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Hurricane Katrina: Maternal Depression Trajectories and Child Outcomes

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Abstract

Background—The authors examined depression trajectories over two years among mothers exposed to Hurricane Katrina. Risk and protective factors for depression trajectories, as well as associations with child outcomes were analyzed.

Method—This study included 283 mothers (age at time 1, $M = 39.20$ years, $SD = 7.21$; 62% African American). Mothers were assessed at four time points over two years following Hurricane Katrina. Mothers reported posttraumatic stress symptoms, hurricane exposure, traumatic life events, and social support at time 1. Depressive symptoms were modeled at times 2, 3, and 4. Youth reported their distress symptoms (posttraumatic stress, depression, and anxiety) at time 4.

Results—Latent class growth analyses identified three maternal depression trajectories among mothers exposed to Hurricane Katrina: low (61%), resilient (29%), and chronic (10%). Social support was identified as a protective factor among mothers.

Conclusions—Three main trajectories of maternal depression following Hurricane Katrina were identified. Social support was protective for mothers. Identified trajectories were not associated with children's distress outcomes. These results have implications for disaster responses, screening efforts, and interventions targeted towards families. Future studies warrant the investigation of additional risk and protective factors that can affect maternal and child outcomes.

Keywords

Depressive Symptoms; Posttraumatic Stress Symptoms; Trajectories; Parents; Children; Disasters; Growth Mixture Modeling

In late August 2005, the Gulf Coast was battered by Hurricane Katrina, one of the most destructive natural disasters in United States history (CDC, 2006). Katrina resulted in the deaths of approximately 1800 people, the displacement of hundreds of thousands of people, and estimated costs of over one hundred billion US dollars (Knabb, Rhome, & Brown, 2005). The destructive impact of Hurricane Katrina was further exacerbated by a prolonged

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recovery period (Finch, Emrich, & Cutter, 2010; Galea, Tracy, Norris, & Coffey, 2008). Exposure to disasters, such as Hurricane Katrina, are associated with elevated symptoms of posttraumatic stress (PTS), depression, and anxiety in adults (Kessler, Galea, Jones, & Parker, 2006; Sastry & VanLandingham, 2009; Zwiebach, Rhodes, & Roemer, 2010) and children (Lai, La Greca, Auslander, & Short, 2013; Lai, La Greca, & Llabre, 2014; Overstreet, Salloum, & Badour, 2010; Weems et al., 2010).

In this study, we investigated whether mothers exposed to Hurricane Katrina reported differing depression trajectories in the two years following the disaster. Little is known about variability in adult depression after disasters. This is surprising, given that a growing body of literature documents heterogeneous, adult trajectories of *PTS* after disasters (Bonanno, Rennie, & Dekel, 2005; Boscarino, 2009; Lowe & Rhodes, 2013; Meewisse, Olff, Kleber, Kitchiner, & Gersons, 2011; Norris, Tracy, & Galea, 2009). Prototypical *PTS* symptom trajectories that have been identified include: a) chronic - high elevated symptoms over time; b) recovery - initial elevations in symptoms that decrease over time; c) delayed - moderate symptoms than increase over time; and d) resilient - low or minimal symptoms over time.

Depression trajectories are likely to vary among adults after disasters. Depressive and *PTS* symptoms are highly comorbid after disasters (Meewisse et al., 2011; Norris, Murphy, Baker, & Perilla, 2004), and *PTS* symptoms have varied trajectories over time. In addition, depressive symptoms are prevalent among many but not all, adults following disasters (Norris et al., 2004).

Progress thus far in studying depression trajectories following a disaster has been hampered by two main factors. First, multiple assessments are needed in order to identify trajectories and predictors of these trajectories (Lowe & Rhodes, 2013). Very few disaster studies have three or more postdisaster assessments (Norris et al., 2004), due to research challenges. Research has primarily been cross-sectional (Pietrzak, Southwick, Tracy, Galea, & Norris, 2012) or has assessed participants at only two time points (e.g., Altindag, Ozen, & Sir, 2005; Ginexi, Weihs, Simmens, & Hoyt, 2000; Goenjian et al., 2000; Henry, Tolan, & Gorman-Smith, 2004; Seplaki, Goldman, Weinstein, & Lin, 2006). A second factor limiting research on postdisaster trajectories has been the lack of statistical methodology to study heterogeneous trajectories (Muthén & Asparouhov, 2008). However, growth mixture modeling is a relatively recently developed methodology that is beginning to be widely utilized.

To our knowledge, only one published study has examined postdisaster trajectories of depression in adults. Nandi and colleagues (2009) sampled adult residents of New York ($n = 2,282$) after the September 11th attack. This study included data at four time points from 2001 to 2004. They identified five trajectories of depressive symptoms: minimal symptoms (39% of the sample), mild delayed depression (34%), recovery (6%), severe delayed symptoms (13%), and chronic severe symptoms (8%).

We focused specifically on depression trajectories in impoverished mothers, the majority of whom were single parents, a particularly high-risk sample. To our knowledge, there are no

studies that have focused on maternal depression trajectories postdisaster. Understanding maternal depression following a disaster is necessary for developing interventions for improving maternal adjustment. For example, maternal depression is associated with negative parenting practices and increased behavior problems in children (Beardslee, Gladstone, Wright, & Cooper, 2003). This is important, as it is well documented that children's distress symptoms are elevated following a disaster (Felix et al., 2011; Furr, Comer, Edmunds, & Kendall, 2010; La Greca et al., 2013; Lai, Auslander, Fitzpatrick, & Podkowirow, 2014; Weems et al., 2010). Mothers, especially impoverished mothers, may be at greater risk for developing depressive symptoms postdisaster. Women report higher levels of depression generally, and stressors have been noted to be higher among mothers postdisaster (Peek & Fothergill, 2008), as mothers tend to place children's needs above their own (Lowe, Chan, & Rhodes, 2011).

In this study, we utilized a nuanced definition of resilience that considered not only positive functioning, but also levels of exposure to disaster stressors. Disaster samples are heterogeneous with regard to disaster exposure. As argued by Weems & Graham (2014), it is possible that some low symptom trajectory groups may simply have had less exposure to the disaster. Therefore, it is theoretically important to identify resilient groups that have similar levels of exposure as "non-resilient" groups.

Our second objective was to identify risk and protective factors that distinguished resilient mothers from "non-resilient" mothers with similar levels of exposure. Based on Nandi and colleagues' (2009) examination of depression trajectories after the September 11th attack and research examining risk and protective factors for postdisaster depression (e.g., Panyayong & Pengjantr, 2014), we expected PTS symptoms and exposure to other traumatic events to be risk factors for more severe depression trajectories. We also expected social support to be a protective factor associated with less severe depression trajectories. From a developmental perspective, it is important to understand ways contextual, social, and psychological systems of functioning interact, and how these interactions affect the probability of resilience (Masten, 2014).

Our final objective was to examine whether maternal depression trajectories were associated with elevated distress in children (i.e., PTS, depression, or anxiety symptoms). We expected that parents with chronic depressive symptom trajectories would have children who reported higher levels of distress, given that chronicity and impairment of parent depression increases the likelihood that children will experience distress (Beardslee et al., 2011).

Method

Participants

Participants in this study were part of a larger longitudinal study ($n = 426$) examining parents and children living in Southern Louisiana during Hurricane Katrina. Participants were evaluated at four time points spanning the two years after Hurricane Katrina made landfall in August 2005. Baseline assessment (time 1) was measured 3 – 7 months postdisaster, with follow-up occurring at 13 – 17 months postdisaster (time 2), 19 – 22 months postdisaster (time 3), and 25 – 27 months postdisaster (time 4). Participants included

in the present study were 283 mother-child dyads, representing approximately 67% of the original sample. Given that maternal depressive symptoms were the focus of the current study, mothers who failed to complete questionnaires measuring depression at timepoints two–four were excluded from the study ($n = 141$; 33%). In addition, two fathers who completed the larger study were excluded from this study. Participants in this study did not differ from those who were excluded in terms of age, educational status, child age, or child gender. However, excluded participants did differ from those who were included in terms of racial composition, $\chi^2(5) < .001$; namely, 80% of the excluded dyads were African American, compared to 62% in the final sample.

The majority of the participants were displaced as a result of the storm (73%). Mothers ranged in age from 26 to 61 ($M = 39.20$, $SD = 7.21$) at time 1, with an average education level of high school graduate. Mothers were predominantly African American (62%; 31% White, 7% Other). The average pre-Katrina annual household income was \$15,000 – \$24,000. Among the children in the dyads, approximately half were female (53%). Children ranged in age from 8 years to 15 years ($M = 11.52$, $SD = 1.54$) and were in grades 3 – 8.

Procedures

After obtaining institutional review board approval, six reopened schools following Katrina were contacted with regard to recruitment for this study. Parents were invited to participate through flyers. Approximately 35% of families contacted to participate in the study provided parental consent and child assent. Children completed the measures at their school under the supervision of the researchers. Consenting parents completed the questionnaires at home, and sent the completed survey back in a sealed envelope with their children. Participants were compensated by cash drawings or pizza parties. At subsequent timepoints, questionnaires were mailed directly back to the researchers in prepaid envelopes, with compensation ranging from small items such as stickers for children to monetary compensation of \$25 for parents at each timepoint.

Measures

Mothers completed self-report measures at all four time points. Depressive symptoms were modeled from data collected at times 2, 3, and 4. Mothers completed measures of risk factors and protective factors at time 1 (i.e. PTS symptoms, hurricane exposure, hurricane-related stressors, exposure to other traumatic events, and social support). Child distress symptom outcomes, depression, and anxiety were collected via child report at time 4.

Maternal Depressive Symptoms—*Maternal report at times 2, 3, and 4.* The Brief Symptom Inventory (BSI) (Derogatis & Melisaratos, 1983) is a 53-item instrument with nine symptom-specific subscales (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoia, psychoticism).. The 6-item depression subscale was used to assess maternal depressive symptoms. Mothers rated each item a five point Likert scale ranging from 0 (“Not at all”) to 4 (“Extremely”). These items demonstrated adequate internal consistency (time 2, $\alpha = .91$; time 3, $\alpha = .91$; time 4, $\alpha = .89$).

Risk and Protective Factors

The following measures were completed by mothers at time 1

Maternal PTS Symptoms: The Posttraumatic Stress Diagnostics Scale (PDS) (Foa, Cashman, Jaycox, & Perry, 1997) assesses PTS symptomology in accordance with the *Diagnostic and Statistical Manual of Mental Disorders 4th Edition-Text Revision* (American Psychiatric Association, 2000). The PDS has demonstrated good psychometric properties (Foa et al., 1997). Levels of maternal PTS were assessed using Parts III and IV (Foa et al., 1997). For each item, mothers responded from 0 (“Not at all or only one time”) to 3 (“5 or more time a week/almost always”). Scores were summed to yield an overall summary score of PTS symptoms among mothers, and clinical symptom severity ranges were identified (i.e., mild = 1–10; moderate = 11–20; moderate-severe = 21–35; severe = 36 and greater). The PDS demonstrated adequate internal consistency for this sample ($\alpha = .87$).

Maternal Hurricane Exposure and Hurricane-Related Stressors: The Hurricane-Related Traumatic Experiences Revised (HURTE-R) (Vernberg, La Greca, Silverman, & Prinstein, 1996) consists of 23 items. Items assess exposure (perceived and actual life threat) and other hurricane-related stressors (i.e., immediate and ongoing loss/disruption). Perceived life threat was measured by one dichotomous item (“Did you think you might die?”); Actual life threat was assessed by six dichotomous items (e.g., “Did windows or doors break?”). Immediate loss/disruption was assessed by ten dichotomous items (e.g., “Did your family have trouble getting food or water?”); of note, an additional item regarding postdisaster theft (“Has anyone stolen anything from your home since the hurricane?”) was included in the immediate loss/disruption category of this measure. Ongoing loss/disruption was assessed by five dichotomous items (e.g., “Are you living in a house that still has damage?”). With respect to ongoing loss/disruption, mothers were also asked to report the number of times they moved since the hurricane occurred. This particular item was recoded into a dichotomous item to assess whether mothers moved or never moved postdisaster. Responses were summed for each category to create a summary score, with higher scores indicating greater levels of hurricane exposure and hurricane-related stressors. The HURTE-R is used widely in postdisaster research (La Greca, Silverman, Lai, & Jaccard, 2010; La Greca, Silverman, Vernberg, & Prinstein, 1996; Vernberg et al., 1996); internal consistency is not reported for items on the HURTE-R, as items were not expected to hang together.

Maternal Trauma Exposure: Part I of the PDS (Foa et al., 1997) consists of 12 dichotomous items and one explanatory item (“Which event bothered you the most?”). Items were used to assess exposure to stressful and traumatic life events among participants (e.g., witnessing a serious accident, fire or explosion). Scores were summed to obtain a summary score (potential scores ranging from 0 to 12), with higher scores indicating greater levels of exposure to traumatic events.

Maternal Perceived Social Support: The Interpersonal Support and Evaluation List (ISEL) (Cohen & Hoberman, 1983) is used to estimate perceived social support among mothers. The ISEL contains 40 items and four subscales (appraisal, tangible, self-esteem and belonging). Mothers rated each item on a four-point Likert scale ranging from 0 (“Definitely false”) to 3 (“Definitely true”). A summary score for social support across all subscales was

created to measure perceived social support (potential scores ranging from 0 to 120). Higher scores indicate higher levels of perceived social support. Internal consistency was good for this sample ($\alpha = .93$).

Child Distress Outcomes

Child distress outcomes were completed by children at time 4

Child PTS Symptoms: The UCLA PTSD Reaction Index-Revision 1 (UCLA-R-R1) (Pynoos, Rodriguez, Steinberg, Stuber, & Frederick, 1998) screens for PTS symptomology among youth based on the DSM, 4th Edition-TR (American Psychiatric Association, 2000) and contains 22 items comprising four subscales. Youth rated how often they experienced symptoms following the hurricane using a 5-point Likert scale, ranging from 0 (“None of the time”) to 4 (“Most of the time”). Summary scores range from 0 to 68, with higher scores indicating more severe levels of PTS symptomology. This measure has exhibited good psychometric properties (Steinberg, Brymer, Decker, & Pynoos, 2004) and has been utilized throughout the postdisaster research (Kelley et al., 2010; Self-Brown, Lai, Thompson, McGill, & Kelley, 2013; Weems et al., 2010; Yelland et al., 2010). Internal consistency was good for this sample ($\alpha = .92$).

Child Depressive and Anxiety Symptoms: The Behavioral Assessment System for Children, Second Edition (BASC-2) (Reynolds & Kamphaus, 2004) is a self-report measure of adaptive behavior and clinical symptoms among children. Children rated items using a dichotomous True/False response option, as well as a four-point Likert scale ranging from 0 (“Never”) to 3 (“Almost always”). The depression and anxiety subscales of the BASC-2 were used to assess internalizing symptoms. Consistent with Reynolds and Kamphaus (2004), *t*-scores between 60 – 69 were considered to fall within the “At risk” range, while *t*-scores of 70 and above were considered as “Clinically significant”.

Results

Preliminary Analyses

Maternal Descriptive Statistics—Mean levels of depressive symptoms were: $M = 3.80$, $SD = 5.29$ (time 2), $M = 4.30$, $SD = 4.97$ (time 3), and $M = 3.40$, $SD = 4.05$ (time 4).

With regard to mother’s functioning at time 1: the mean level PTS symptoms was $M = 26.99$, $SD = 17.51$, indicating moderate-severe levels of PTS severity. Nineteen percent of mothers reported perceived life threat with hurricane exposure, and 31% reported at least one actual life-threatening event ($M = .48$, $SD = .92$). The most commonly reported events were having broken windows or doors (16%) and seeing someone get badly hurt (13%).

With respect to immediate loss and disruption, 83% of mothers reported at least one event ($M = 3.66$, $SD = 2.67$); the most commonly reported event was difficulty seeing friends as a result of moving (60%). For ongoing loss/disruption, 84% of mothers reported at least one such event ($M = 2.28$, $SD = 1.56$), with the most commonly reported events including, still living in a house with unfixed damage from the hurricane (62%) and having to move as a result of the storm (57%). In terms of exposure to traumatic events, most mothers (96%)

reported experiencing at least one traumatic life event ($M = 2.07$, $SD = 1.60$). In regard to protective factors, mothers at time 1 reported moderate levels of social support ($M = 87.47$, $SD = 23.34$).

Child Descriptive Statistics—The mean level of PTS symptoms among children at time 4 was $M = 10.34$ ($SD = 11.29$). Child BASC mean depressive and anxiety symptoms scores among children fell below the “At risk” cut off thresholds. The mean t -scores for depression and anxiety at time 4 were $M = 47.55$ ($SD = 9.36$), and $M = 46.31$ ($SD = 10.44$), respectively.

Maternal Depression Trajectories

To identify whether mothers reported varying depression trajectories post-Katrina, we utilized Latent Class Growth Analysis (LCGA) unconditional models (i.e., models that did not include risk or protective factors) in *Mplus* (version 7.11). LCGA is a subtype of growth mixture modeling. It does not allow variation in intercepts and slopes within trajectory groups. We tested linear trajectories, given that we only had three time points of equivalent depression scores (times 2, 3, and 4).

To determine the number of depression trajectories in our sample, we examined fit indices for one to five trajectory group models (Table 1). Decisions about numbers of trajectory groups were based upon past research and fit indices. Better fit is indicated by lower Akaike Information Criterion (AIC), lower Bayesian Information Criterion (BIC), lower sample size adjusted BIC, higher entropy, higher posterior probabilities, a significant Lo-Mendell-Rubin likelihood ratio test (LMR-LRT), and a significant bootstrap likelihood ratio test (BLRT) (Jung & Wickrama, 2008).

The nature of the unconditional trajectory solutions are described here. The two trajectory model included a resilient (83%) and a recovering (17%) trajectory. The three trajectory model included a low (71%), resilient (21%), and chronic (7%) trajectory. The four trajectory model included a low (67%), resilient (19%), recovering (10%), and severe (4%) trajectory. The five trajectory model included a low (66%), resilient (18%), recovering (8%), moderate (5%), and severe (4%) trajectory.

Next, we examined conditional models (i.e., models that regressed class membership on risk and protective factors) for the three, four, and five depression trajectory group models. We chose these models to examine further due to their relatively lower AIC and BIC, and sample-size adjusted BIC values, as well as their significant LMR-LRT and BLRT values. In addition, these models were of substantive interest. Our risk factors of interest were PTS symptoms, hurricane exposure (i.e., perceived and actual life threat), hurricane-related stressors (i.e., immediate loss/disruption, ongoing loss/disruption), and prior traumatic events. Our protective factor of interest was social support.

When we ran the conditional models, the three depression trajectory group model, in contrast to the four and five trajectory group, was stable and similar in class size and structure to the unconditional model. Information on the final model is presented in Table 2.

As seen in Figure 1, the trajectories were labeled: a) low (61%), b) resilient (29%), and c) chronic (10%).

To characterize the samples, we compared levels of hurricane-related stressors between the three trajectories. Overall, the low depression trajectory was characterized by the lowest exposure to disaster related stressors, while the resilient and chronic depression trajectories were characterized by similar levels of disaster exposure. The trajectories did not differ in terms of their levels of perceived life threat, $\chi^2(2) = 5.04$, *ns*, or actual life threat, $\chi^2(2) = 3.40$, *ns*. However, they differed in terms of their immediate and ongoing loss/disruption, $\chi^2(2) = 15.55$, $p < .001$ and $\chi^2(2) = 14.90$, $p = .001$, respectively. The low group reported the lowest levels of immediate loss/disruption ($M = 3.19$, $SE = .21$), which was significantly different from that reported by the resilient group ($M = 4.50$, $SE = .38$) and the chronic group ($M = 5.18$, $SE = .53$), $\chi^2(1) = 8.21$, $p < .01$ and $\chi^2(1) = 12.15$, $p < .001$, respectively. The resilient and chronic group did not significantly differ in terms of their levels of immediate loss/disruption stressors. With regard to ongoing loss/disruption, the low group reported the lowest levels of ongoing loss/disruption ($M = 2.02$, $SE = .13$), which was significantly different from that reported by the resilient group ($M = 2.77$, $SE = .22$) and the chronic group ($M = 2.97$, $SE = .22$), $\chi^2(1) = 8.13$, $p < .01$ and $\chi^2(1) = 13.63$, $p < .001$, respectively. The resilient and chronic group did not significantly differ in terms of their levels of ongoing loss/disruption stressors.

Factors Distinguishing the Resilient Trajectory

Based on the final conditional model, we examined risk and protective factors that distinguished between the resilient and chronic trajectory groups, as these two groups reported commensurate levels of exposure. We examined odds ratios comparing odds of chronic group membership compared to odds of membership in the resilient trajectory group (Table 3).

No risk factors distinguished between odds of falling into the chronic versus the resilient trajectory group. However, social support emerged as a protective factor. For every additional unit of social support reported, mothers were .03 times less likely to fall in the chronic, compared to the resilient depression trajectory group (OR = .97, 95% CI = .95 – .99).

Maternal Depression Trajectories and Long-Term Child Distress Symptoms

Our final objective was to examine whether maternal depression trajectories were associated with elevated distress (PTS, depressive and anxiety symptoms) in children. To test this objective, we examined whether maternal depression trajectory groups differed with regard to children's time 4 distress. We utilized the AUXILIARY option with the e-setting to conduct posterior probability based multiple imputations to calculate pairwise mean comparisons (Muthen & Muthen, 1998 – 2007). This option allowed us to test the equality of means of children's distress symptoms in different maternal trajectory groups. Surprisingly, none of our three maternal trajectory groups differed with regard to mean levels of child PTS, depressive symptoms, and anxiety symptoms at time 4.

Discussion

To our knowledge, this study is the first to examine depression trajectories among mothers exposed to a large-scale natural disaster. We identified three distinct trajectories of depressive symptoms over two years post-disaster: low, resilient, and chronic. Social support was a protective factor associated with increased likelihood of falling into the resilient trajectory. Finally, we examined how maternal depression trajectories related to long-term child distress outcomes. Surprisingly, maternal depression trajectories were not associated with differences in children's distress symptoms. These findings are discussed in detail below.

Our primary objective was to examine whether mothers reported differing depression trajectories over two years post-Katrina. The vast majority of mothers fell into the low trajectory (61%), followed by the resilient (29%) and chronic (10%) trajectories. Our findings related to a very small chronic group are similar to results reported in Nandi and colleagues' 2009 study of adults over three years after the September 11th attack. In that study, they identified a minimal symptom/resilient (40%), mild delayed (34%), and chronic (8%) trajectory. However, Nandi and colleagues identified two additional trajectories: recovery and severe delayed. We did not identify recovery or delayed trajectories, which have also been identified in the larger literature on prototypical PTS symptom trajectories postdisaster (e.g., Bonnano et al., 2005). One potential explanation for this finding is that our first depressive symptom assessment point was over one year postdisaster. Assessments closer in time to the disaster are likely needed in order to discern recovering and delayed trajectories. For example, in the study by Nandi and colleagues, their first assessment occurred six months after September 11th, which allowed them to examine changes in symptoms that occurred over the first year postdisaster.

Overall, our findings indicate that the majority of mothers did not report elevated depressive symptom trajectories postdisaster. Our findings parallel those found in the literature on PTS symptom trajectories postdisaster. A growing body of research documents that adults and children have varied reactions to disaster, but overall, most people report minimal symptoms (Boe, Holgersen, & Holen, 2010; La Greca et al., 2013; Lowe & Rhodes, 2013; Meewisse et al., 2011; Self-Brown, Lai, Harbin, & Kelley, 2014). However, a small percentage of mothers in our study reported chronic, persistent depressive symptoms more than two years postdisaster. These symptoms declined slowly between 13 and 25 months post-Katrina. This suggests that efforts towards earlier identification and treatment of depressive symptoms postdisaster are warranted.

Importantly, we characterized resilience in this study based not only on symptom levels, but also on disaster exposure levels. By doing so, we discerned that the low depression trajectory group had relatively lower exposure to Katrina. At the same time, the resilient group reported disaster exposure levels commensurate with the chronic group, but they reported relatively healthy functioning over time. This provided the opportunity to examine factors that might help distinguish between these two important groups of African American, impoverished mothers.

With regard to risk factors, no risk factors distinguished between risks of falling into the chronic versus the resilient group. However, social support emerged as a robust protective factor. Higher levels of social support were associated with a greater likelihood of falling into the resilient group, rather than the chronic group. Taken together, these two findings suggest that the most important factor distinguishing resilient from chronic groups was social support. This may be especially true of impoverished families who have little financial resources for coping with the impact of a natural disaster. Although in need of replication, our findings add to a growing body of literature documenting social support as a buffer against psychological distress post-disaster (Benight, 2004; Brewin, Andrews, & Valentine, 2000; Charuvastra & Cloitre, 2008). In particular, family, friends and communities may act as a critical sources of support and coping post-disaster (Ibañez, Buck, Khatchikian, & Norris, 2004).

Finally, we examined how maternal depression trajectories related to long-term child distress outcomes. No differences emerged between maternal trajectories on child distress outcomes. This is surprising, as parental psychopathology is a strong predictor of child PTS symptoms subsequent to a disaster (Norris et al., 2002; Scheeringa & Zeanah, 2008). One potential explanation for our finding is that children were assessed 25 months postdisaster, by which time relationships between parent and child distress may have dissipated. Future research examining the dynamic interplay between parent and child distress symptoms is needed. Parallel process mixture modeling may be one method through which to examine this question. In addition, we did not include parenting behaviors in this study. It may be that maternal depressive symptoms have a more direct impact on parenting behaviors, which in turn are related to child distress outcomes. By not including parenting behaviors in this model, we may have failed to include a variable needed to identify the relationship between parent and child distress postdisaster.

Several limitations should be considered when evaluating our findings. We did not have information about mothers' predisaster functioning. This information is important to obtain in future studies, especially given that past depressive symptoms are associated with future depressive symptoms (Lewinsohn, Zeiss, & Duncan, 1989; Ye, Fang, Lingyan, & Qingguo, 2014). In addition, this study utilized self-report. Validity of future studies may be strengthened by using multi-informant or multiple methods to obtain depressive symptom information. Also, we utilized latent class models to identify trajectories in this study. Although this is a strength of the current study, our results will need to be replicated in other samples. As Twisk and Hoekstra (2012) caution, all classification methods should be applied with caution as they may fail to accurately identify developmental patterns. Further, Hurricane Katrina was one of the most destructive disasters in U.S. history, and it was associated with numerous stressors in the recovery environment. Although this makes Hurricane Katrina a particularly important disaster to study, it may mean that our findings may not generalize to other disasters that are less severe.

In conclusion, this study represents a crucial first step in understanding mothers' depression trajectories postdisaster. Risk and protective factors for depression trajectories represent potential avenues for clinical intervention. Notably, the risk and protective factors examined in this study may be distinguished early postdisaster. Further, given the comorbidity

between PTS and depressive symptoms, more studies are needed that examine the interplay between PTS and depressive symptoms over time. In addition, studies are needed that examine fathers' distress symptoms, in order to better understand the family context postdisaster.

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Fig 1.
Maternal depression trajectories

Table 1

Fit indices and group assignment accuracy for linear unconditional Latent Class Group Analysis models.

Number of Trajectory Groups	AIC	BIC	Sample Size Adjusted BIC	Entropy	Posterior Probabilities	LMR-LRT	BLRT
1 Trajectory	3627.15	3645.38	3629.53	1	1	N/A	N/A
2 Trajectories	3347.98	3377.15	3351.78	.90	.92 – .98	<.01	.01
3 Trajectories	3241.55	3281.65	3246.77	.89	.88 – .97	.06	.07
4 Trajectories	3184.29	3235.33	3190.94	.88	.86 – .97	.03	.03
5 Trajectories	3156.08	3218.05	3164.14	.89	.84 – .96	.03	.04

Note. AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, LMR-LRT = Lo-Mendell-Rubin Likelihood Ratio Test, and BLRT = Bootstrap Parametric Likelihood Ratio Test. Entropy, LMR-LRT, and BLRT values are not applicable (N/A) in single group models.

Table 2

Parameters for the three depression trajectory conditional model (n = 283).

Class	%	Intercept		Slope	
		Estimate	SE	Estimate	SE
Low	61%	1.31***	.25	.05	.05
Resilient	29%	5.83***	.75	.17	.13
Chronic	10%	16.96***	1.14	-.41*	.20

Note. SE= Standard Error,

*
p < .05,

p < .001.

Table 3

Time 1 Risk and Protective Factors Predicting Membership in Depression Trajectory Groups.

Comparison Trajectory Group	Resilient
Trajectory Group	Chronic Odds Ratio (95% CI)
Posttraumatic Stress Symptoms	1.01 (0.97 – 1.05)
Traumatic Events	0.78 (0.49 – 1.24)
Social Support	0.97* (0.95 – 0.99)

Note. CI = Confidence Interval.

*
 $p < .05$,

**
 $p < .05$,

 $p < .001$