestive evidence that new onset caregiver symptomatology was more strongly related to new onset children's symptomatology.

DISCUSSION

These findings make several contributions to understanding the impact of trauma on preschool children

TABLE 4
Spearmen Correlations Between Children and Caregivers' Symptoms

Children	All Caregivers[a]		Caregivers With Old Or No PTSD Symptoms[b]		Caregivers With New PTSD Symptoms[c]	
	PTSD	MDD	PTSD	MDD	PTSD	MDD
PTSD	.56****	.35**	.49**	.04[d]	.74****	.78****
MDD	.49***	.43***	.43*	.26[e]	.62***	.70****
ADHD	.13	.17	.03	.10	.30	.25
ODD	.33*	.34*	.26	.23	.45*	.45*
SAD	.36***	.37**	.32	.43*	.40*	.28

Note: PTSD = posttraumatic stress disorder; MDD = major depressive disorder; ADHD = attention deficit hyperactivity disorder; ODD = oppositional defiant disorder; SAD = separation anxiety disorder.
[a] N = 59. [b] n = 33. [c] n = 26. [d] Spearman correlation coefficient of .04 is significantly smaller than the coefficient of .78 for caregivers with new PTSD symptoms, $p < .001$. [e] Spearman correlation coefficient of .26 is significantly smaller than the coefficient of .70 for caregivers with new PTSD symptoms, $p < .05$.
*$p < .05$. **$p < .01$. ***$p < .001$. ****$p < .0001$, for test of being different from zero.

in general and the impact of a natural disaster in particular. First, preschool children in this sample who suffered from Hurricane Katrina in the New Orleans metropolitan area were severely impacted psychologically even though approximately two thirds of this sample had evacuated before the storm. The mean number of PTSD symptoms for the group was 5.6, 50% were diagnosed with PTSD by empirically validated alternative criteria for young children, and 88.6% of those diagnosed had at least one other comorbid disorder, of which approximately half began after Katrina. These data on prevalence and comorbidity rates of five disorders add to the limited data on how preschool children are affected by natural disasters. In contrast to prior studies, these data were gathered with developmentally appropriate structured diagnostic interviews of the caregivers, as opposed to checklists, and covered a wider range of comorbid disorders than any previous study.

Second, approximately two thirds of this sample had evacuated before the storm, yet 43.5% of this evacuated subsample still developed full PTSD, and they developed comorbid disorders (particularly MDD and ODD) at rates equal to or higher than the subsample that was trapped in the city. This was an unexpected finding. There have been few previous studies of the effect of displacement on young children, but those studies were potentially confounded by separations from mothers (Carey-Trefzer, 1949) or the displaced children having destroyed homes but the nondisplaced children having intact homes (Laor et al., 1997). No previous study has shown that children whose homes were damaged but were never directly in harm's way have such high rates of diagnosable disorders.

This generates a new set of questions about what aspects of evacuation, sheltering, or returning to view damaged homes are capable of causing fear reactions in young children that lead to PTSD. It is beyond the scope of this study, and perhaps beyond what is possible to examine in young children, to understand the internalized cognitive processes that occurred to create the state of panic that is typically required to induce PTSD in those situations. However, it was evident from the systematic interviews that we conducted that the evacuated children did indeed experience moments of unmanageable stress for various reasons, such as panicked evacuations, separations from parents, seeing their homes after the destruction, having all their belongings ruined, or seeing entire neighborhoods devastated.

Although some may argue otherwise, the generally accepted concept about PTSD is that individuals must experience moments of "intense fear, helplessness, or horror" (APA, 2000, p. 467). This is well beyond being merely frightened. This is perhaps better phrased as

moments of uncontrollable, unmanageable fear for one's life. For example, when children saw their homes in person, did they now suddenly realize that they would have been in danger if their parents had not removed them? Did they overgeneralize from this event and think that they would be in harm's way with the next rainstorm? Because nearly 100% of their worldly possessions were ruined and living area was wiped out, whereas adults had other possessions and other life experiences such as work, relatives, and a larger context for their lives, did this produce a greater sense of vulnerability? These questions may be useful for generating new hypotheses to understand and to help young children following future disasters.

Third, this is the second demonstration of high rates of comorbidity in young children with PTSD, consistent with the adult literature. More specifically, this was the second study to show high rates of comorbid ODD and SAD in young children with PTSD (Scheeringa et al., 2003). It appears more intuitive that SAD may arise following traumas because of young children's unique dependence on caregivers for protection, but it is less obvious why ODD is so common. Because one of the hyperarousal symptoms of PTSD is irritability or outbursts of anger, it is possible that ODD may overlap with PTSD due to strong hyperarousal. Nevertheless, viewing comorbid disorders simply as overlap with PTSD has been rejected generally in a review of adult studies (McMillen et al., 2002), but ODD is not considered for adults. This suggests that a direction for future studies is to disentangle this empirical finding by comparing correlates of pure ODD cases to PTSD/ODD cases and to assess for ODD in older samples of traumatized children. It was unexpected to find higher rates of ADHD in girls with PTSD symptoms compared to boys. The most likely explanation appears to be that caregivers are more likely to seek help with girls who have ADHD symptomatology.

Fourth, we found no cases in children and only two cases in caregivers of new non-PTSD disorders in the absence of new PTSD symptomatology. This is extremely important in the context of targeting treatment interventions following disasters. It suggests that treatment aimed at PTSD may be the most salient and parsimonious strategy. Future treatment studies for PTSD ought to track improvements in this range of comorbid disorders to determine if trauma-focused treatments improve these other disorders.

Limitations

Because this was a self-selected sample that mostly responded to newspaper advertisements, it is possible that this represents an overestimate of Katrina-related psychopathology. However, at the time these data were

collected, approximately one fourth of the pre-Katrina population, or more than 300,000 people, had not yet returned to the New Orleans area. If those who have not returned are more severely impacted, then the current might represent an underestimate of psychopathology.

Because the typical age that disorders are first noticed in children is when they develop language capacities after 3 years of age, it is conceivable that the onsets of some of these disorders were when the disorder would have arisen naturally, regardless of traumatic experiences. As a result, the attribution of these non-PTSD disorders to traumatic events may be overestimates. However, the rate of disorders in this study far exceed prevalence rates for these disorders in a quasi-epidemiological sample (Egger et al., 2006).

The low rate of depression that we found in children could be due to self-selection from advertisements. Parents may be more likely to seek help for externalizing behaviors than internalizing behaviors. However, it also suggests a developmental difference that young children may not develop depression following traumas at the same high rates as adults.

The investigation of links between caregiver disorders, parent–child relationship quality, and child disorders is best conducted with prospective study designs. Any implication from these data that the parent–child relationship has a causal influence on children's symptomatology is limited by being a retrospective inference. All information about children's symptomatology was gathered from parent report, which is necessary with this age group, but carries the limitation known from prior research that this may well be an underestimation of severity.

Implications for Future Research, Policy, and Practice

It is impossible to shield children from all traumatic events in life, but these findings do point to some particular preventive steps that could be taken with young children in disasters. It may be wise to prevent children from viewing their devastated homes. They may not have the cognitive capacities yet to comprehend that the danger is over or that they were not and will not be in harm's way. Returning to damaged homes cannot always be avoided, so before returning it might be productive for parents preemptively to prepare children for what they are going to see to reduce the degree of shock. When evacuating, children's distress could be limited by leaving during the daytime, when the roads are less crowded, and if one parent cannot come, explaining clearly where that parent is and how they plan to meet up.

The significant correlations between children's and caregivers' symptomatology replicates the positive associations that have been found in numerous past studies.

For research, it is important to determine the direction of effects. For example, severe child symptomatology may cause distress in caregivers that exacerbates parental symptomatology as parents struggle to deal with their protective feelings and guilt. Of course, it is entirely plausible that the direction of effects are bidirectional, with each member of the dyad's distress and symptomatology exacerbating that of the other, as described in "relational PTSD" (Scheeringa & Zeanah, 2001). Another alternative explanation is that children of symptomatic parents develop PTSD because of shared genetic vulnerability (True, Rice, & Eisen, 1993).

For clinical practice, these findings add to the growing body of empirical literature that young children can be severely impacted by life-threatening events (Ghosh-Ippen et al., 2004; Laor et al., 1997; Levendosky et al., 2002; Ohmi et al., 2002; Scheeringa et al., 2003). Further, when new disorders occur, PTSD must be considered as part of the differential diagnosis. Oppositional defiant behaviors and separation anxiety in particular show high rates of concurrent onset with PTSD. Symptomatic parents and children need treatment following disasters, and fortunately, effective evidence-based treatments are increasingly available (Cohen, Deblinger, Mannarino, & Steer, 2004). Parents may be invaluable aids in helping their children recover and may benefit from the treatments they receive.

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