

# Post Traumatic Stress, Context, and the Lingering Effects of the Hurricane Katrina Disaster among Ethnic Minority Youth

Carl F. Weems · Leslie K. Taylor · Melinda F. Cannon ·  
Reshelle C. Marino · Dawn M. Romano ·  
Brandon G. Scott · Andre M. Perry · Vera Triplett

Published online: 26 August 2009  
© Springer Science + Business Media, LLC 2009

**Abstract** This study examined the stability of post traumatic stress disorder (PTSD) symptoms in a predominantly ethnic minority sample of youth exposed to Hurricane Katrina. Youth ( $n=191$  grades 4th thru 8th) were screened for exposure to traumatic experiences and PTSD symptoms at 24 months (Time 1) and then again at 30 months (Time 2) post-disaster. PTSD symptoms did not significantly decline over time and were higher than rates reported at earlier time points for more ethnically diverse samples. Younger age, female sex, and continued disrepair to the child's home predicted stable elevated PTSD symptoms. Findings are consistent with predictions from contextual theories of disaster exposure and with epidemiological data from adult samples suggesting that the incidence of PTSD post Katrina is showing an atypical pattern of remittance. Theoretical, applied, and policy implications are discussed.

**Keywords** Context · Post traumatic stress disorder · Trauma · Disaster · Stability · Ethnic minority

Hurricane Katrina was an intensely traumatic event for many youth and has had a substantial effect on the mental health of many survivors (Kessler et al. 2008; Weems et al. 2007b). Research suggests that exposure to natural disasters

is associated with post-traumatic stress (PTS) symptoms in youth (e.g., Lonigan et al. 1994; La Greca et al. 1996; Vernberg et al. 1996; see Silverman and La Greca 2002) particularly those associated with the diagnosis of post-traumatic stress disorder (PTSD; APA 1994). A consistent dose-response relationship has been observed in which those with more severe and intense traumatic experiences during a disaster are more likely to have more severe symptoms in the immediate aftermath (La Greca et al. 1998; Norris et al. 2002; Weems et al. 2007a). The effect of the post disaster environment on youth's emotional and health-related developmental trajectories is likely to be substantial, pervasive, and long lasting (Gard and Ruzek 2006; Weems et al. 2007a).

Research on previous disaster exposed samples suggests that youth symptoms tend to significantly remit over time (La Greca et al. 2002). For example, La Greca et al. (1996) reported that 29.1% of their sample of youth ( $N=442$  in grades 3–5) exposed to Hurricane Andrew in south Florida had “severe” or “very severe” PTSD symptoms at three months post landfall using a severity classification of the *Post Traumatic Stress Reaction Index for Children* (PTSD-RI; Frederick et al. 1992). By ten months post landfall only 12.7% reported severe or very severe symptoms. However, a number of factors may influence rates of decline and the typical pattern of remission may be less evident in certain circumstances and contexts (Yule et al. 2000). For example, ethnic minority children and children who continued to experience disruption after the storm may be less likely to have declines in symptoms over time (La Greca et al. 1996). A recent epidemiological study of adult Katrina survivors suggest that symptoms of emotional disorders such as PTSD are not remitting in the post Katrina context, as typically expected, and may even be on the rise (Kessler

---

This research was made possible in part by a grant from the New Orleans Institute of Mental Hygiene awarded to Carl F. Weems.

C. F. Weems (✉) · L. K. Taylor · M. F. Cannon · B. G. Scott  
Department of Psychology, University of New Orleans,  
New Orleans, LA 70148, USA  
e-mail: cweems@uno.edu

R. C. Marino · D. M. Romano · A. M. Perry · V. Triplett  
Department of Education, University of New Orleans,  
New Orleans, LA 70148, USA

et al. 2008). The purpose of this study was to examine if similar trends are evident for ethnic minority youth exposed to the Katrina disaster at two years and two and a half years post Katrina landfall.

Contextual analyses of the Katrina disaster (see Weems and Overstreet 2008; Weems et al. 2007b) suggest that the pervasiveness of the disaster and the lingering effects (communities remain in serious disrepair over 3 years later) may be influencing the maintenance of symptoms. In other words, the specific dose response relationship noted above may extend to the post disaster context (i.e., the more pervasive, lasting and extensive the community devastation, the more pervasive and lasting the emotional difficulties that follow). Contextual analyses posit that that individuals function within multiple contexts, or “ecologies”, and that these ecologies influence each other and human development in critical ways (Bronfenbrenner 1977, 1979). In addition to affecting multiple developmental contexts, disasters such as Hurricane Katrina impact emotional development by threatening basic human needs and goals (Hobfoll 1989; Sandler 2001). For example, in Hobfoll’s conservation of resources model (Hobfoll 1989) stressors such as Katrina deplete the individual’s financial, material, cognitive, and emotional resources. Similarly, Sandler’s (2001) risk and resilience model suggests that there are basic needs relevant to adaptation to severe stress including physical safety, self-worth, control/efficacy, and a sense of social relatedness. When these needs are not met, an individual is more likely to have difficulty in the face of adversity (See Sandler 2001 for expanded discussion). Disasters like Hurricane Katrina threaten these basic needs and resources and so challenge healthy emotional development and mental health.

At the broadest contextual level Hurricane Katrina made salient societal prejudices toward people of color and people living in poverty (Bobo 2006; Huddy and Feldman 2006; Lieberman 2006). Consistent with these national trends, surveys of adults residing in the Gulf region in the early months following Katrina indicated that ethnic minorities perceived more discrimination than non-minorities and that regardless of ethnicity individuals living in New Orleans perceived less social support and perceived more discrimination than those living along the Gulf Coast of Mississippi (Weems et al. 2007b). An additional broad influence that is important to note is the state and federal government response and the laws and policies that govern funding the mental health response (Drury et al. 2008). A final potential influence worth noting at the macrosystem level is television viewing in a culture of continuous news cycles. Weems et al. (2007b) found that 81% to 98% of the sample reported viewing some form of intense disaster related traumatic events on TV, including death, human suffering, and violence following Katrina. In a culture of

24 h a day seven day a week news cycles, even families who evacuated and did not experience the disaster firsthand could not escape images of destruction on the TV. We reasoned that these broad influences are likely to be evident in the atypical developmental symptom progression (i.e., the lack of symptom remission) found in Kessler et al. (2008). One goal of this study was to test this hypothesis of atypical symptom remission among ethnic minority youth.

Extending an understanding of the long term traumatic stress response after disaster to minority samples that have been relatively understudied in the disaster literature is critical to developing a comprehensive picture of disaster related emotional problems (Rabalais et al. 2002). As noted, there is some evidence to suggest that the remission of symptoms is less evident in ethnic minorities (La Greca et al. 1996). Ethnic minorities also may be less likely to seek community treatment and perceive less potential benefit from clinic based treatment (Chavira et al. 2003; Mojtabai and Olfson 2006) increasing the probability of prolonged difficulties. In this study, we therefore focused on a sample of minority youth from a high impact area within New Orleans.

In addition to broad community level influences impacting stability broadly, more proximal and individual factors may predict stability. For example, the “microsystem” in Bronfenbrenner’s theorizing (1977; 1979) represents proximal ecologies within which the child develops, including the family/home and school environments, neighborhood environments and peer relationships. Disasters may affect child adaptation by increasing risk in these contexts. It is all too clear that disasters the scale of Hurricane Katrina created disruptions in all of the microsystems within which youth develop. We reasoned that an important contextual (at the microsystem level see Bronfenbrenner 1977, 1979; Weems and Overstreet 2008) index of the lasting disruption would be if the child’s family home remains damaged/in need of repair and if the youth continued to have difficulty seeing friends. Ongoing disruptions in friendships also tie in with a disruption in basic needs in terms of disruption in social relatedness and continued problems with rebuilding tie into both the physical safety and control/efficacy needs (e.g., the family is not in control of their physical safety if their home has not been rebuilt). Alternatively or additionally, intervening life stressors may be fostering maintenance (i.e., general stressors not specific to the disaster happen to be maintaining rates, see La Greca et al. 1996).

We also sought to increment knowledge on the child characteristics of age and sex on PTSD symptoms (i.e., these would be factors in the “ontogenetic” level in contextual models Bronfenbrenner 1977, 1979). While the effects of age have been mixed (La Greca et al. 1998; Weems et al. 2007a) there is evidence to suggest that younger children exposed to Katrina may be at increased risk (Scheeringa and Zeanah 2008). Because of developmentally

related biological, emotional, and psychosocial changes, disaster exposure may be particularly detrimental to younger children. Younger children may be less able to process exposure to traumatic events and cope with the disruption. In particular, there is a normative emergence of death and disease concerns in children around the age of 10 to 12 (Warren and Sroufe 2004; Weems 2008; Westenberg et al. 2001; Westenberg et al. 1999). This normative salience in death and disease concerns may be exacerbated by disaster exposure and make the post disaster context more emotionally taxing for younger children (grades 4–6 elementary age) as compared to older youth (grades 7–8 middle school) thereby leading to more stable elevated or worsening PTSD symptoms for younger children.

In addition, female sex has been consistently associated with relatively increased PTSD symptoms (Weems et al. 2007a, b), but few studies have examined the role of gender in the long term stability of PTSD symptoms. Girls may be at greater risk due to both genetic and social factors (Weems and Silverman 2008). A salient omission from this literature concerns the issue of whether age and gender differences in disaster related PTSD symptoms represent simple mean differences or if age and gender truly represent increased risk for severe PTSD. Specifically, past research has tended to examine age and sex's association with continuously assessed PTSD symptoms. Thus, the association could represent differences in the continuous distribution PTSD symptoms across age or sex and not that females and younger children are over-represented among the most severely effected. In this study we sought to clarify this methodological issue.

In sum, we sought to increment knowledge on the long term reactions to disaster in youth. We predicted that among ethnic minority youth exposed to Hurricane Katrina and residing in one of the main devastated areas of the city, PTSD symptoms would remain relatively stable over time and that rates would be similar to or higher than those reported among samples assessed earlier post-disaster. We further predicted that younger age, female sex, intervening life events, and continued disruption (to the home and peer relations) would predict higher PTSD symptoms and would be associated with stable severe or increasingly severe PTSD symptoms. These hypotheses were tested by examining PTSD symptoms both continuously as well as by examining severity classifications.

## Method

### Participants

This study utilized a prospective design with a predominantly African American sample of 202 school children

from New Orleans. One hundred and ninety-one youth completed the Time 2 assessments and written informed parental consent was obtained. These youth represented 4th through 8th graders attending school in a New Orleans neighborhood that received massive damage, almost total flooding, and continues to have a significant proportion of the community in disrepair. The sample was screened for exposure to traumatic experiences and distress related to Hurricane Katrina and PTSD symptoms at 24 months (Time 1) well within hurricane season and then again at 30 months (Time 2) outside hurricane season post-disaster as part of a school-based initiative. The sample was aged 8–15 years (median age 11.5 years) and was 55% male. Youth reported their ethnicities as 97% African American ( $n=196$ ), 2% 'mixed African-American/other' ( $n=4$ ), 1 as Caribbean-American, and 1 as Euro-American. The school serves youth predominantly from low income families (school data indicate that 97% of the students receive free lunch, 2% are on a reduced payment, and 1% pay for lunch).

Comparison of the youth who completed both the Time 1 and Time 2 assessments versus the youth who only completed the Time 1 assessment revealed no statistically significant differences on Time 1 study variables of age, sex, ethnicity, exposure experiences, and PTSD symptoms.

### Measures

Symptoms of PTSD were measured using a modified version of the *Post Traumatic Stress Reaction Index for Children* (PTSD-RI; Frederick et al. 1992). The PTSD-RI is one of the most widely used instruments to assess post-traumatic stress reactions and thus allows easy comparison amongst studies. As done in previous research (Hensley and Varela 2008; Vernberg et al. 1996; La Greca et al. 1996) the PTSD-RI used in this study contains 20 items, with answer choices modified for ease of administration from the original five options to three options (none of the time, some of the time, most of the time—coded as 0, 2, 4 respectively) and youth were instructed to rate their symptoms in response to the Katrina Hurricane events. Total PTSD-RI scores thus range from 0 to 80. Internal consistency for the present sample was good (Time 1  $\alpha = .87$ , Time 2  $\alpha = .86$ ). To foster comparisons with previous studies using the RI (e. g., La Greca et al. 1996; Vernberg et al. 1996) and to create PTS severity groups, we classified the sample by severity of symptoms using the system developed by Frederick et al. (1992) which includes the following categories: Doubtful (score of 0–11), Mild (12–24), Moderate (25–39), Severe (40–59), and Very Severe (60–80).

Exposure experiences and hurricane-related distress were assessed via a survey of exposure to the hurricane and its aftermath based on the work of La Greca and colleagues (La Greca et al. 1998; Vernberg et al. 1996). Sample items

include: “Did you get hurt during the hurricane?” “Was your home damaged badly or destroyed by the hurricane?” Respondents indicated Yes or No to whether they were exposed to each event. Commonly reported experiences are presented in Table 1. Continued damage to the home (22% reported the damage had still not been fixed as of 24 months post) and continued separations from friends (71% indicated difficulty seeing friends) were assessed with a single item yes or no format questions as part of this survey. The survey also included a global assessment of the level of distress experienced during the storm and after the storm. These items are: “Overall how scared or upset were you during the hurricane?” “Overall how scared or upset were you after the hurricane?” and are scored from 0 “not at all” to 3 “a whole lot”. These items were used to establish the link between exposure related distress and PTSD symptoms as demonstrated in previous studies conducted in the more immediate aftermath of the storm.

A short form of the Life Events Checklist (LEC; Johnson and McCutcheon 1980) used in previous disaster research (e.g., La Greca et al. 1996) was administered to assess intervening life events (non disaster events) associated with PTSD symptoms. The short form contains 14 major life events that reflect personal stressors (e.g., death of a family member or loved one; serious illness or hospitalization), as well as other major stressful events (e.g., birth of a sibling). The test-retest reliability of the LEC over a 2-week interval has been shown to be .72, and studies have provided support for its validity (Greenberg et al. 1983).

## Procedures

Data collection was conducted as part of the school’s counseling curriculum and written informed consent for the use of the data in research was obtained from the parent (~90% response rate). Oral assent was obtained from the child (children were not required to fill in the questionnaires or to participate). The IRB reviewed the procedures and approval was obtained for the use of the de-identified data. Specifically, the longitudinal data base was created to

help track and identify youth in need of school services; however, identifying information was removed from the data for use in this study. Youth completed the measures in a group classroom setting and were assisted by trained staff. Younger children were read the instructions and each item by a staff member and trained staff helped individual children as necessary as done in previous research (La Greca et al. 1996; Vernberg et al. 1996).

## Results

Descriptive analyses and examination of the scores’ ranges and skew indicated acceptable levels for the planned parametric analyses (linear regression); however, results are also supplemented with non-parametric analyses. As shown in Table 1, participants were exposed to a wide range and large number of potentially stressful hurricane-related events. Preliminary analyses of the relationship between PTSD and level of distress related to hurricane exposure events indicated that global assessment of the level of distress experienced during and after the storm were both significantly related to PTSD-RI scores (the correlation with distress during the hurricane was  $r=.43$  for Time 1 and  $r=.26$  for Time 2 and the correlation with distress experienced after the hurricane was  $r=.44$  for Time 1 and  $r=.23$  for Time 2).

In terms of PTSD symptoms, children were classified by severity of symptoms using the system developed by Frederick et al. (1992) at Time 1: “Doubtful” 27%, “Mild” 32%, “Moderate” 22%, “Severe” 15%, and “Very Severe” 4%. At Time 2: “Doubtful” 25%, “Mild” 36%, “Moderate” 23%, “Severe” 13%, and “Very Severe” 3%. Chi square analyses indicated that youth were significantly likely to retain their severity classification over time [ $\chi^2(16)=69.78$ ,  $p<0.001$ ]. Wilcoxon sign ranked tests on the PTSD-RI groups were also conducted to examine changes from lower to higher PTSD severity groups from Time 1 to Time 2. Fifty five children (29%) increased from a lower to higher severity group while 58 youth (30%) decreased severity group and 78 (41%) remained the same ( $Z=-0.59$ ,  $p=.556$ , no significant change on average) suggesting that the vast majority (70%) stayed the same or increased. Comparison of the Time 2 rates with previous reported published rates (e.g., Hensley and Varela 2008 collected PTSD-RI ratings in a sample between five and eight months following Hurricane Katrina) indicated a that the rates were highly similar [goodness of fit  $\chi^2(4)=3.72$ ,  $p>.1$  see “Discussion” for percentages in Hensley & Varela].

When continuous PTSD symptom data were analyzed with paired samples *t*-tests, results indicated no significant reduction in PTSD-RI scores [ $t(190)=0.42$ ,  $p=.678$ , mean PTSD-RI score at Time 1 equal to 23.71 (17.0) and Time 2

**Table 1** Common Hurricane-related Experiences in the Sample

Did you think someone might die	79%
Clothes or toys ruined	78%
Hard to see friends	76%
Home badly damaged or destroyed	65%
Witnessed others hurt during the storm	45%
Pet hurt or died	41%
Thought they might die during the storm	38%
Things stolen from home	32%
Had trouble getting food and water after	20%

equal to 23.26 (15.2)]. Interclass correlation coefficients were also calculated on Time 1 and Time 2 PTSD-RI scores and indicated fairly high level of stability (absolute agreement ICC=.57). Pearson's correlation ( $r=.57$ ,  $p<0.001$ ) and Spearman's rho correlation ( $\rho=.56$ ,  $p<0.001$ ) indicated similar estimates for the Time 1 and Time 2 PTSD-RI scores association.

To examine the hypothesized predictors' linear association with PTSD symptoms, multiple linear regression analysis was conducted to examine predictors of change in PTSD symptoms. Specifically, Time 2 PTSD-RI scores were entered as the dependent variable and Time 1 PTSD-RI scores, LEC scores, sex, age, continued damage to the home, and separations from friends were entered simultaneously as predictors. Results are summarized in Table 2 and indicated that younger age, female sex [coded female (1) male (0)], and continued damage to the child's home [coded home still not fixed (0), home fixed (1)] predicted change in PTSD-RI scores (model  $R^2=.43$ , adjusted  $R^2=.41$ ,  $p<0.001$ )<sup>1</sup>.

As noted in the introduction, the associations identified in the linear regression analyses could represent differences in the continuous distribution PTSD symptoms across age or sex and not that females and younger children are over-represented among the most severely effected. In order to clarify this methodological issue, we next calculated odds ratios predicting stable severe PTSD using logistic regression analyses for the three significant predictors of Time 2 PTSD (age, sex, and home fixed). Youth whose PTSD remained in the severe to very severe category or whose symptoms increased into the severe or very severe category from Time 1 to Time 2 were coded 1 (all others coded 0). The predictors were coded in the following manner for consistency in reporting odds ratios: female sex (1) male (0), grade 4–6 (1) grade 7–8 (0), and home still not fixed (1), home fixed (0). Results are summarized in Table 3 and indicated that each of these dichotomously coded variables carried from 2.7 to 4.5 times increased risk of having stable severe or increasingly severe PTSD symptoms [model  $\chi^2(3)=20.97$ ,  $p<0.001$ ]<sup>2</sup>.

<sup>1</sup> We also tested if level of hurricane distress changed these results in a separate regression analysis and results indicated that these were non-significant predictors in regression models controlling Time 1 PTSD RI scores. Moreover, they did not change the effect of the other variables in the model and were thus left out of the final model reported in Table 2 in the interest of parsimony.

<sup>2</sup> Given that difficulty seeing friends approached a traditional .05 alpha in the linear regression analysis (i.e.,  $p=.06$ ), we also examined the odds ratio for this predictor in an additional logistic regression analysis [that similarly included sex (1) male (0), grade 4–6 (1) grade 7–8 (0), and home still not fixed (1), home fixed (0)] and results indicated that difficulty seeing friends (yes coded 1) was associated with youth whose PTSD remained in the severe to very severe category or whose symptoms increased into the severe or very severe category from Time 1 to Time 2 (Wald=4.09,  $p=.043$ , odds ratio=4.8.)

## Discussion

This study extends existing findings on the effects of disaster in general and on Hurricane Katrina in particular by demonstrating the continued stability of PTSD symptoms in New Orleans youth using a prospective design. Results were consistent with hypotheses and with research using adult samples (Kessler et al. 2008) suggesting that the severity of the disaster has resulted in an atypical pattern of PTSD symptom remission. Estimates of severe PTSD are similar or higher than rates reported on samples of youth assessed within one year of the storm. For example, Hensley and Varela (2008) used the PTSD-RI and reported the following estimates: Doubtful (28.8%), Mild (33.8%), Moderate (24.5%), Severe (10.3%), and Very Severe (2.3%) in a sample of 302 6th and 7th graders in the New Orleans metropolitan area (their sample was 61% male and 63% non-White with ages ranging from 10 to 15 years and data was collected between five and eight months following Hurricane Katrina). Spell et al. (2008) similarly reported that 11% of their sample of 260 children recruited from public schools within Orleans (43% of sample), Jefferson (43% of sample), and East Baton Rouge (15% of sample) Parish 3 to 7 months post-Hurricane Katrina had severe PTSD according to the PTSD-RI (their sample was 43% male the majority were African American 68%).

The ethnic minority youth in this sample evidenced high rates of PTSD symptoms following exposure to natural disaster and appear to show disturbingly high rates of stable elevated symptoms. The severity classification results from moderate to severe on the PTSD RI combined with the regression analyses suggest that from 39% to 16% of youth in highly effected areas could still benefit from treatment a full 2.5 years after exposure to the disaster and that these rates are not a function of intervening life stressors. Overall, the rates of severe levels of post traumatic stress symptoms in this study are alarming given the potential for negative emotional, behavioral, cognitive, neuro-developmental and hormonal outcomes associated with PTSD (Carrion et al. 2001; Carrion et al. 2007; De Bellis et al. 1999 see La Greca et al. 2002).

The far reaching effects of Katrina and its aftermath challenge the applicability of many specific theoretical models to capture the complexity of youth adaptation. To try to capture the breadth of influence, our writing and research on the Katrina disaster (Weems and Overstreet 2008; Weems et al. 2007b) has utilized broad contextual models of lifespan human development (e.g., Bronfenbrenner 1977, 1979) and of risk and resilience to stress (e.g. Hobfoll 1989; Sandler 2001). Drawing from these theoretical models, we have termed our integrative framework an ecological needs-based perspective (Weems and Overstreet 2009). The ecological needs based model suggests that the

**Table 2** Summary of Regression Analysis Predicting Time 2 PTSD Symptoms

	B	S. E.	Beta	t	p-value	Semi-partial
Intercept	30.29	7.27		4.17	0.000	
PTSD RI Time 1	0.33	0.06	0.37	5.46	0.000	0.31
LEC	7.91	6.57	0.08	1.20	0.231	0.07
Sex	6.09	1.90	0.20	3.21	0.002	0.18
Age	-2.05	0.54	-0.22	-3.82	0.000	-0.22
Hard to see friends	3.86	2.06	0.11	1.87	0.063	0.11
Damage to house fixed	-6.14	2.15	-0.17	-2.86	0.005	-0.16

Full model significant at  $p < 0.001$ ; model  $R^2 = .43$

PTSD-RI Reaction Index-Posttraumatic Stress Disorder symptoms, LEC Life Events Checklist

challenges to the basic needs of youth (e.g., physical safety, efficacy, self-worth, and social relatedness) precipitate emotional distress and emanate from multiple contexts. The data from this study and others (Kessler et al. 2008) suggests that the individual dose response relationship may extend to the contexts in which disaster survivors find themselves living post-disaster such that the stability of the traumatic stress response may be related to the pervasiveness of the broader contextual devastation and so point to the need to better understand the layered contextual effects of disaster. They further highlight the need for child care workers (e.g., pediatricians, family practice workers) to specifically assess for these problems in such contexts for years after the initial impact.

Although younger age and female sex are not modifiable risk factors, the results point to the potential importance of developing prevention efforts targeting females and younger children. While the development of valid assessment and effective treatment programs for younger children have been relatively neglected (Scheeringa and Zeanah 2008) there is emerging evidence to suggest that cognitive and behavioral techniques may be efficacious even for preschoolers (e.g., see Scheeringa et al. 2007). Moreover, while we did not directly assess treatment services, the lasting elevated levels of PTSD in the sample speak to the importance of school and community based efforts to address the mental health needs of youth following natural disaster that are ongoing and not short term immediately post disaster. Such programs have promising intervention and prevention potential for underserved youth (Salloum and Overstreet 2008; Weems et al. 2009). For example, research by Salloum and Overstreet (2008) illustrates the

potential of school-based mental health services to increase those connections in a sample of 58 youth who received intervention services following Katrina. Most parents of the children found it difficult to come to the school for a meeting, so the intervention incorporated a community-based parent meeting (i.e., at the parent's home or work) scheduled at the parent's convenience. Youth in the intervention groups had significant reductions in posttraumatic stress symptoms, depression, and traumatic grief. Funding large scale implementation of similar programs in areas hard hit by disaster may help reduce the mental health burden on youth reducing rates of PTSD and fostering symptom decline.

Drury, Scheeringa, and Zeanah (2008) have provided an insightful review the federal laws governing the distribution of funds for mental services following disaster. Drury et al. (2008) note that following the Katrina disaster, the Federal government allocated a large amount of funds (over 40 million dollars) to Louisiana for disaster related mental health response through the Federal Emergency Management Agency (FEMA); however, despite the funds they were not allocated to provide increased treatment services for individuals or to expand the training of clinicians in evidence-based approaches. Drury et al. argue that this is because the Stafford Disaster Relief and Emergency Assistance Act, which provides for federal assistance, describes the mental health response as "crisis counseling". The Substance Abuse and Mental Health Services Administration (SAMHSA) manages this FEMA mental health component and interprets the Stafford Act to mean that FEMA funds after disasters cannot be used for comprehensive mental health treatment. Again while we did not directly assess treatment involvement, the results presented in this paper and others from Hurricane Katrina samples points to the importance of developing more responsive allocation of disaster funds to help reduce the mental health burden in disaster exposed communities and the time may be ripe for such reform (Bristol 2008). Programs directed at young, ethnic minority, children may be particularly useful given the pattern of findings in this study.

The findings should be considered in light of the study's limitations. The first is that there are a number of factors

**Table 3** Estimates of Risk for 30 Month Stable Severe or Increasingly Severe PTSD Symptoms

	Wald	p-value	Odds	95% C.I.	
Female Sex	10.01	0.002	4.45	1.76	11.20
Lower Grade	7.37	0.007	3.94	1.46	10.63
Home not Fixed	4.17	0.041	2.71	1.04	7.04

Model  $\chi^2(3) = 20.97$ ,  $p < 0.001$ ; Overall Classification = 84.2%

not assessed in this study that could also be maintaining high rates of PTS and a number of factors implied by our conceptual model that were not assessed. While no single study can hope to capture all the potential influences, given the timing of the Time 2 assessment (outside hurricane season) it appears that stability was not simply due the salience of hurricane season promoting elevated reporting. Moreover, this study also relied on youth's self-reports. It might be the case that reports from other sources (such as parents) would have resulted in different findings. However, youth have been consistently found to be valid reporters (and often better reporters) of their own internalizing distress (see e.g., Weems et al. 2005). Another limitation of the present study concerns the clinical severity of youth's symptoms. While we used severity cut offs actual diagnostic status could have been ascertained by using a DSM-IV clinical interview. A limitation to generalizing results to other populations is that the study sample was composed of predominantly ethnic minority youth. While this is a positive feature in that it extends the literature to a population that has been understudied (Rabalais et al. 2002) the effect on ethnic majority youth is less clear from this sample. Inclusion of a group of ethnic majority youth and using a sample from diverse socio-economic backgrounds would have strengthened conclusions about the relative impact on minority youth and allowed us to disentangle the interrelations among socio-economic status, minority status and the effects of trauma on symptoms.

## References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders, (DSM-IV)* (4th ed.). Washington: Author.
- Bobo, L. D. (2006). Katrina: unmasking race, poverty, and politics in the 21st century. *Du Bois Review*, 3, 1–6.
- Bristol, N. (2008). Obama's plans for US and global health. *Lancet*, 372, 1797–1798.
- Bronfenbrenner, U. (1977). Toward an experimental ecology of human development. *American Psychologist*, 32, 513–531.
- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge: Harvard University Press.
- Carrión, V. G., Weems, C. F., Eliez, S., Patwardhan, A., Brown, W., Ray, R., et al. (2001). Attenuation of frontal lobe asymmetry in pediatric PTSD. *Biological Psychiatry*, 50, 943–951.
- Carrión, V. G., Weems, C. F., & Reiss, A. L. (2007). Stress predicts brain changes in children: a pilot longitudinal study on youth stress, PTSD, and the hippocampus. *Pediatrics*, 119, 509–516.
- Chavira, D. A., Stein, M. B., Bailey, K., & Stein, M. T. (2003). Parental opinions regarding treatment for social anxiety disorder in youth. *Journal of Developmental & Behavioral Pediatrics*, 24, 315–322.
- De Bellis, M. D., Keshavan, M. S., Clark, D. B., Casey, B. J., Giedd, J. N., Boring, A. M., et al. (1999). Developmental traumatology: II. Brain development. *Biological Psychiatry*, 45, 1271–1284.
- Drury, S. S., Scheeringa, M. S., & Zeanah, C. H. (2008). The traumatic impact of Hurricane Katrina on children in New Orleans. *Child and Adolescent Psychiatric Clinics of North America*, 17, 685–702.
- Frederick, C. J., Pynoos, R. S., & Nadar, K. (1992). *Reaction index to psychic trauma form C (Child)*. Los Angeles: Author: University of California.
- Gard, B. A., & Ruzek, J. I. (2006). Community mental health response to crisis. *Journal of Clinical Psychology*, 62, 1029–1041.
- Greenberg, M. T., Siegle, J. M., & Leitch, C. J. (1983). The nature and importance of attachment relationships to parents and peers during adolescence. *Journal of Youth & Adolescence*, 12, 373–386.
- Hensley, L., & Varela, R. E. (2008). PTSD symptoms and somatic complaints following Hurricane Katrina: the role of trait anxiety and anxiety sensitivity. *Journal of Clinical Child and Adolescent Psychology*, 37, 542–552.
- Hobfoll, S. E. (1989). Conservation of resources: a new attempt at conceptualizing stress. *American Psychologist*, 44, 513–524.
- Huddy, L., & Feldman, S. (2006). Worlds apart: Blacks and Whites react to Hurricane Katrina. *Du Bois Review*, 3, 97–113.
- Johnson, J. H., & McCutcheon, S. (1980). Assessing life stress in older children and adolescents: preliminary findings with the life events checklist. In I. G. Sarason & C. D. Spielberger (Eds.), *Stress and anxiety*, vol. 7 (pp. 111–125). Washington: Hemisphere.
- Kessler, R. C., Galea, S., Gruber, M. J., Sampson, N. A., Ursano, R. J., & Wessely, S. (2008). Trends in mental illness and suicidality after Hurricane Katrina. *Molecular Psychiatry*, 13, 374–384.
- La Greca, A. M., Silverman, W. K., Vernberg, E. M., & Prinstein, M. (1996). Symptoms of posttraumatic stress after Hurricane Andrew: a prospective study. *Journal of Consulting and Clinical Psychology*, 64, 712–723.
- La Greca, A. M., Silverman, W. K., & Wasserstein, S. B. (1998). Children's predisaster functioning as a predictor of posttraumatic stress following Hurricane Andrew. *Journal of Consulting and Clinical Psychology*, 66, 883–892.
- La Greca, A. M., Silverman, W. K., Vernberg, E. M., & Roberts, M. C. (Eds.) (2002). *Helping children cope with disasters and terrorism*. Washington: American Psychological Association.
- Lieberman, R. C. (2006). The storm didn't discriminate. Katrina and the politics of color blindness. *Du Bois Review*, 3, 7–22.
- Lonigan, C. J., Shannon, M. P., Taylor, C. M., Finch, A. J., & Sallee, F. R. (1994). Children exposed to disaster: II. Risk factors for the development of post-traumatic symptomatology. *Journal of the American Academy of Child and Adolescent Psychiatry*, 33, 94–105.
- Mojtabai, R., & Olfson, M. (2006). Treatment seeking for depression in Canada and the United States. *Psychiatric Services*, 57, 631–639.
- Norris, F. H., Friedman, M. J., & Watson, P. J. (2002). 60,000 disaster victims speak: Part II. Summary and implications of the disaster mental health research. *Psychiatry*, 65, 240–260.
- Rabalais, A. E., Ruggiero, K. J., & Scotti, J. R. (2002). Multicultural issues in the response of children to disasters. In A. M. La Greca, W. K. Silverman, E. M. Vernberg & M. C. Roberts (Eds.), *Helping children cope with disasters and terrorism* (pp. 73–99). Washington: American Psychological Association.
- Salloum, A., & Overstreet, S. (2008). Evaluation of individual and group grief and trauma interventions for children post disaster. *Journal of Clinical Child and Adolescent Psychology*, 37, 495–507.
- Sandler, I. (2001). Quality and ecology of adversity as common mechanisms of risk and resilience. *American Journal of Community Psychology*, 29, 19–61.
- Scheeringa, M. S., & Zeanah, C. H. (2008). Reconsideration of harm's way: onsets and comorbidity patterns of disorders in preschool children and their caregivers following Hurricane Katrina. *Journal of Clinical Child and Adolescent Psychology*, 37, 508–518.

- Scheeringa, M. S., Aramberger, R., Salloum, A., Weems, C. F., Amaya-Jackson, L., & Cohen, J. (2007). Feasibility and effectiveness of cognitive-behavioral therapy for posttraumatic stress disorder in preschool children: two case reports. *Journal of Traumatic Stress, 20*, 631–636.
- Silverman, W. K., & La Greca, A. M. (2002). Children experiencing disasters: Definitions, reactions, and predictors of outcomes. In A. M. La Greca, W. K. Silverman, E. M. Vernberg & M. C. Roberts (Eds.), *Helping children cope with disasters* (pp. 11–34). Washington: American Psychological Association.
- Spell, A. W., Kelley, M. L., Self-Brown, S., Davidson, K., Pellegrin, A., Palcic, J., et al. (2008). The moderating effects of maternal psychopathology on children's adjustment post-Hurricane Katrina. *Journal of Clinical Child and Adolescent Psychology, 37*, 553–563.
- Vernberg, E. M., La Greca, A. M., Silverman, W. K., & Prinstein, M. (1996). Predictors of children's post-disaster functioning following Hurricane Andrew. *Journal of Abnormal Psychology, 105*, 237–248.
- Warren, S. L., & Sroufe, L. A. (2004). Developmental issues. In T. H. Ollendick & J. S. March (Eds.), *Phobic and anxiety disorders in children and adolescents: A clinician's guide to effective psychosocial and pharmacological interventions* (pp. 92–115). New York: Oxford University Press.
- Weems, C. F. (2008). Developmental trajectories of childhood anxiety: identifying continuity and change in anxious emotion. *Developmental Review, 28*, 488–502.
- Weems, C. F., & Overstreet, S. (2008). Child and adolescent mental health research in the context of Hurricane Katrina: an ecological-needs-based perspective and introduction to the special section. *Journal of Clinical Child and Adolescent Psychology, 37*, 487–494.
- Weems, C. F., & Overstreet, S. (2009). An ecological-needs-based perspective of adolescent and youth emotional development in the context of disaster: Lessons from Hurricane Katrina. In K. E. Cherry (Ed.), *Lifespan perspectives on natural disasters: Coping with Katrina, Rita and other storms* (pp. 27–44). New York: Springer.
- Weems, C. F., & Silverman, W. K. (2008). Anxiety Disorders. In T. P. Beauchaine & S. P. Hinshaw (Eds.), *Child and adolescent psychopathology*. Hoboken: Wiley.
- Weems, C. F., Zakem, A., Costa, N. M., Cannon, M. F., & Watts, S. E. (2005). Physiological response and childhood anxiety: association with symptoms of anxiety disorders and cognitive bias. *Journal of Clinical Child and Adolescent Psychology, 34*, 712–723.
- Weems, C. F., Pina, A. A., Costa, N. M., Watts, S. E., Taylor, L. K., & Cannon, M. F. (2007a). Pre-disaster trait anxiety and negative affect predict posttraumatic stress in youth after Hurricane Katrina. *Journal of Consulting and Clinical Psychology, 75*, 154–159.
- Weems, C. F., Watts, S. E., Marsee, M. A., Taylor, L. K., Costa, N. M., Cannon, M. F., et al. (2007b). The psychosocial impact of Hurricane Katrina: contextual differences in psychological symptoms, social support, and discrimination. *Behaviour Research and Therapy, 45*, 2295–2306.
- Weems, C. F., Taylor, L. K., Costa, N. M., Marks, A. B., Romano, D. M., Verrett, S. L., et al. (2009). Effect of a school-based test anxiety intervention in ethnic minority youth exposed to Hurricane Katrina. *Journal of Applied Developmental Psychology, 30*, 218–226.
- Westenberg, P. M., Siebelink, B. M., Warmenhoven, N. J., & Treffers, P. D. A. (1999). Separation anxiety and overanxious disorders: relations to age and level of psychosocial maturity. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*, 1000–1007.
- Westenberg, P. M., Siebelink, B. M., & Treffers, P. D. A. (2001). Psychosocial developmental theory in relation to anxiety and its disorders. In W. K. Silverman & P. D. A. Treffers (Eds.), *Anxiety disorders in children and adolescents: Research, assessment and intervention* (pp. 72–89). Cambridge: Cambridge University Press.
- Yule, W., Bolton, D., Udwin, O., Boyle, S., O'Ryan, D., & Nurrish, J. (2000). The long-term psychological effects of a disaster experienced in adolescence: I. The incidence and course of PTSD. *Journal of Child Psychology and Psychiatry, 41*, 503–512.