



## Predicting mothers' reports of children's mental health three years after Hurricane Katrina

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### ABSTRACT

This study explored pathways through which hurricane-related stressors affected the psychological functioning of elementary school aged children who survived Hurricane Katrina. Participants included 184 mothers from the New Orleans area who completed assessments one year pre-disaster (Time 1), and one and three years post-disaster (Time 2 and Time 3, respectively). Mothers rated their children's behavior problems at Time 3 only ( $n = 251$  children; 53.0% male; mean age: 10.19 years,  $SD = 1.68$  years). A path analytic model indicated that hurricane-related stressors were associated with increased maternal psychological distress and school mobility in the first post-disaster year, which were associated with higher child internalizing and externalizing symptoms three years post-disaster. Mediation analysis indicated that hurricane-related stressors were associated with child symptoms indirectly, through their impact on maternal psychological distress. Findings underscore the importance of interventions that boost maternal and child mental health and support children through post-disaster school transitions.

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Children who were exposed to Hurricane Katrina faced a range of stressors, including the loss of loved ones and threats to their physical safety (Madrid & Grant, 2008; Osofsy, Osofsky, & Harris, 2007). In the years since the disaster, many have faced ongoing stressors associated with caregiver mental health problems, residential instability, and multiple school transitions (Osofsy et al., 2007; Pane, McCaffrey, Tharp-Taylor, Asmus, & Stokes, 2006; Spell et al., 2008). Not surprisingly, a growing body of research has documented the adverse mental health consequences of Hurricane Katrina on children (e.g., Abramson, Park, Stehling-Ariza, & Redlener, 2010; Scheeringa & Zeanah, 2008). The purpose of this study was to investigate the longer-term impact of hurricane exposure on low-income mothers' reports of their elementary school aged children's psychological functioning. We explored both the direct effects of hurricane exposure on child functioning, as well as the indirect effects of maternal psychological distress and disruptions in schooling.

#### *Impact of Hurricane Katrina on children's psychological functioning*

Children exposed to Hurricane Katrina and other natural disasters are at increased risk for short and long-term psychological distress, including symptoms of depression, post-traumatic stress (PTS), separation anxiety, and oppositionality (e.g., Abramson et al., 2010; La

Greca, Silverman, Lai, & Jaccard, 2010; Scheeringa & Zeanah, 2008). According to several studies (e.g., McLaughlin et al., 2010; Weems et al., 2010), elevated levels of child psychological distress (e.g., symptoms of PTS and emotional disturbance) have persisted in the years following Hurricane Katrina. For example, in a study of school-aged children ( $n = 283$ ) in which households that had been displaced or affected greatly by Hurricane Katrina were randomly selected from FEMA and census databases, Abramson et al. (2010) found that 37.5% had been given a mental health diagnosis since the hurricane (per parent reports), and that 30.0% were still suffering from the diagnosed condition four years after the hurricane. Another study ( $n = 576$ ) that used a probability sample of residents of the areas affected by Hurricane Katrina (recruited by either random-digit-dialing or through a random selection of families applying for assistance from the American Red Cross) documented higher rates of parent-reported child psychosocial problems (e.g., conduct problems, peer relation problems) and associated parent-reported functional impairment as measured by the Strengths and Difficulties Questionnaire (SDQ) 18–27 months (15.1%) and 36–39 months (11.5%) post-Katrina (McLaughlin et al., 2010), which was notably higher than the pre-Katrina estimates of elevated SDQ status (4.2%).

It is important to note, however, that children's reactions to the difficult circumstances caused by Hurricane Katrina have varied widely. Although many have exhibited symptoms of distress, others have remained remarkably unscathed (e.g., La Greca et al., 2010; McLaughlin et al., 2010). Research on post-disaster functioning has revealed a dose–response relationship, in which psychological symptoms vary in proportion to disaster exposure (e.g., La Greca et al., 2010; Scheeringa & Zeanah, 2008). Disaster exposure has relevance

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to children's psychological functioning during and in the immediate aftermath of the hurricane as well as in the longer-term disaster recovery process (Abramson et al., 2010; Bonanno, Brewin, Kaniasty, & La Greca, 2010; La Greca et al., 2010; McLaughlin et al., 2010). With regard to the immediate impact, increased exposure to the disaster (e.g., being in locations hardest hit by the storm, being stranded in shelters) increased the likelihood of experiencing threatening and potentially traumatic events, thereby leading to increased risk of psychological distress. The association between disaster exposure and children's post-disaster psychological functioning is more complex as it is likely mediated by a range of factors (Bonanno et al., 2010). Considering children's ecological contexts and the multiple spheres of influence on their functioning, including child, family, school and community contexts (Bronfenbrenner, 1977), provides a useful framework for understanding the mechanisms by which disasters impact children's long-term functioning (Weems & Overstreet, 2008).

#### Family context

Children's post-disaster functioning occurs within the context of the family system, particularly parent-child relationships. Thus, children's experiences of disasters and their aftermath are affected by their parents' mental health (Scheeringa & Zeanah, 2008) and the consistency and warmth of care parents are able to provide both during and after a disaster. For example, in a convenience sample of preschool aged children and their caregivers ( $n = 70$ ) who were living in the New Orleans metropolitan area at the time of Hurricane Katrina, Scheeringa and Zeanah (2008) found that the timing of caregiver symptom onset moderated the strength of association between caregiver and child symptoms. Specifically, stronger correlations were observed between children's and caregivers' posttraumatic stress disorder symptoms among caregivers with new (i.e., post-Katrina) symptoms as compared to caregivers with pre-existing or no symptoms, although all symptomatology was assessed post-Katrina. Hurricane-related stressors can lead to increases in parents' distress which, in turn, can decrease their parenting efficacy and capacity to cope with the demands of parenting, thereby negatively influencing child psychological functioning (Abramson et al., 2010; Scaramella, Sohr-Preston, Callahan, & Mirabile, 2008). For example, using a sample that combined two separate groups of pre- and post-Katrina low-income mothers and their 2-year-old children ( $n = 102$ ) recruited from Head Start centers, Scaramella et al. (2008) found that financial strain and neighborhood violence were associated with higher levels of maternal depressed mood, which was associated with lower levels of parenting efficacy and subsequent increased levels of child internalizing and externalizing problems.

Thus, particularly in the context of the challenges presented by natural disasters, difficulties experienced by the parent can negatively affect child psychological functioning (Proctor et al., 2007; Scaramella et al., 2008). Proctor et al. (2007) gathered observational parent-child play data prior to the Northridge earthquake and parent-reported symptoms of parental stress and child distress 8 months after the earthquake within a sample of two-parent families ( $n = 117$ ) with children (ages 4 to 5 years). The effect of the earthquake's impact on child distress was mediated (fully for boys and partially for girls) by parental stress. In addition to parental stress, maternal depression is associated with reduced parenting sensitivity, warmth, disciplinary consistency, efficacy, and responsiveness (Field, 2010; Scaramella et al., 2008; Weinberg, Olson, Beeghly, & Tronick, 2006) and heightened risk for child emotional and behavioral problems (e.g., Van der Molen, Hipwell, Vermeiren, & Loeber, 2011). Although parent psychological functioning has been examined in relation to child functioning following disasters (e.g., Proctor et al., 2007; Scheeringa & Zeanah, 2008), we know of no studies that have included parent psychological functioning assessed pre-disaster, which is necessary to control for

parents' pre-existing psychological vulnerabilities and reduce bias introduced by retrospective reporting.

#### School context

Children's post-disaster psychological functioning may also be impacted by disruptions associated with hurricane exposure, such as moves and changes in schools. In the aftermath of Hurricane Katrina, many families were forced to relocate in response to the devastation of residences and local economies (Gault et al., 2005; Groen & Polivka, 2009). Consequently, approximately 196,000 school-aged children (kindergarten through grade 12) were displaced from Louisiana following Hurricane Katrina (Pane et al., 2006). Residential mobility can be extremely disruptive to both children and their parents, as it often entails the loss of family and friendship networks, additional financial burdens, and the adjustment to new social, educational, and occupational demands. Indeed, residential instability is associated with decreased social support, increased stress, and increased symptoms of psychological distress (e.g., Magdol, 2002; Magdol & Bessel, 2003).

Although residential mobility often prompts changes in schools, even those children who remained in New Orleans faced school disruptions, or school mobility, as the hurricane seriously damaged or destroyed educational facilities and led to numerous school closures (Liu, Fellowes, & Mabanta, 2006; Pane et al., 2006). For example, approximately one year after Hurricane Katrina made landfall, less than one third of the New Orleans metropolitan area public schools were in operation (Liu et al., 2006). School-related disruptions rendered by hurricane exposure can have negative effects on children's psychosocial functioning. Indeed, changes in school enrollment outside of those required by the school system (i.e., outside of normative transitions from elementary school to middle school) increase children's risk for academic problems (Gruman, Hartman, Abbott, Catalano, & Fleming, 2008; Mantzicopoulos & Knutson, 2000) and psychosocial problems (Gilman, Kawachi, Fitzmaurice, & Buka, 2003; Hoglund & Leadbeater, 2004), even when controlling for other factors commonly associated with mobility (e.g., poverty, family structure).

School disruptions are often associated with a loss of peer, teacher, and mental health support. School resources, including relationships with classmates, teachers and other staff members, can serve as a comforting source of support and stability for children following disaster (Pina et al., 2008; Prinstein, LaGreca, Vernberg, & Silverman, 1996). Children who lack that support due to changes in schooling may be more vulnerable to post-disaster psychological and behavioral problems than children with stable schooling. In the aftermath of Hurricane Katrina, mental health providers working in Louisiana school-based health centers that received a greater number of displaced students reported larger increases in psychosocial problems and mental health needs than providers working in schools that received lower numbers of displaced students (Madrid et al., 2008). Additionally, given that schools serve as a vital provider of services, (Farmer, Burns, Phillips, Angold, & Costello, 2003; Yeh et al., 2002), school changes likely meant disruptions in the receipt of mental health care.

Moreover, school disruptions may be a marker of a broader constellation of cumulative stressors. That is, as children transition in and out of different schools and communities, their vulnerability to psychological symptoms rises sharply (e.g., Sameroff, Bartko, Baldwin, & Seifer, 1998). Disruptions and losses associated with Hurricane Katrina occurred over a protracted period, meaning that their impact might not be detected in assessments of children's short-term post-disaster psychological functioning. Rather, it might be necessary to take a longer-term perspective to detect the effects of post-disaster disruption on children's mental health.

#### Present study

The purpose of this study was to investigate the impact of hurricane exposure on the psychological functioning of children who survived

Hurricane Katrina. We took an ecological systems approach to understanding how the hurricane could impact children's functioning, focusing on maternal mental health and school mobility in a low-income sample of primarily African American mothers. We sought to clarify the mechanisms by which disasters can negatively impact children's long-term psychological functioning by examining the impact of maternal psychological health and school disruptions. We hypothesized that hurricane-related stress exposure would affect children's internalizing and externalizing symptoms three years after the storm both directly and indirectly, through its influence on (a) maternal psychological distress and (b) school mobility (defined as the number of schools the child had attended in the school year following the hurricane).

The current dataset, which spans one year pre-disaster to three years post-disaster, permitted a stronger test of causal pathways than previous studies, most of which have been fully cross-sectional and have examined a shorter period of post-disaster data. Because data were not collected on children's functioning until the three-year post-disaster assessment, the child outcome component of the present study is cross-sectional. Nonetheless, the larger longitudinal design focused on maternal well-being afforded the opportunity to include pre- and post-Katrina data on maternal functioning across three time points, which enabled us to control for maternal pre-disaster functioning and to explore how changes in maternal distress from pre- to post-disaster related to mother-reported child functioning three years following Hurricane Katrina. Moreover, previous research has found that higher pre-disaster psychological distress is predictive of both higher post-disaster distress (Weems et al., 2007) and greater disaster exposure (Green, Lowe, & Rhodes, 2012), and we were able to take this pre-existing vulnerability into account.

Although the majority of studies on children's post-disaster functioning have not included pre-disaster data, there are a few notable exceptions. For example, using a longitudinal sample of school-aged children, Weems et al. (2007) found that children's pre-Katrina negative affect predicted disaster-related PTSD symptoms and generalized anxiety disorder symptoms (pre-disaster  $n = 173$ ; post-disaster  $n = 53$ ; retention rate: 30.1%). La Greca, Silverman, and Wasserstein (1998) used a prospective longitudinal sample and child-, teacher-, and peer-reported data, and found that child pre-disaster psychosocial and academic functioning was associated with child PTSD symptoms 3 months after Hurricane Andrew and that child pre-disaster anxiety predicted PTSD symptoms 7 months post-disaster (baseline  $n = 138$ ; 3-month  $n = 92$ ; 7-month  $n = 74$ ; overall retention rate: 53.6%). These studies have highlighted the importance of pre-disaster symptoms in predicting children's post-disaster psychological functioning, but have not focused on the role of contextual factors, including the influence of maternal distress and school-related disruptions.

The current study adds to the extant body of literature on children's adaptation post-disasters through its focus on a multiply at-risk population and its relatively high retention rate. The sample of low-income, young, African American single mothers was especially vulnerable to the impact of Hurricane Katrina (e.g., Brewin, Andrews, & Valentine, 2000). Indeed, the racial, class, and gender disparities that were present before Hurricane Katrina in the New Orleans area rendered lower-income, African American families particularly vulnerable to the impact of the storm (Jones-DeWeever & Hartman, 2006; Rhodes et al., 2010; Ruscher, 2006). Young, single mothers were at increased risk of clinically elevated psychological symptoms following Hurricane Katrina (e.g., Kessler et al., 2008; Rhodes et al., 2010) and they were exposed to child-related stressors during the storm, such as parent-child separations, which further exacerbated their risk for psychological distress (Lowe, Chan, & Rhodes, 2011). Furthermore, and consistent with research on the multiple co-occurring risk factors associated with living in poverty (Yoshikawa, Aber, & Beardslee, 2012), families headed by low-income, African American single women have faced a

number of additional stressors since the storm, including financial barriers (e.g., Galea, Tracy, Norris, & Coffey, 2008; Jones-DeWeever, 2008) and concerns about the lack of occupational opportunities, crime, and safety (Kaiser Family Foundation, 2010). These interrelated stressors may further increase mothers' risk for psychological distress and place children in these families at a heightened risk for adjustment disorders and mental health problems (Biglan, Flay, Embry, & Sandler, 2012; Yoshikawa et al., 2012). Given the dearth of previous Katrina research focused on large samples of young, single, African American mothers and the increased vulnerabilities of the children in this group, our sample addresses a gap in the existing literature and an important area of study.

## Method

### Procedure

Institutional Review Boards from MDRC and the principal investigators' universities (Harvard University, Princeton University, and University of Massachusetts Boston) approved the study. Participants were initially part of a larger study examining whether performance-based scholarships to attend community college affected the academic achievement, health, and well being of low-income parents (Richburg-Hayes et al., 2009). To be eligible for the study, students had to be between the ages of 18 and 34, have at least one dependent child under 19 years of age, have a household income under 200% of the federal poverty level, and have a high school diploma or equivalent. Beginning in 2004, students were recruited through a general marketing and outreach campaign, which included flyers, newspaper and radio announcements, and oral presentations in mandatory orientation and testing sessions for incoming freshman. The larger study had multiple sites throughout the United States, including three community colleges in the New Orleans area, from which participants were recruited in 2004–2005. At baseline (i.e., upon enrollment in the study and prior to random assignment) participants provided primarily demographic information (e.g., age, race, number of children).

By the time Hurricanes Katrina and Rita made landfall, on August 29, 2005 and September 24, 2005, respectively, 492 participants had been enrolled in the program long enough to complete a 12-month, pre-disaster follow-up survey (Time 1). Trained interviewers conducted the survey via phone, which included a measure of psychological distress. Given the impact of Hurricane Katrina on the New Orleans area, and on the three community colleges the participants had attended, the New Orleans sample was dropped from the larger scholarship study. However, the investigators mobilized efforts to follow the New Orleans participants as an investigation of how the hurricane affected their psychosocial functioning and physical health.

After Hurricanes Katrina and Rita, between May 2006 and March 2007, extensive efforts were made to locate participants. The researchers first made use of contact information, including addresses, phone numbers, and email addresses for each participant and another person who would likely know of their whereabouts, collected at Time 1. Additional contact information was obtained from participants' community colleges and person locator databases. Through these efforts, 402 of the 492 participants from Time 1 (81.7%) were successfully located and surveyed. Trained interviewers administered the post-disaster survey (Time 2), which included the same questions as the 12-month follow-up survey, as well as a module of hurricane experiences. Approximately three years after the hurricanes, between April 2009 and March 2010, trained researchers administered an additional follow-up survey over the phone (Time 3). The Time 3 survey included the same measures as the previous surveys. In addition, participants reported the ages of each of their children, completed a measure of psychological functioning for each of their children between the ages of 4 and 17 years, and answered questions assessing the impact of the hurricanes on each of their children's schooling. Of

the 402 participants who completed the Time 2 survey, 345 (85.8%; 70.1% of the Time 1 sample) also completed the Time 3 survey. A small number of male participants ( $n = 14$ ) were dropped due to our focus on the impact of maternal mental health on child functioning. Participants were compensated for their time with gift cards at each time point (\$20 at Time 1, \$50 at Times 2 and 3).

### Participants

The current study included mothers of children who had been in elementary school at the time of Hurricane Katrina. Of the 331 mothers who completed the study, 185 (55.9%; 37.6% of the Time 1 sample) fit this criterion. An additional mother was dropped from the study because her one school-aged child, a 13-year old daughter, had missed an entire year of school in the aftermath of the hurricane. The final sample consisted of 184 mothers of school-aged children, ages 8- to 13-years at Time 3 (5- to 10-years at the time Hurricane Katrina hit). All of the mothers were community college students at baseline and were living in areas affected by Hurricane Katrina at the time of the hurricane. Over half (53.8%) were living in areas affected by Hurricane Rita when it made landfall less than a month later. On average, mothers provided data on 1.36 school-aged children ( $SD = 0.67$ ); 132 (71.17%) had one school-aged child, 41 (22.3%) two school-aged children, and 11 (5.9%) three or more school-aged children. The total number of children in the sample about whom information was obtained was 251. The demographic data for the 184 mothers and the 251 children are listed in Table 1. In light of previous findings indicating that child sex and age are related to post-disaster psychological functioning (e.g., La Greca et al., 2010; Lonigan, Shannon, Taylor, Finch, & Sallee, 1994; Vernberg, La Greca, Silverman, & Prinstein, 1996; Weems et al., 2010), we included these as covariates in our analysis.

### Measures

#### Hurricane-related stressors

Sixteen questions assessed stressors experienced during the hurricanes and the week that followed. The questions were drawn from a larger survey of the demographic and health characteristics, evacuation and hurricane experiences, and future plans of Hurricane Katrina evacuees. The Washington Post, the Kaiser Family Foundation, and the Harvard School of Public Health jointly designed the scale (Brodie,

Weltzien, Altman, Blendon, & Benson, 2006). Participants indicated whether they had experienced the following as a result of the hurricanes: 1) lacked enough fresh water to drink, 2) lacked enough food to eat, 3) felt their life was in danger, 4) lacked necessary medicine, 5) lacked necessary medical care, 6) had a family member who lacked necessary medical care, 7) lacked knowledge of safety of children, and 8) lacked knowledge of safety of other family members. These questions were asked for both Hurricane Katrina and Hurricane Rita, yielding 16 items in total. A composite score with the count of affirmative responses to these items was created ( $KR-20 = .84$ ).

#### Maternal psychological distress

The K6 scale, a six-item screening measure of nonspecific psychological distress (Kessler et al., 2003), was used to assess the mothers' psychological distress at each time point. This scale has been shown to have good psychometric properties; for example, two independent validation studies have shown the K6 to have an area under the receiver operator characteristic curve between 0.86 and 0.89 in predicting DSM-IV mood disorders that meet the severity criteria for the Substance Abuse and Mental Health Services Administration's definition of serious mental illness (Furukawa, Kessler, Slade, & Andrews, 2003; Kessler et al., 2002; Kessler et al., 2003). In addition, the K6 has been used in previous research on the psychological functioning of Hurricane Katrina survivors (e.g., Galea et al., 2007). Participants rated items (e.g., "During the past 30 days, about how often did you feel so depressed that nothing could cheer you up?") on a 5-point Likert-type scale ranging from 0 (*none of the time*) to 4 (*all the time*). The reliability of the K6 scale in this study was a Cronbach's alpha of .70 at Time 1, .80 at Time 2, and .80 at Time 3.

#### School mobility

At Time 3, mothers indicated how many schools each of their children attended in the school year following the hurricane. Eighty children (33.2%) attended one school; 83 (34.4%), two schools; 60 (24.9%), three schools; and 18 (7.5%), four or more schools.

#### Child behavioral problems

The Behavioral Problems Index (BPI; Peterson & Zill, 1986) was used to assess children's psychological functioning at Time 3. Consisting of 32 items, the BPI was developed for children ages 4 to 17, and was used in the National Survey of Children, the National Health Interview Survey, and the National Longitudinal Survey of Youth (Zill, 1990). It includes several items from the widely used Child Behavior Checklist (Achenbach & Edelbrock, 1981), and has been shown to have acceptable reliability and internal consistency (Chase-Lansdale, Mott, Brooks-Gunn, & Phillips, 1991; Peterson & Zill, 1986). Previous research has found the BPI to discriminate between youth who have and have not received clinical treatment (Zill, 1990), and between youth from high- and low-conflict marriages (Peterson & Zill, 1986). The BPI includes subscales of internalizing (10 items, e.g., "worries too much") and externalizing (20 items, e.g., "is impulsive, or acts without thinking") behaviors. Mothers rated the extent to which their children exhibited each behavior on a three-point scale from 1 (*not at all true*) to 3 (*often true*). Mothers completed the BPI for each of their children between the ages of 4 and 17 years. Cronbach's alpha reliabilities for the internalizing and externalizing subscales were .85 and .91, respectively.

### Results

#### Preliminary analysis

#### Descriptive statistics

Prior to path analysis, Pearson correlations were computed with the disaggregated dataset for a preliminary exploration of relationships

**Table 1**  
Demographic data on for mothers ( $N = 184$ ) and children ( $N = 251$ ).

	M/%	SD/n	N
<b>Mothers</b>			
Age at baseline	26.10	3.44	184
Race/ethnicity			178
Non-Hispanic Black	86.5%	154	
Non-Hispanic White	7.9%	14	
Hispanic	2.8%	5	
Other race/ethnicity	2.8%	5	
Number of school-aged children	1.36	.67	184
Time 1 psychological distress	5.55	4.41	184
Time 2 psychological distress	6.37	5.15	184
Hurricane-related stressors	3.80	3.19	182
<b>Children</b>			
Age	10.19	1.68	251
Gender			251
Female	47.0%	118	
Male	53.0%	133	
Number of schools attended	2.08	.98	241
Internalizing subscale	3.06	3.81	245
Externalizing subscale	7.64	8.32	245

between the variables (Table 2). Consistent with our hypotheses, the number of hurricane-related stressors was significantly and positively correlated with Time 2 maternal psychological distress and schools attended, which in turn were significantly and positively correlated with child internalizing and externalizing symptoms (all  $p < .05$ ). A paired-samples  $t$ -test found that mothers' psychological distress increased from Time 1 to Time 2,  $t(183) = 2.04, p = .04$ .

#### Missing data

All the variables in the study had less than 5% missing data. In subsequent analysis, missing data was handled using the full-information maximum likelihood (FIML) approach in Mplus 6.0.

#### Path analytic models

Because the children in the study were nested in families, with an average of 1.36 children per family ( $SD = 0.67$ ), we conducted a multilevel path analytic model in Mplus 6.0. Time 1 and Time 2 maternal psychological distress and hurricane-related stressors were entered at the family level only, whereas child age, sex, and number of schools attended were allowed to vary both within and between families. The hypothesized multi-level models are illustrated in Fig. 1. Within families, it was expected that more schools attended would predict greater Time 3 child internalizing and externalizing symptoms, whereas no a priori hypotheses were made about the relationships between child age, sex, and symptoms. Between families, it was hypothesized that more hurricane-related stressors would predict greater Time 2 maternal psychological distress and number of schools, which in turn would predict greater Time 3 child internalizing and externalizing symptoms. Additionally, higher Time 1 maternal psychological distress was hypothesized to predict a greater number of hurricane-related stressors and higher Time 2 maternal psychological distress, and more hurricane-related stressors were hypothesized to predict more Time 3 child internalizing and externalizing symptoms. The number of schools was included at both levels because of its high intraclass correlation ( $ICC = .94$ ), indicating that, although there was some variation in the number of schools attended within families, the majority of the variation was between families. Therefore, we were able to investigate the impact of the number of schools on child symptoms between families, while still accounting its impact at the within-family level. Following the recommendations of Hu and Bentler (1998), we set the cutoff of acceptable model fit at  $< .08$  for  $RMSEA$  and  $> .95$  for  $CFI$ .

The hypothesized two-level path analytic model for internalizing symptoms had a good fit,  $\chi^2(16) = 15.20, p > .05, RMSEA < .001, CFI > .99$ . Two non-significant paths were trimmed at the within-family level, (the paths from sex and number of schools to Time 3 child internalizing symptoms), and three non-significant paths were trimmed at the between-family level (the paths from hurricane-related stressors and Time 1 maternal psychological distress to Time 3 child internalizing

symptoms and the path from Time 1 maternal psychological distress to hurricane-related stressors). The resulting trimmed model also had a good fit,  $\chi^2(11) = 11.48, p > .05, RMSEA = .01, CFI = .99$ . A comparison of the hypothesized and trimmed models using the Satorra–Bentler scaled chi-square difference test for multilevel models (Santorra & Bentler, 2001) revealed no significant difference in model fit,  $(\chi^2(5) = 2.17, p > .01)$ . Therefore, the more parsimonious, or trimmed model, was used for interpretation and is illustrated in Fig. 2. As shown, greater hurricane-related stressors were significantly predictive of greater number of schools in the year after Hurricane Katrina, as well as greater Time 2 maternal psychological distress. More schools attended and higher Time 2 maternal psychological distress were significantly predictive of greater Time 3 child internalizing symptoms.

The same analytic procedure was repeated for child externalizing symptoms. Again, the hypothesized model had good fit with the data,  $\chi^2(16) = 16.23, p > .05, RMSEA = .01, CFI > .99$ . Two non-significant paths were trimmed from the within-family level (the paths from age and number of schools to Time 3 child externalizing symptoms), as were three non-significant paths at the between-family level (the paths from hurricane-related stressors and Time 1 maternal distress to Time 3 child externalizing symptoms, and the path from Time 1 maternal distress to hurricane-related stressors). The trimmed model had a good fit with the data,  $\chi^2(11) = 9.04, p > .05, RMSEA < .001, CFI > .99$  (Fig. 3). Comparison of the two models using the Satorra–Bentler scaled chi-square difference test found that the trimmed model significantly improved fit,  $\chi^2(5) = 11.43, p < .05$ . As with child internalizing symptoms, the paths from hurricane-related stressors to the number of schools attended and Time 2 maternal psychological distress were positive and significant. The paths from the number of schools and Time 2 maternal psychological distress to Time 3 child externalizing symptoms were also positive and significant.

#### Mediation analysis

To further test the indirect effects of hurricane-related stressors on child internalizing and externalizing symptoms, we used a mediation procedure for multilevel models outlined by Preacher, Zyphur, and Zhang (2010). Indirect effects through schools attended and Time 2 maternal psychological distress were specified and added to the trimmed models. Each indirect effect was computed as the product of the paths from hurricane-related stressors (the independent variable) to the mediator (number of schools attended or Time 2 maternal psychological distress) and from the mediator to Time 3 child internalizing or externalizing symptoms (the dependent variable).

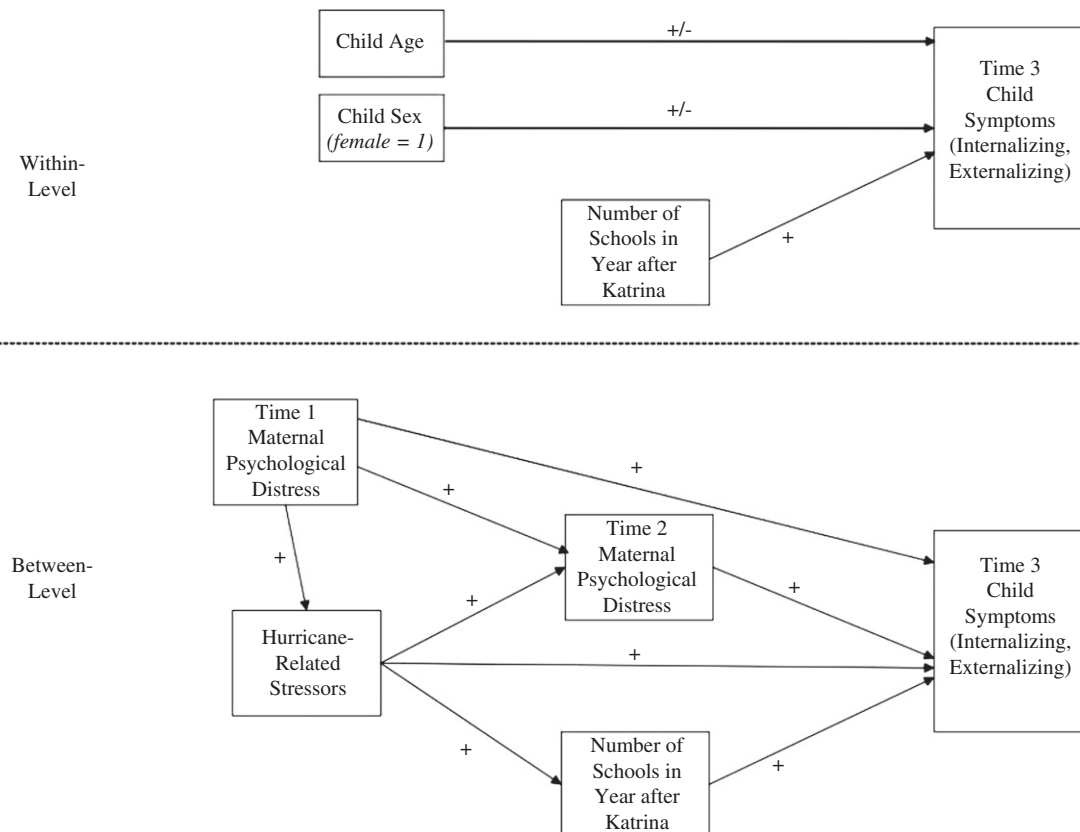
Results from the mediation analysis are listed in Table 3. For both child internalizing and externalizing symptoms, the indirect effect from hurricane-related stress through Time 2 maternal psychological distress was significant, whereas the indirect effect through the number of schools attended was not.

**Table 2**

Correlation matrix for all variables included in the study with the disaggregated dataset ( $N = 251$ ).

Variable	1	2	3	4	5	6	7	8
1. Time 1 maternal psychological distress	–							
2. Hurricane-related stressors	.12 <sup>a</sup>	–						
3. Time 2 maternal psychological distress	.34 <sup>***</sup>	.23 <sup>***</sup>	–					
4. Number of schools attended	.04	.19 <sup>**</sup>	.11 <sup>a</sup>	–				
5. Child age	–.02	.04	.05	.08	–			
6. Child sex (female = 1)	–.02	–.06	–.05	.10	<–.01	–		
7. Time 3 child internalizing symptoms	.07	.13 <sup>*</sup>	.26 <sup>***</sup>	.20 <sup>**</sup>	–.15 <sup>*</sup>	–.11 <sup>a</sup>	–	
8. Time 3 child externalizing symptoms	.14 <sup>*</sup>	.15 <sup>*</sup>	.27 <sup>***</sup>	.27 <sup>***</sup>	.06	–.25 <sup>***</sup>	.78 <sup>***</sup>	–

Note. <sup>a</sup> $p < .10$ . <sup>\*</sup> $p < .05$ . <sup>\*\*</sup> $p < .01$ . <sup>\*\*\*</sup> $p < .001$ .



**Fig. 1.** Hypothesized path analytic model. A plus sign indicates a hypothesized positive relationship; a negative sign indicates a hypothesized negative relationships; a plus/minus sign indicates no a priori prediction for direction.

## Discussion

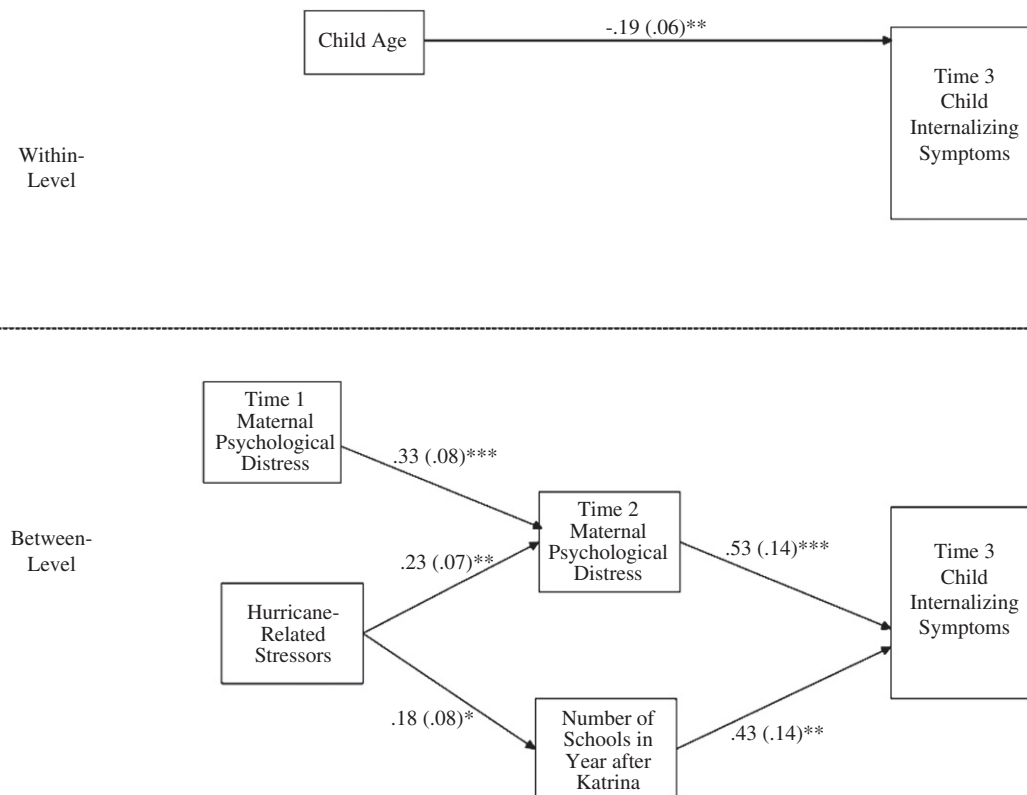
The purpose of this study was to explore the impact of Hurricane Katrina on the psychological functioning of elementary school aged children (5–10 years old) of low-income mothers who were exposed to the storm, 53.8% of whom were also exposed to Hurricane Rita. Mothers, who were initially part of a community college intervention study, provided data on their own psychological functioning both prior to and a year after the hurricanes, their exposure to hurricane-related stressors, and their children's internalizing and externalizing symptoms three years after the storm. Through path analysis, we found support for a model wherein a greater number of hurricane-related stressors were associated with significantly higher maternal psychological distress, as well as a significantly greater number of schools children attended in the year following Hurricane Katrina. Higher maternal psychological distress and number of schools attended, in turn, were associated with significantly higher mother-reported child internalizing and externalizing symptoms three years after the storm.

To test for mediation, we added indirect effects to the path analytic model and found that hurricane-related stressors had a significant indirect effect on mother-reported child internalizing and externalizing symptoms through post-disaster maternal psychological distress, whereas indirect effects through the number of schools were non-significant. Maternal psychological distress at approximately one year post-disaster was a mediator of the relationship between hurricane-related stressors and mother-reported child symptoms, controlling for pre-disaster maternal distress. It is likely that mothers' increased psychological distress put a strain on their ability to effectively support their children through the challenges following the hurricane(s), disrupting mother-child relationships. Alternatively, children might have been attuned and reactive to their mothers' increased distress. These interpretations, which could be further

explored in future studies, are consistent with the results of previous research, which have documented the effects of natural disasters on family processes (e.g., Abramson et al., 2010).

Inclusion of pre-disaster data on maternal distress provided insight into how changes in maternal distress from pre- to post-disaster relate to mother-reported child functioning. We found that maternal distress significantly increased from pre- to post-disaster. The results further suggest that exposure to a greater number of hurricane-related stressors was associated with increases in pre- to post-disaster distress, and that such increases were associated with greater mother-reported child symptoms three years after Hurricane Katrina. Additional waves of data would have enabled us to use hierarchical linear modeling and other statistical techniques to demonstrate with greater precision how changes in maternal distress in the aftermath of disasters relate to child functioning (Green et al., 2012).

Because the data in our study spanned one year pre-disaster to three years post-disaster, we are able to make stronger claims about causal pathways from maternal distress to child functioning than fully cross-sectional studies, which comprise the majority of disaster studies (Norris et al., 2002). Moreover, because we controlled for pre-disaster maternal psychological distress, we could account for mothers' pre-existing psychological vulnerabilities, which might have contributed to children's symptoms. Previous research has shown that parents' symptoms can affect assessments of their children's functioning (e.g., Briggs-Gowan, Carter, & Schwab-Stone, 1996). Because we were able to control for pre-disaster mental health, we could provide insight into changes in maternal mental health in the aftermath of the storm and the impact of changes in maternal functioning on children's internalizing and externalizing behaviors. Additionally, because maternal psychological distress was measured one year post-disaster, whereas child symptoms were assessed three years post-disaster, the potential impact of concurrent maternal symptoms on assessments of children's



**Fig. 2.** Results of trimmed path analytic model predicting Time 3 internalizing symptoms. Numbers represent standardized path coefficients. Standard errors are in parentheses. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

mental health was reduced and the long-term consequences of maternal distress were highlighted.

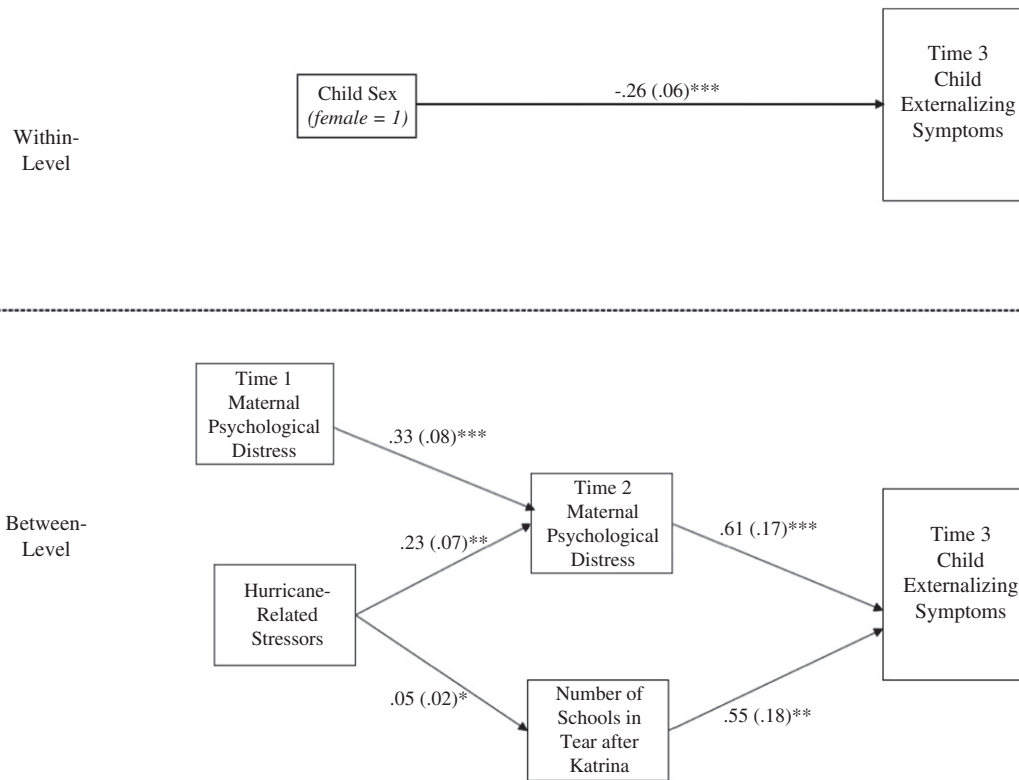
The degree of exposure to hurricane-related stressors had a direct effect on the number of schools attended, which, in turn, was associated with mother-reported child symptoms. The indirect effect of hurricane-related stressors on mother-reported symptoms was not significant, however, suggesting that the number of schools did not mediate the relationship between hurricane-related stressors and child symptoms. This phenomenon, in which direct effects are established but indirect (meditational) effects are not, has been referred to as direct-only non-mediation (Zhao, Lynch, & Chen, 2010). The findings could indicate that variance in child symptoms explained by the number of schools attended was independent from that explained by hurricane-related stressors. For example, frequent school transitions are associated with psychosocial stressors that are quite distinct from exposure to concrete stressors during a natural disaster and might therefore have differential effects on child development. Disrupted friendships and teacher relationships, adjustment to new academic settings and standards, and the potential for peer rejection and neglect can heighten the risk of symptoms of psychological distress (Gruman et al., 2008; Prinstein et al., 1996), particularly given the protective role of social support in the aftermath of disasters (Kaniasty & Norris, 2009; Pina et al., 2008). Moreover, school changes could represent residential instability in the aftermath of the hurricane, which corresponds to other risk factors and stressors, such as financial strain and the disruption of social support networks (Gasper, DeLuca, & Estacion, 2010; Scanlon & Devine, 2001). Given the lack of research on children's school experiences in the aftermath of disasters, future research focusing on this topic would be a major contribution to the disaster literature.

### Implications

The results of this study have implications for research, policy, and practice. With regard to research, as mentioned above, future

investigators should delve further into the pathways through which disaster-related stressors impact children's functioning, including through parenting and attachment styles, and peer and teacher relationships. In doing so, researchers could also explore potential moderators of the effect, for example gender and age, which have been found to influence children's post-disaster psychological responses (e.g., Shannon, Lonigan, Finch, & Taylor, 1994; Weems et al., 2007). Alternative means of data collection, including observations of parent-child relationships and child- and teacher-reported assessments of children's mental health, would further add to our understanding of children's post-disaster functioning. Qualitative analysis of mothers' and children's experiences would likewise shed light on how mothers understand family processes, residential changes, and children's academic experiences, and their effects on child development in the aftermath of disasters. Additionally, longitudinal data on children's post-disaster psychological responses would permit further exploration of reciprocal relationships between post-disaster maternal and child psychological functioning over time.

With regard to practice and policy, the results suggest the importance of practices that bolster schools' and families' readiness for disasters. This might include additional means for reaching out to parents and tracking students in the aftermath of disasters, both to ensure that students are connected with new schools and to foster communication among students, parents, teachers, counselors, and other school personnel during transitions. Students who maintain some connection to their former school might feel supported even as they enter a new school and community. To improve tracking efforts, schools could require families to update their contact information more frequently and provide more emergency contacts, including those who are out of state. Policymakers could encourage the use of a national student database to ensure that students are located and tracked post-disaster. Even prior to disasters, schools could include a disaster plan in their parent orientation and attempt to forge connections with schools in communities that might attract a large



**Fig. 3.** Results of trimmed path analytic model predicting Time 3 externalizing symptoms. Numbers represent standardized path coefficients. Standard errors are in parentheses. \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

number of evacuees post-disaster. To the extent possible, post-disaster policies should prioritize and facilitate temporary locations for damaged schools, and planning for their reconstruction. Policies that promote the long-term stability of low-income families, who are particularly likely to face a large number of co-occurring stressors, in the aftermath of disasters would also protect against frequent school transitions and psychological distress (Yoshikawa et al., 2012).

The results suggest that children who change schools frequently in the aftermath of disasters would be appropriate targets for mental health services. Routine screening of new students for mental health problems would help identify children in need, and identified children could receive counseling services during the school day. Schools represent an ideal setting for screening and the provision of psychological services for children in the aftermath of disasters, given that they are a common point of entry and provider of services for children with mental health needs (Farmer et al., 2003), and that they can serve as “nurturing environments,” helping to foster prosocial behaviors and prevent mental health problems (Biglan et al., 2012).

Empirically supported interventions for children in the aftermath of disasters, such as cognitive behavioral and trauma-focused therapies, would protect against elevated symptoms (Jaycox et al., 2010; La

Greca & Silverman, 2009; Salloum & Overstreet, 2008). Interventions could help children build skills to cope with emergent symptoms. For example, a study by Weems et al. (2009) found that a group behavioral intervention for test anxiety, consisting of relaxation and graded exposure, not only reduced test anxiety and improved academic performance of ninth graders in New Orleans, but was also associated with decreased posttraumatic stress. Interventions that boost children’s regulatory skills (e.g., attention and inhibitory control) and reduce the use of negative coping strategies could also protect against post-disaster psychological symptoms (Terranova, Boxer, & Morris, 2009a).

Further research has indicated bidirectional relationships between psychological symptoms and peer relational problems, including bullying behaviors and peer victimization experiences (Terranova, Boxer, & Morris, 2009b; Terranova et al., 2009a). Therefore, interventions aiming to reduce children’s post-disaster psychological symptoms could improve peer relationships. Psychosocial interventions that help new students build relationships with classmates and teachers and fill academic gaps would also facilitate children’s adjustment to new schools and protect against psychological symptoms (Gruman et al., 2008; Jason et al., 1993). School-based interventions could be either facilitated by mental

**Table 3**  
Results of mediation analysis predicting Time 3 internalizing and externalizing symptoms.

	Estimate	SE	Z	p	95% confidence interval	
					Lower	Upper
Time 3 child internalizing symptoms						
Time 2 maternal psychological distress	.07*	.03	2.49	.01	.02	.11
Number of schools attended	.04	.03	1.59	.11	<-.01	.09
Time 3 child externalizing symptoms						
Time 2 maternal psychological distress	.15*	.06	2.69	.01	.06	.24
Number of schools attended	.11 <sup>a</sup>	.06	1.71	.09	<.01	.21

Note. <sup>a</sup> $p < .10$ . \* $p < .05$ .



health professionals, or developed in tandem with teachers and integrated into the standard curriculum (Margolin, Ramos, & Guran, 2010).

Given the strong associations between maternal distress and mother-reported child outcomes, in screening and treating children, school counselors should be encouraged to include parents in interventions and/or facilitate referrals to community providers. More generally, the results suggest that mental health services for low-income mothers in the aftermath of disasters could offset the impact of these disasters on the psychological functioning of children. In addition to reaching low-income mothers through children's schools, practitioners could connect with mothers through religious communities, housing developments, social service agencies, and community health centers to provide support and advocacy. Empirically-supported, culturally competent, and developmentally appropriate mental health services would help to reduce maternal psychological distress, enabling mothers to more effectively care for their children in the post-disaster period (Costa, Weems, & Pina, 2009; Hobfoll et al., 2007). Clinicians should take into account structural barriers that often prevent low-income mothers from receiving services, including lack of insurance, childcare, and transportation (Miranda & Green, 1999). Attitudinal barriers (e.g., concerns about being medicated and the fit of psychotherapy with religious beliefs and practices) also can reduce low-income women's willingness to access mental health services, calling for the need for outreach and psychoeducation groups (Miranda & Green, 1999).

#### Limitations

Despite its potential to inform research, policy, and practice, this study has several limitations. Although we benefitted from data on maternal psychological distress collected prior to the storm, we did not have access to pre-disaster data on children's functioning. We were therefore unable to account for children's pre-disaster mental health, which has been found to influence post-disaster responses (e.g., Weems et al., 2007). Child functioning was not assessed in the first post-disaster assessment, rendering it impossible to document children's symptomatology in the more immediate aftermath of the storm and its relation to hurricane-related stressors, maternal psychological distress, and school disruptions, and there was a two year time span between the two post-disaster assessments. We were also unable to explore reciprocal relationships between child and maternal psychological functioning, and it was likely that mothers were influenced by the specific nature of their children's distress. As noted earlier, we did not have data from children directly and, although not collected concurrently, mothers' psychological symptoms could have affected their reports of child functioning (Briggs-Gowan et al., 1996). Future studies would benefit from the use of independent observers to rate children's behavior and distress as well as the quality of parent-child relationships in the aftermath of disasters. Information about other family members, including fathers, siblings, and grandparents, and their relationships with children would also be useful in understanding children's post-disaster functioning.

Additionally, our maternal mental health measure was of non-specific psychological distress, and we were therefore unable to explore the influence of specific disorders that are elevated in the aftermath of disaster (e.g., posttraumatic stress disorder, major depression) on children. Mothers also provided data on hurricane-related stressors, and it is possible that children might not have faced the same stressors (e.g., if mothers and children were separated) or perceived them in the same way. Likewise, our hurricane-related stressor measure did not include other experiences that could potentially affect children, such as bereavement, property loss, and home damage (e.g., Goenjian et al., 2001; Russoniello et al., 2002). Our single-item measure of school mobility, number of schools in the aftermath of disaster, did not allow for in-depth exploration of children's post-disaster academic experiences

and their impact on functioning. For example, we were unable to ascertain whether children returned to their pre-disaster schools at any point, which could shape their experiences. We also did not include other stressors that children might have endured in their post-disaster environments, including family conflicts and negative interactions with neighborhood peers. Because participants were initially part of a community college intervention study, the results might not generalize to all low-income families that endured Hurricane Katrina.

Despite these limitations, the results of this study shed new light on the processes by which exposure to stressors such as Hurricane Katrina has longer-term effects on child functioning. Although maternal stress certainly had some direct effects on children, it is important that the effects on maternal functioning over a longer period of time also appeared to undermine family processes that nurture child psychological development. Disruptions in schooling rendered by the hurricane could also have long-term effects, even as children settle into new schools and communities. Further research on the processes by which exposure to hurricanes and other disasters affects children's functioning can assist in the development of policies and interventions to offset long-term psychological effects.

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