

Predictors of Long-term Mental Health Outcomes among Hurricane Katrina Survivors

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On August 29, 2005, Hurricane Katrina, one of the deadliest hurricanes of this century and the sixth strongest Atlantic hurricane, made landfall on the Gulf Coast of the United States (Blake & Gibney, 2011). An estimated total of 1,833 deaths, both directly and indirectly related to the hurricane, were reported, roughly 1,577 of which occurred in Louisiana. Aside from the reported deaths, several hundred people were reported missing in association with the storm; therefore, the storm's exact death toll remains a mystery (Brunsma, Overfelt, & Picou, 2007).

Despite the fact that over 1.2 million people in Southeastern Louisiana and Alabama were under an evacuation order, there was an estimated 350,000 residents who did not evacuate (Boyd, 2010). These individuals were confronted with not only the distressing experiences that occurred while the storm was taking place, but also the devastating after effects primarily due to the massive storm surge (Knabb et al. 2005). This surge caused the levees and floodwalls of the New Orleans area to either overtop or breach, resulting in destructive flooding that threatened the lives of many who stayed (Knabb et al. 2005; Boyd, 2010). The access to necessities such as food and water became limited to none, further worsening the situation, prompting looters and encouraging rampant crime (Boyd, 2010; Kessler et al., 2008). Additionally, regardless of whether they evacuated prior to the storm, almost all residents of New Orleans were also confronted with various stressors in the aftermath of the storm such as loss of contact with family and friends, extensive damage to neighborhood and homes, and the subsequent prolonged displacement (Boyd, 2010).

This current study examines the long-term mental health outcomes among Hurricane Katrina survivors residing in the metropolitan New Orleans area two years after the storm. It is

hypothesized that, among survivors, those who did not evacuate New Orleans prior to the storm as well as those who faced more storm-related stressors will have poor mental health.

Prevalence of Mental Health Problems Following Disasters

The various stressors and traumatic events brought on by disasters can have lasting effects on an individual's mental health. Research has indicated that disasters are associated with increases in psychological distress symptoms, such as symptoms of PTSD, anxiety, and depression (Canino et al., 1990; Freedy et al., 1993; Phifer & Norris, 1989; Kessler et al., 2008; Rubonis & Bickman, 1991; Sattler et al., 1995; Smith et al., 1986). Furthermore, some types of disasters are more likely than others to lead to mental health problems. Compared to natural disasters, human-made disasters have shown notably higher levels of mental health problems among the exposed population. Norris and colleagues (2002) conducted a literature review examining various disaster types and the subsequent mental health problems. They classified samples as severely impaired if the rate of psychopathology in the sample was greater than 25%. The researchers found that 67% of the samples exposed to mass violence and 39% of samples exposed to technological disasters were severely impaired, as compared to 34% of samples exposed to natural disasters.

There are a number of challenges associated with assessing how disasters impact the prevalence of mental health problems in the general population (Bonanno, 2005; Bonanno et al., 2010; Canino et al., 1990). In addition to the difficulty of conducting random sampling in the aftermath of a disaster, oftentimes it is impossible to obtain accurate information about pre-disaster mental health functioning (Bonano et al., 2010; Rhodes et al., 2010). Although research has shown that natural disasters lead to increased prevalence of mental illness, the range is extremely broad. Based on their review of the most scientifically sound disaster studies

available, Bonanno and colleagues (2010) argue that approximately 30% of the population experiences severe psychological problems following serious disasters.

Prevalence of Mental Health Problems Following Hurricane Katrina

There are a number of characteristics of Hurricane Katrina that suggest the prevalence of mental health problems among survivors may be relatively high compared to other disasters. Katrina was unique among previous hurricanes because it had many characteristics associated with human-made disasters, including a lack of preventative maintenance on the levees, poorly organized evacuation efforts, and an incompetent and seemingly indifferent post-disaster response (Bourque et al., 2006). The government received much criticism on the timeliness of their disaster response, including many complaints that they were both unmotivated and unprepared (Vanderford et al., 2007). As such, the Army Corps of Engineers has accepted responsibility for the failed floodwalls during Hurricane Katrina, which resulted in the destructive flooding that occurred in the Lower Ninth Ward and St. Bernard Parish (Army Corps of Engineers, 2006). Furthermore, many nonevacuees who remained in the city during the storm were directly or indirectly exposed to high levels of violence, including violence inflicted by other survivors and brutal mistreatment by law enforcement officials (Kimmelmeier et al., 2008; Sims, 2007). Given the increased prevalence of mental impairments among victims of both natural and man-made disasters and the notion that Hurricane Katrina embodied characteristics of both these types of disasters, Hurricane Katrina survivors may be at an especially high risk of reporting psychopathology.

Researchers have been trying to determine the prevalence of mental illness following Hurricane Katrina (Meewisse et al., 2011; Galea et al., 2007, 2008; Kessler et al., 2008; McLaughlin et al., 2011; Tucker et al., 2012; Wadsworth et al., 2009). Many researchers who

have explored Hurricane Katrina mental health prevalence rates have obtained their samples from the Hurricane Katrina Community Advisory Group (CAG) (Galea et al., 2007; Galea et al., 2008; Kessler et al., 2008; McLaughlin et al., 2011; Shear et al., 2011; Wan et al., 2007). The CAG sample consisted of 1043 pre-hurricane residents of the counties and parishes in Alabama, Mississippi, and Louisiana that were directly affected by Hurricane Katrina. The researchers attempted to select a representative sample by employing a number of different methodologies including random-digit dialing (see Galea et al., 2007 for a detailed description of the sample). The CAG completed screening questionnaires that assessed hurricane-related stressors, DSM-IV anxiety and mood disorders (for both SMI and MMI) using the K6 scale of nonspecific psychological distress, and DSM-IV PTSD using the Trauma Screening Questionnaire (TSQ) (Galea et al., 2007). Studies on the Community Advisory Group 5-8 months after the storm have indicated the estimated prevalence of any 30-day DSM-IV anxiety or mood disorder is 31.2% in the total sample, with 11.3% following under the category of serious mental illness (SMI) and 20% under mild/moderate mental illness (MMI) (Galea et al., 2007; Wang et al., 2007). The prevalence rate for PTSD was found to be 16.3% in the total sample (Galea et al., 2007). Thus, the prevalence estimate of 31.2% for anxiety and mood disorders after Hurricane Katrina is comparable to research on other severe disasters (Bonanno, 2005).

Galea and colleagues (2007) examined the differences in mental health between pre-Katrina residents of the New Orleans Metropolitan area compared to those who resided in other affected areas within the Gulf Region (Alabama, Louisiana, and Mississippi). In terms of PTSD, pre-Katrina residents of New Orleans had an estimated prevalence of 30.3% as compared to 12.5% for the remainder of the sample (Galea et al., 2007). For the New Orleans sub-sample, the estimated prevalence of anxiety disorders was 49.1%, as compared to 26.4% for those in other

areas (Galea et al., 2007). Within the total sample, PTSD was found to be comorbid with anxiety disorders with the estimated prevalence of PTSD given probable SMI being 85.8% and given probable MMI being 24.8%. Among the New Orleans subsample, these prevalence rates were significantly higher than the remainder of the sample with the prevalence of PTSD given probable SMI being 98.1% and given probable MMI being 42.5% (Galea et al., 2007). These findings suggest that survivors who resided in New Orleans prior to the storm have worse mental health outcomes as compared to those from other affected areas. Furthermore, this research suggests that the prevalence rate of mental illness among Katrina survivors residing in the New Orleans area was exceptionally high, even compared to other severe disasters.

Researchers also examined the storm's long-term effects on mental health using the CAG. Kessler and colleagues (2008) found increased rates of PTSD and SMI one year after the storm, with PTSD prevalence increasing by 6% (14.9% 5-8 months post-Katrina to 20.9%) and SMI increasing by 3.1% (10.9% 5-8 months to 14%). Galea and colleagues (2008) examined the prevalence of PTSD approximately two years after the storm, using Hoge et al.'s (2004) convention of presenting both "broad" and "strict" definitions of PTSD, measured by the PTSD module of the CIDI for the DSM-IV. The researchers also found evidence for increases in the prevalence of PTSD when using broad criteria for PTSD; however, when strict criteria for PTSD were used, they found that the prevalence for PTSD remained unchanged. Thus, whereas rates of mental illness following a disaster typically decline after two years, the prevalence of mental illness for Katrina survivors remained high, and in some cases even increased.

Research on Katrina survivors using samples other than the CAG have shown similar prevalence rates for mental health problems (Cepeda et al., 2010; Kim et al., 2008; Larrance et al., 2007; Tucker et al., 2012; Wadsworth et al., 2009; Zwiebach et al., 2010). Wadsworth and

colleagues (2009) examined chronic post-traumatic symptoms (PTS) and depression of 93 adult survivors, by interviewing the participants both 6 months and a year after the storm.

Participants' PTS and depression was determined to be chronic if they met criteria at both interviews. Of the participants, 25% were identified to have chronic PTS and 15% were identified to have chronic depression (Wadsworth et al., 2009). Tucker and colleagues (2012) researched the comorbidity of PTSD and Axis I disorders among Katrina survivors, finding a comorbidity rate of 38%. Among this percent, 29% were found to have both PTSD and major depression (Tucker et al., 2012).

To summarize, the prevalence of mental illness following Hurricane Katrina was quite high, even by the standards in the disaster literature (Bonanno, 2005; Norris et al., 2002). Residents of New Orleans had higher rates of mental illness compared to other geographical regions affected by Hurricane Katrina (Galea, 2007). Furthermore, instead of showing a pattern of decreasing prevalence of mental illness over time, as is typical in disaster research (Bonanno, 2005; Meewisse et al., 2011), Katrina mental illness rates remained elevated two years after the storm (Kessler et al., 2008; Galea et al., 2008). Finally, research suggests high comorbidity rates of mental illness for Katrina survivors (Galea et al., 2007; Shear et al., 2011; Tucker et al., 2012).

Individual Differences in Mental Health Problems Following Disasters

While levels of mental disorders in the general population increase after a disaster, not everyone reacts to disasters the same way (Bonanno et al., 2010). Although research has tended to focus on psychological dysfunction after traumatic events, it is important to note that exposed individuals often display resilience and do not suffer prolonged psychological distress (Bonanno, 2010). Researchers have attempted to identify which individuals are most vulnerable to experience mental health problems following a disaster/trauma. Green and colleagues (1996)

proposed a model describing factors that may contribute to more positive or negative mental health outcomes after trauma. At the core of their model lies the level of exposure to the traumatic event, such that an increase in exposure can result in poorer mental health (Green, 1996; Freedy et al., 1993; Horowitz, 1986). Consistent with this model, previous studies have demonstrated a “dose-response” relationship between the degree of trauma exposure and trauma symptomology, indicating that the intensity of exposure is a strong predictor of poor mental health (Goenjian et al., 2001; Roussos et al., 2005; Salloum et al., 2011; Shaw et al., 1995; Sprang & LaJoie, 2009). Across adult trauma studies, there have been consistent findings on the effects of increased trauma exposure on mental health symptoms (Canino et al., 1990; Fairley et al., 1986; Green, 1996; Phifer & Norris, 1989; Smith et al., 1986).

Aside from the trauma exposure that occurs during the disaster itself, there are many disaster-related stressors that follow in the aftermath of a disaster and can subsequently affect mental health. In the case of natural disasters, these stressors could be property damage or displacement from one’s home. Additionally, Galea et al. (2007) found that Katrina survivors often describe these experiences as if they were traumatic. Given these findings, stressors encountered in relation to Hurricane Katrina may put people at an increased risk of experiencing mental health problems. Further, for those who did not evacuate, these stressors can serve as a reminder of the initial traumatic event, which can further hinder mental health (Shaw, Applegate, and Schorr 1996; Bourque et al., 2006).

As with other disasters, Katrina survivors faced a variety of traumas and stressors during both the storm and the recovery period. Roughly 80,000 residents of New Orleans did not evacuate the city and were consequently subjected to high levels of trauma including flood exposure, severe winds, undersupplied and overcrowded emergency shelters, extreme heat, toxic

pollution, lack of or poor medical services, high levels of crime, and other chaotic circumstances due to the infrastructure collapse (Boyd, 2010). Residents who did evacuate experienced the stress of displacement from their homes, families, and friends and faced uncertainty over the fate of loved ones and personal property. Hurricane Katrina disrupted the social networks and support systems that generally act as a protective factor against psychopathology (Bourque et al., 2006). After the storm, because all types of communication were impaired, these supports were disrupted to the extent that some individuals had to wait weeks before they found out the fate of their family members and friends (Bourque et al., 2006). In addition to the damaged social supports was the lack of a timely response from government officials and agencies (Bourque et al., 2006). The importance of relief response efforts is tied to the impact of man-made disasters and quick returns to normalcy (Bourque et al., 2006).

Researchers have studied the loss of social support and valued resources as an explanation for the variability in mental health outcomes after natural disasters (Rhodes et al., 2010). The conservation of resources stress model offers support to this line of research, suggesting that individuals strive to acquire and maintain certain resources, and the loss of these resources can result in both diminished coping capacity and psychological distress (Freedly et al., 1992; Settler et al., 1995). Since the majority of Katrina survivors experienced prolonged displacement from family and friends (a loss of social support), as well as damage to their homes and property (a loss of valued resources) the conservation of resources stress model can help to predict which survivors are most at risk for experiencing poor mental health outcomes following the Katrina disaster.

Initial studies using the CAG assessed participants' exposure to various hurricane-related stressors. Survey results showed that the majority of participants in the New Orleans area

(91.9%) and in the remainder of the sample (81.7%) reported experiencing at least 1 of the 10 categories of hurricane-related stressors (Galea et al., 2007). Additionally, over one-third of respondents (40.6%) reported experiencing five or more significant hurricane-related stressors (Hurricane Katrina Community Advisory Group, 2006). The most significant stressors included physical illness/injury, physical adversity, and property loss (Galea et al., 2007). Galea and colleagues (2007) found the number of hurricane-related stressors to be significantly related to mental health problems, including PTSD and both severe and mild/moderate anxiety-mood disorders. Similarly, Rhodes (2010) found the number of stressors and the level of property damage to be linked to increased symptoms of mental illness, PTSD and marginally higher levels of perceived stress. Therefore, there have been consistent findings suggesting a relationship between hurricane-related stressors and mental health outcomes among Katrina survivors.

While one approach to exploring mental health outcomes following disasters has focused on exposure to disaster-related stressors, another approach is to examine demographic variables to predict mental health outcomes in the aftermath of a disaster. Past research has indicated that different demographic groups may be more vulnerable to negative mental health outcomes following disasters (Norris et al., 2002). In a literature review conducted by Norris and colleagues (2002), some of the individual characteristics that were found to be risk factors for poor mental health outcomes include being female (mainly for depression and anxiety), a member of an ethnic minority group, of low socioeconomic status, and possessing few or weak social resources.

In addition, middle-aged adults may be more at risk for poor mental health following disasters because of the responsibilities they acquire following the disaster (Norris et al., 2002). Not only many of middle-aged survivors responsible for taking care of their children, they are

also responsible for taking care of their elderly parents who require assistance and are, therefore, doubly burdened. Daly posits that psychological distress and poor mental health may be greater among middle-aged adults overall, suggesting that they are at increased vulnerability to being negatively impacted by the trauma of disasters. Further, Lang and colleagues (2011) have found substantive evidence that age-related changes in psychological distress differ as a function of income, thus, supporting the view that these variables are intricately related to each other.

Current Study

Similar to the studies conducted by Galea and colleagues (2007), I examined the relationship between hurricane-related stressors and mental health outcomes. More specifically, I examined the relationship between evacuation status, exposure to hurricane-related stressors, and long-term mental health outcomes among Hurricane Katrina survivors residing in the metropolitan New Orleans area two years after the storm.

Degree of exposure to hurricane-related stressors was determined by using a composite variable consisting of three indicators, including length of evacuation, how much flooding participants experienced in their homes, and the extent of damage to their neighborhood. Individuals who experienced flooding and neighborhood damage were likely confronted with a loss of resources and possessions; therefore, increased flooding and neighborhood damage constitutes increased exposure. Additionally, length of evacuation was included in the composite variable to indicate exposure to hurricane-related stressors because the longer an individual is displaced from their home, the longer they are without resources and social support. Evacuation status was examined separately; while participants who did not evacuate may have been exposed to more stressors during the storm, this is an imprecise measure of exposure since even those who evacuated may have been exposed to hurricane-related stressors. The conservation of

resources stress model predicts that individuals who have greater hurricane-related stressors, and who did not evacuate prior to the storm will be more likely to experience poorer mental health outcomes because these individuals are more likely to have experienced loss of social support and valued resources.

In addition to examining the relationship between evacuation, hurricane-related stressors, and mental health outcomes, I also examined the role of gender, age, ethnicity, education, and income. Based on past research (e.g., Norris et al., 2002), I predicted that those who are female, middle-aged, low-income, and a member of an ethnic minority group would have poor mental health and display a high number of psychological symptoms. Moreover, I predicted that females would report greater anxiety and depression symptoms, but not hostility, while the other demographics would predict greater symptoms of anxiety, depression, and hostility. I also tested the possibility that income moderates the relationship between evacuation status, hurricane-related stressors, and mental health outcomes. That is, I test whether the strength of the relationship between stressors and mental health outcomes is the same for people of low and high-income. In reference to the conservation of resources stress model (Freedy et al., 1992), effects of hurricane-related stressors may be greater for people of low-income as they are already predisposed to low resource-levels before the storm. Thus, the relationship between stressors and mental health outcomes may be particularly strong for people of lower income as compared to people of higher income.

The mental health outcomes examined in this study include symptoms of depression, anxiety, and hostility. Most research on disaster survivors have focused on PTSD and its symptoms, however there are many other psychological responses that occur after traumatic events that pose a threat to overall functioning (McDermott & Palmer, 2002; Vernberg & Varela,

2001; Hensley and Varela, 2008). Across several studies, the prevalence rates for PTSD following various types of disasters have been comparable to that of different disorders, such as depression and anxiety (Meewisse et al., 2011). In addition, some research suggests that symptoms of depression following disaster may linger for a longer period of time as compared to PTSD (Meewisse et al., 2011; Onder, Tural, Aker, Kilic, & Erdogan, 2006). Therefore, although PTSD has been one of the most commonly researched post-disaster disorders, it is important to look at other psychological problems that affect disaster survivors.

Across disaster-related studies, the two of the most reported trauma reactions have been depression and anxiety. Although less researched in disaster studies, reactions involving hostility and aggression may also occur in response to trauma (Borja & Callahan, 2009; Brodsky et al., 2001; Marsee, 2008; Seifert, 2003). Studies have found that these more reactive response styles have been consistently linked to poor self-regulation of emotion (Elklit & Christiansen, 2009; Shields & Cicchetti, 1998; van der Kolk et al., 1996; Marsee, 2008; Scott & Weems, 2010). Marsee (2008) developed an indirect path model to explain the link between hurricane exposure and reactive aggression, suggesting that post-traumatic stress symptoms occurring after exposure can lead to emotional dysregulation that results in reactive aggression. Additionally, Scott & Weems (2010) suggest that individuals who have low actual control, but high perceived control, may exhibit relatively more aggressive behavior than those with other control profiles. Furthermore, support for the relationship between trauma exposure and aggression can be found in studies on men with combat-related PTSD, where aggression related problems are commonly reported (Marsee, 2008; Chemtob et al., 1994, 1997).

While aggression and hostility are closely related to each other, it is important to acknowledge that they are conceptually distinct (Teten et al., 2010). Hostility is defined as a

negative, antagonistic attitude or evaluation of others that is associated with feelings of disgust, indignation, and resentment; on the other hand, aggression is more action-oriented and defined as hostile or violent behavior or attitudes towards other people, often without provocation (Teten et al., 2010). Given that thoughts preclude behavior, hostility is often viewed as a precursor to aggression. Additionally, past research on PTSD veteran samples has indicated a relationship between PTSD, hostility, and aggression (Teten et al., 2010). Therefore, this study measures hostility symptoms, as this may be a particularly pervasive outcome following natural disasters that has not been systematically examined. Given the variability in distress responses following disasters, the inclusion of multiple measures of mental health outcomes, including anxiety, depression, and hostility, is strength of the present research.

Method

Participants

This study used an archival convenience sample of adult community members living in post-Katrina New Orleans two years after Hurricane Katrina. Participants were recruited via advertising in the local newspaper, *The Times Picayune*, for a study on Katrina experiences. In addition, participants were recruited via the snowball sampling method (Goodman, 1961). Individuals who participated were given flyers to distribute to family, friends, co-workers, etc. Participants were compensated \$30 for their participation.

The final sample consisted of 337 participants, 12 of which were excluded from the analysis due to complications during data collection. At this point, 325 participants remained, including 133 Whites, 162 African Americans, 6 Asians/Asian Americans, 3 American Indians/Native Americans, 12 Latino(a)s, 8 individuals who indicated 'other', and 1 individual who did not indicate an ethnicity. From these 325 participants, I selected 140 African Americans

and 106 White Americans who indicated that they lived in the metropolitan New Orleans area prior to Katrina's landfall and who completed the demographics questionnaire, the Katrina-impact questionnaire, and the Brief Symptom Inventory (BSI). The final sample, consisting of 246 participants, was 56.9% African American and 61.4% female with a mean age of 44. The median income was between \$10,000 and \$25,000 and the median education was 'Some College' (see Table 1, for demographics).

Materials and Procedure

Data collection occurred approximately two years post-Katrina. When participants arrived to the laboratory, they were greeted by the experimenter and instructed to complete a packet of questionnaires, which included our primary measures. The order of the measures was counterbalanced across participants and participation lasted roughly one hour. When participants finished, they were debriefed and paid.

Measures

Demographic information. Participants self-reported their age, sex, race/ethnicity (Asian American, Indigenous Nation/Native American, White/Caucasian American, Black/African American, Latino(a)/Hispanic American, or Other), education status (ranging from Elementary school to Post-graduate degree) and their annual household income. Income was assessed on a seven point Likert-type scale where 0 was labeled less than \$10,000 and 7 was labeled more than \$100,000. Participants were divided into three age categories (young adults = less than 39; middle aged= 40-54; older adults = 55+) in order to test the prediction that middle-aged adults have worst mental health.

Evacuation Status. Evacuation status was determined by the participants' reported evacuation status before the storm (0=Yes, evacuated before storm, 1 = No, did not evacuate

before storm). Participants who evacuated before the storm are referred to as “evacuees” and participants who did not evacuate before the storm are termed “nonevacuees”.

Hurricane-Related Stressors. Exposure to hurricane-related stressors was measured using a composite variable consisting of three indicators. These indicators include flood damage to their home (not at all, less than 6 in., 6 in. – 3 ft., 3 ft. – 9 ft., 9ft.+), neighborhood damage (not at all, not very much, moderate damage, substantial damage, total damage), length of evacuation (never left, one month, 2-4 months, 5-7 months, 8-10 months, 10-13 months) ($\alpha = .77$) (see Table 2, for sample disaster exposure information).

Psychological Symptoms. Psychological symptoms were assessed approximately 2 years after Hurricane Katrina using the depression, anxiety, and hostility subscales of the Brief Symptom Inventory (BSI; Derogatis, 1993; see Appendix A). The BSI is a valid, reliable, and widely used measure containing self-rated questions measuring dimensions of psychological distress. The BSI was normed on a non-patient community sample consisting of 494 men and 480 women; 85.5% identified as white, 11.4% identified as black, and 3.1% identified as other races. Detailed demographics on other variables are not available. The BSI has adequate test-retest reliability for the depression ($r_{tt} = .84$), anxiety ($r_{tt} = .79$), and hostility ($r_{tt} = .81$) scales. The items used for each scale have also been shown to have good construct validity.

Participants are given a list of feelings and are asked to rate how often they experience each feeling on a five point, Likert-type scale from 0 (*not at all*) to 4 (*extremely often*). The measure used in the present study included a total 16 items consisting of the depression (5 items; e.g., *feeling no interest in things*, $\alpha = .87$), anxiety (6 items; e.g., *spells of terror or panic*, $\alpha = .89$), and hostility (5 items; e.g., *having urges to break or smash things*, $\alpha = .81$) subscales of the BSI (see Table 3, for sample means; see Table 7, for correlations between all study variables).

Results

Prevalence of Clinically Significant Levels of Symptoms

To determine the prevalence of clinically significant levels of anxiety, depression, and hostility, I compared participants' scores to the available adult nonpatient norms (Derogatis, 1993). I conducted separate comparisons for men and women because Derogatis (1993) provides separate norms for men and women. Individuals with anxiety, depression, or hostility scores that are greater than or equal to a T-score of 70 were considered to have clinically significant levels of symptoms. First, I tested gender differences in raw scores for depression, anxiety, and hostility and found no significant difference (depression, $t(244) = -.022$, anxiety, $t(244) = 1.21$, hostility, $t(244) = -1.46$, respectively; all $p > .16$). Next, I compared gender differences in the level of clinically significant symptoms. Men were more likely than women to report clinically significant symptoms of depression, $\chi^2 = 27.21$, $p < 0.01$, anxiety, $\chi^2 = 24.03$, $p < 0.01$, and hostility, $\chi^2 = 45.02$, $p < 0.01$ (see Table 3, for mental health symptoms by gender). Because the norms were developed on a sample that was primarily White and the present sample was more ethnically diverse, I examined participants' raw scores in all subsequent analyses.

Regression analysis

After computation of initial descriptive statistics, I conducted a separate regression analyses with each of the dependent (outcome) variables of anxiety, depression, and hostility. The independent (predictor) variables in each of the analyses are the demographic variables (ethnicity, sex, education, income, and age, with age dummy coded into two variables with the middle aged group as the reference group), evacuation status, exposure to hurricane-related

stressors, and the interactions between income and evacuation status and income and hurricane-related stressors¹.

For depression, the overall regression equation was significant, $R^2 = .14$, $F(10, 235) = 3.93$, $p < .001$ (see Table 5, for depression predictors). The only demographic variable that significantly predicted depression scores was age. Consistent with predictions, middle aged adults ($M=1.69$, $SD = 1.14$) were more depressed than young adults ($M=1.33$, $SD=.96$), $\beta = -.15$, $t(235) = -2.02$, $p < .05$, and older adults ($M=1.23$, $SD = 1.01$), $\beta = -.15$, $t(235) = -2.02$, $p < .05$ (see Table 4, for mental health symptoms by age).

There was a marginally significant effect of evacuation status, $\beta = .11$, $t(235) = 1.73$, $p = .09$, such that nonevacuees tended to report higher levels of depressive symptoms. Participants who reported greater hurricane-related stressors also tended to have higher levels of depression, $\beta = .12$, $t(235) = 1.72$, $p = .09$, however this relationship was also only marginally significant. The interaction terms between income and evacuation status and income and hurricane-related stressors variable were both nonsignificant, suggesting that income did not moderate the relationship between exposure to stressors and depression.

For anxiety, the overall equation was once again significant, $R^2 = .18$, $F(10, 235) = 5.23$, $p < .001$ (see Table 5, for anxiety predictors). Among the demographic variables, both sex and age significantly predicted anxiety scores. Women ($M= 1.33$, $SD= .99$) reported significantly more anxiety than men ($M=1.17$, $SD= 1.05$), $\beta = -.13$, $t(235) = -2.08$, $p < .05$. Consistent with predictions, middle aged adults ($M= 1.54$, $SD = 1.09$) were more anxious than young adults ($M= 1.13$, $SD= .95$), $\beta = -.17$, $t(235) = -2.38$, $p < .05$, and older adults ($M= 1.12$, $SD= .95$), $\beta = -.12$,

¹ Ethnicity and education were also tested to determine whether they interacted with stressors and evacuation. Ethnicity and education were not significant moderators and, therefore, results are not reported here.

$t(235) = -1.67, p = .10$, although the difference between middle-aged adults and older adults was not significant. Evacuation status also significantly predicted anxiety scores, $\beta = .15, t(235) = 2.35, p < .05$, such that nonevacuees reported higher levels of anxiety. Once again, participants who reported greater hurricane-related stressors tended to have higher levels of anxiety, $\beta = .12, t(235) = 1.76, p = .08$; however, this relationship was not statistically significant. There was a marginally significant interaction between evacuation status and income, $\beta = -.14, t(235) = -1.87, p = .06$. Simple slopes tests revealed that the relationship between evacuation status and anxiety was not significant among high-income individuals, $\beta = .04, t(235) = .40, p = .69$. However, the relationship between evacuation status and anxiety was significant among low-income individuals, $\beta = .26, t(235) = 3.12, p < .01$ (see Figure 1)

For hostility, the overall equation was once again significant, $R^2 = .18, F(10, 235) = 5.21, p < .001$ (see Table 7, for hostility predictors). The only demographic variable that significantly predicted hostility scores was age. Consistent with predictions, middle aged adults ($M = 1.25, SD = 1.04$) were more hostile than older adults ($M = .78, SD = .77$), $\beta = -.16, t(235) = -2.16, p < .05$; although middle-aged adults were also more hostile than young adults ($M = 1.12, SD = .76$), this difference was not significant, $\beta = -.06, t(235) = -.84, p = .40$. Evacuation status did not significantly predict symptoms of hostility; however, there was a significant interaction between income and evacuation status, $\beta = -.24, t(235) = -3.08, p < .01$. Simple slopes tests revealed that the relationship between evacuation status and hostility was not significant among high-income individuals, $\beta = -.10, t(235) = -1.06, p = .29$. However, the relationship between evacuation status and hostility was significant for low-income individuals, $\beta = .28, t(235) = 3.28, p < .01$ (see Figure 2). Exposure to hurricane-related stressors and the hurricane-related stressors by income interaction were both nonsignificant, $ps > .15$.

Discussion

This study explored the predictors of mental health symptoms among New Orleans residents two-years post Hurricane Katrina. Specifically, this study examined the long-term impact of Hurricane Katrina on the mental health of victims. Past research suggests that mental health problems have been elevated for relatively long periods of time among Katrina victims, in particular. Therefore, I hypothesized that individuals with high exposure to hurricane-related stressors as well as those who did not evacuate prior to the storm would report greater psychological symptoms in comparison to the rest of the sample. Although participants with greater exposure to hurricane-related stressors tended to report greater depression and anxiety, both of these relationships were only marginally significant. While those who did not evacuate also tended to experience greater depression and anxiety symptoms than those who did evacuate; this effect was only statistically significant for anxiety. Neither exposure to hurricane related stressors, nor evacuation, were significantly related to hostility. Thus, I found only weak support for my hypothesis that individuals with high exposure to hurricane-related stressors and who did not evacuate would experience more negative mental health outcomes.

Based on the conservation of resources stress model, I hypothesized that income would moderate the relationships between evacuation status and mental health outcomes as well as between exposure to stressors and mental health outcomes. While there was no evidence that income moderated the relationship between stressors and mental health outcomes, there was partial support for the moderating effect of income on the relationship between evacuation status and mental health. This moderating effect of income was significant for hostility and marginally significant for anxiety, but not significant for depression. Whereas the effect of evacuation status on anxiety and hostility was significant for low-income individuals, this effect was not

significant for high-income individuals. The finding that evacuation status had a greater effect on mental health outcomes for low-income nonevacuees than high-income nonevacuees provides support for the conservation of resources stress model. Because low-income individuals already have limited resources prior to the storm, the subsequent loss of these already limited resources can have a detrimental impact on coping ability. Additionally, low-income individuals are less likely to have access to needed resources following the storm, and therefore, the effects of not evacuating may have a particularly negative impact.

One explanation for the differential effect of evacuation status on low- and high-income individuals is that, due to limited resources, low-income individuals were not able to adequately prepare for and respond to the storm. Not only were low-income individuals more likely to live in older homes that were less fit to withstand a strong storm, it is also probable that they could not afford to access resources that would ensure that their homes were protected. Furthermore, individuals with limited resources prior to the storm tend to be less equipped to invest resources in recovery. For example, the lack of necessary resources may have acted as a barrier to evacuating the city in the aftermath of the storm, furthering the exposure to the hurricane's devastation.

Additionally, the differential effect of evacuation on low- and high-income individuals may be explained by more institutional level factors, with the government focusing their prevention efforts on high-income neighborhoods as opposed to low-income areas. According to Snyder (2005), the evacuation plan was largely based on residents having access to private transportation. Researchers have indicated that New Orleans has an evacuation capacity of only 67.3%, which is the likely percentage of people who will be able to evacuate in the peak 12 hours of the evacuation process (American Highway Users Alliance, 2006). Therefore, because

low-income individuals are less likely to have access to private transportation, they were faced with greater challenges to evacuate the city. In contrast, it is possible that high-income nonevacuees chose to stay in New Orleans for other reasons such as a desire to protect their property.

Due to difficulties in evacuating the city, many low-income individuals sought shelter in the Superdome or the Morial Convention Center either before or in the aftermath of the storm; meanwhile, many high-income nonevacuees, who were better prepared, remained in their homes. In seeking refuges in the Superdome or Convention Center, a whole new array of traumatic events was encountered. Not only were they subject to unsanitary and harsh conditions, they also witnessed extremely high rates of violence and death (Brunsma, Overfelt, & Picou, 2007; Kimmelmeier et al., 2008). These differential experiences in the aftermath of the storm could explain why low-income nonevacuees had poorer mental health than high-income nonevacuees.

Demographic Predictors of Mental Health Outcomes

While the primary goal of this study was to look at the relationship between disaster exposure and mental health symptoms, I also examined demographic predictors of mental health outcomes. In the present research, I also conducted ANOVAs to examine gender differences in mental health symptoms. Although there were no gender differences in raw scores for depression, anxiety, or hostility, there were differences for all three variables in clinically significant scores. The finding that men were more likely than women to report clinically significant levels of depression, anxiety, and hostility ran counter to my predictions. While women tend to have higher levels of anxiety and depression than men in the U.S. population as a whole, men may be more likely than women to have clinically significant levels of symptoms following disasters when clinical significance is determined based on gender-typical norms.

While men are generally uncomfortable reporting mental health problems, it is possible that a natural disaster like Hurricane Katrina creates a normative context in which men feel more comfortable than usual in reporting their mental health problems.

In future disaster research, it may be beneficial for researchers to report results for both raw scores and clinically significant levels of symptoms using gender-typical norms. While men and women may report similar levels of mental health symptoms following a disaster, this may represent a larger increase in symptoms for men, relative to their pre-disaster mental health functioning. Thus, the lack of gender difference in raw scores could be somewhat misleading if men are experiencing greater changes in mental health outcomes as a result of disaster exposure.

Importantly, these ANOVAs examining gender differences discussed above were conducted without controlling for other variables. The regression analyses, examining participants' raw scores on depression, anxiety, and hostility, control for the effects of other variables on mental health outcomes. When other variables were controlled for, there was a significant main effect of sex on symptoms of anxiety, with women displaying higher raw scores on anxiety. There were no gender differences in the regression analyses on either depression or hostility. Therefore, the present findings offer very limited support for our hypothesis that women would have worse mental health outcomes than men.

The significant findings of age on mental health symptoms, for the most part, support the hypothesized effect that middle-aged adults would experience greater mental health symptoms than both younger and older adults. Middle-aged adults had greater depression symptoms than younger and older adults, greater anxiety symptoms than younger adults, and greater hostility symptoms than older adults. The findings for depression and anxiety are consistent with past research on mental health and age; however, there has not been much research on hostility and

age. One unique contribution of this research is to show that middle-aged adults have higher hostility than older adults in a sample with high exposure to a disaster.

In the regression analyses, there were no ethnic differences in mental health symptoms. The lack of support for the hypothesized effect of ethnicity on mental health symptoms is surprising in light of past research (e.g., Norris, 2002). While some researchers have found ethnicity to be predictive of poor mental health following trauma, ethnicity did not significantly predict symptoms of depression, anxiety or hostility in the present sample. The nonsignificance of ethnicity in the regression analyses is interesting in reference to the zero-order correlations, which indicate that white individuals are less likely to experience mental health symptoms. It could be that other variables, which are correlated with both ethnicity and mental health outcomes, including age, income, evacuation status, and exposure to hurricane-related stressors, account for the relationship between ethnicity and mental health outcomes that appears in the zero-order correlations.

Limitations and Future Directions

Alternative explanations should be considered when interpreting the results that emerge in the present analyses. While the results indicate a relationship between evacuation status and psychological symptoms, this is a correlation and does not test a causal relationship. It could also be that people who had poor pre-Katrina mental health were less likely to evacuate for a number of possible reasons; therefore, the findings may not be due to the disaster, but to already high levels of psychological symptoms. Since we do not have pre-Katrina psychological histories for the participants, there is no way to rule out this explanation. However, given the comparable findings from past Katrina research, it is likely that non-evacuees were at greater risk

for mental health problems than evacuees (Bourque et al., 2006; Boyd, 2010; Galea et al., 2007; Kessler et al., 2008).

While these findings do support some of the proposed hypotheses, this research is not without limitations. For one, while many of the results are nonsignificant, they are trending in the predicted direction; this lack of statistical significance could be due to power issues with the sample size because the effect sizes are relatively small. This could also be due to problems with the measures themselves. There are only three items included in the exposure to hurricane-related stressors index; a broader measure may have been more likely to show significant effects. Additionally, there are potential flaws with the evacuation measure used. For example, it is unknown where the individuals evacuated to. Some may have evacuated to stay with relatives, while other may have evacuated to the shelter; while both of these constitute evacuating, they likely resulted in vastly different experiences. On the other hand, among individuals who did not evacuate, we do not know the reason they did not evacuate, and whether or not their failure to evacuate was a decision or the result of lack of access to transportation. Because the measures of exposure are all so crude, this could explain the lack of significance for the predicted relationships.

Additionally, this study employed the use of the snowball sampling method. While this method is beneficial in obtaining larger samples in less time, the sample may be less representative of the population because recruitment essentially depends on the participants themselves. Further, motivations to participate in the study could have impacted our results; both people who needed money and those who wanted to share their experiences may have been most likely to respond, creating a biased sample. Another limitation is the use of the BSI subscales measuring psychological symptoms. Anxiety, depression, and hostility were highly

correlated, evidencing a potential problem with discriminate validity. Given this issue with weak discriminate validity of the BSI subscales, the general recommendation is to use the BSI global severity index (Zabora et al., 2001). However, this research was unable to use the global severity index because all of the subscales of the BSI were not included at the time of data collection. Lastly, while this research suggests certain factors are associated with higher levels of mental health symptoms following disasters, it is impossible to determine whether the mental health outcomes of participants are actually due to the hurricane. This was a sample that likely had a lot of pre-existing mental health problems, which may have contributed to these findings. Therefore, caution should be taken in interpreting these results.

The findings of this study offer many implications for the future. The results indicate that many Katrina survivors continue to have poor mental health two-years after the storm, therefore this suggests a need for long-term treatment plans for future disasters. Additionally, the finding that low-income nonevacuees are at great risk of experiencing mental health problems following a natural disaster, such as a hurricane, can be applied to develop better evacuation and hurricane preparedness plans targeting this population. Moreover, the findings that middle-aged individuals experience greater levels of psychological symptoms indicate a need to develop and provide access to age-relevant interventions following natural disasters. Additionally, given the unexpected findings that men experience greater levels of clinically significant levels of symptoms than women suggest a need for greater focus on the mental health outcomes of men following disasters. Future research should also examine the gender differences in clinically significant symptoms following other hurricanes and natural disasters to further explore these findings.

The present research contributes to the natural disaster literature. In line with past research, this study supports the findings that evacuation status is related to mental health outcomes, particularly for low-income nonevacuees. Further, this study provides support for the conservation of resources stress model in relation to long-term mental health outcomes following natural disasters, particularly hurricanes. Because resources are often tied to demographic variables including age, sex, and income, these individuals are at risk of experiencing poor mental health following trauma. This study has implications for future directions in both developing interventions and conducting research. By gaining a better understanding of the variables influencing mental health outcomes following disasters, we will be better able to both prevent and treat mental health problems among victims of future natural disasters.

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Footnotes

Ethnicity and education were also tested to determine whether they interacted with stressors and evacuation. Ethnicity and education were not significant moderators and, therefore, results are not reported here.

Table 1

Demographic Characteristics as a Percentage of the Sample

Characteristic	Percentage
Ethnicity	
White	43.1
Black	56.9
Sex	
Male	38.6
Female	61.4
Age	
Young adult (<39)	35.8
Middle-aged (40-54)	34.6
Older adult (55+)	29.7
Income	
Less than \$10,000	29.3
\$10,000 - \$25,000	26.8
\$25,000 - \$40,000	16.3
\$40,000 - \$55,000	8.1
\$55,000 - \$70,000	6.5
\$70,000 - \$100,000	7.7
\$100,000+	5.3
Education	
Middle/Junior High	1.2
High School	31.3
Some College	38.6
Bachelors Degree	12.2
Some Graduate School	4.9
Graduate Degree	9.3
Post-graduate Degree	2.4

Table 2

Exposure to Hurricane-related Stressors as a Percentage of the Sample

Hurricane-related stressor	Percentage
Evacuate from NOLA before storm?	
No	36.2
Yes	63.8
How much did your home flood?	
Not at All	35.0
Less than 6 inches	9.3
6 inches – 3 feet	15.9
3 feet – 9 feet	27.2
> 9 feet	11.4
Missing	1.2
How bad was your neighborhood damaged?	
Not at all	2.0
Not very much	13.8
Moderate damage	27.2
Substantial damage	29.3
Total damage	27.2
Missing	.4
When did you return to NOLA?	
I never left	2.8
1 month later	23.6
2-4 months later	25.2
5-7 months later	14.2
8-10 months later	10.6
10-13 months later	22.0
Missing	1.6

Table 3

Mental Health Symptoms by Gender

Symptom	Men			Women		
	<i>M</i>	SD	% CS	<i>M</i>	SD	% CS
Depression	1.43	1.10	52.63%	1.43	1.02	20.53%
Anxiety	1.17	1.05	45.26 %	1.33	.988	16.56%
Hostility	1.17	.987	43.16%	1.00	.814	7.28%

Table 4

Mental Health Symptoms by Age

	Young		Middle-aged		Older	
	<i>M</i>	SD	<i>M</i>	SD	<i>M</i>	SD
Depression	1.33	.96	1.69	1.14	1.23	1.01
Anxiety	1.13	.95	1.54	1.09	1.12	.95
Hostility	1.12	.76	1.25	1.04	.78	.77

Table 5

Depression Predictors

Predictor	β	Sig.
Ethnicity	.080	.330
Sex	-.044	.467
Young vs. Middle Aged	-.145	.045*
Older vs. Middle Aged	-.150	.044*
Education	-.066	.385
Income	-.116	.204
Nonevacuee	.113	.085 [†]
Stressors	.124	.086 [†]
Nonevacuee x Income	-.111	.159
Stressors x Income	.066	.317

* $p < .05$
[†] $p < .10$

Table 6

Anxiety Predictors

Predictor	β	Sig.
Ethnicity	.037	.646
Sex	-.127	.034*
Young vs. Middle Aged	-.167	.018*
Older vs. Middle Aged	-.121	.096 [†]
Education	-.042	.573
Income	-.122	.174
Nonevacuee	.150	.020*
Stressors	.124	.080 [†]
Nonevacuee x Income	-.143	.062 [†]
Stressors x Income		.537

* $p < .05$
[†] $p < .10$

Table 7

Hostility Predictors

Predictor	B	Sig.
Ethnicity	-.089	.269
Sex	.051	.392
Young vs. Middle-aged	-.059	.401
Older vs. Middle-aged	-.157	.031*
Education	-.012	.867
Income	.011	.903
Nonevacuee	.090	.160
Stressors	.096	.176
Nonevacuee x Income	-.236	.002*
Stressors x Income	.028	.667

* p < .05 ** p < .01.

Table 8

Correlations between study variables

Variable	Ethnicity	Sex	Mid-age vs Young	Mid-age vs Older	Education	Income	Non-evacuee	Stressors	Depression	Anxiety	Hostility
Ethnicity	—	-.05	-.17**	.37**	.42**	.46**	-.21**	-.53**	-.16*	-.20**	-.30**
Sex	-.05	—	.00	-.02	-.11	-.08	.10	.07	.00	-.08	.09
Mid-age vs Young	-.17**	.00	—	-.49**	-.20**	-.04	-.16*	.05	-.07	-.11	.05
Mid-age vs Older	.37**	-.02	-.49**	—	.22**	.11	-.05	-.18**	-.12	-.09	-.21**
Education	.42**	-.11	-.20**	.22**	—	.54**	-.19**	-.31**	-.21**	-.20**	-.22**
Income	.46**	-.08	-.04	.11	.54**	—	-.17**	-.35**	-.28**	-.29**	-.26**
Nonevacuee	-.21**	.10	-.16*	-.05	-.19**	-.17**	—	.13*	.18**	.23**	.18**
Stressors	-.53**	.07	.05	-.18**	-.31**	-.35**	.13*	—	.21**	.23**	.25**
Depression	-.16*	.00	-.07	-.12	-.21**	-.28**	.18**	.21**	—	.79**	.66**
Anxiety	-.20**	-.08	-.11	-.09	-.20**	-.29**	.23**	.23**	.79**	—	.73**
Hostility	-.30**	.09	.05	-.21**	-.22**	-.26**	.18**	.25**	.66**	.73**	—

*p<.05

**p<.01

Note. Ethnicity coded 1=White, 0= Black; Sex coded 1= male, 0= female; Middle-aged vs young adult coded 1=Young adult, 0=Middle-aged; Middle-aged vs older adult 1=Older adult, 0=Middle-aged.

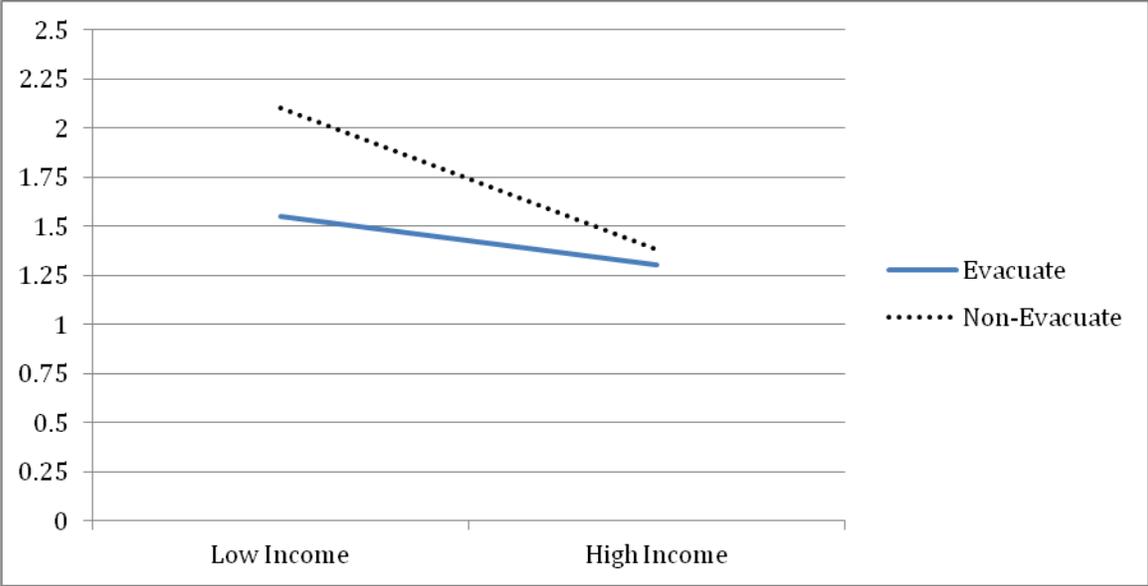


Figure 1. Predicting Anxiety. This figure illustrates the significance of evacuation status on predicting symptoms of anxiety for individuals of low-income.

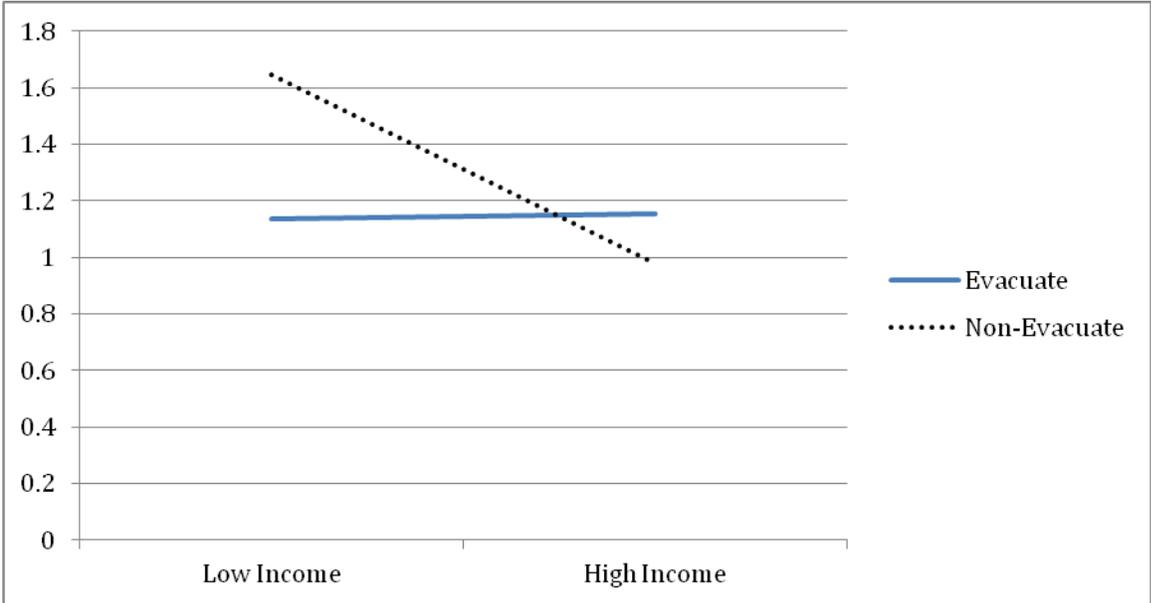


Figure 2. Predicting Hostility. This figure illustrates the significance of evacuation status on predicting symptoms of hostility for individuals of low-income.

Appendix A

Brief Symptom Inventory (BSI)

Below is a list of feelings. Please read each one carefully, and write in the number from the scale above to best describe *HOW OFTEN YOU FEEL THE FOLLOWING*:

0-----1-----2-----3-----4
 Not at all A little bit Sometimes Quite a Bit Extremely Often

1. ____ Nervousness or shakiness inside.
2. ____ Feeling lonely
3. ____ Feeling easily annoyed or irritated.
4. ____ Nausea or upset stomach.
5. ____ Suddenly scared for no reason.
6. ____ Feeling blue
7. ____ Temper outbursts that you could not control.
8. ____ Trouble getting your breath.
9. ____ Feeling fearful.
10. ____ Feeling no interest in things.
11. ____ Having urges to break or smash things
12. ____ Soreness of your muscles.
13. ____ Feeling tense or keyed up.
14. ____ Having urges to beat, injure, or harm someone.
15. ____ Pains in heart or chest
16. ____ Spells of terror or panic
17. ____ Feelings of hopelessness about the future.
18. ____ Getting into frequent arguments.
19. ____ Pains in lower back
20. ____ Feeling so restless you couldn't sit still.
21. ____ Feelings of worthlessness.

Appendix B

Demographic Measures

1. Are you: Male Female

2. How old are you? _____

3. How would you describe your race/ethnicity? (Please check all that apply).

<input type="checkbox"/> Asian American	<input type="checkbox"/> Black/ African American
<input type="checkbox"/> Indigenous Nation / Native American	<input type="checkbox"/> Latino(a) / Hispanic American
<input type="checkbox"/> White/Caucasian American	<input type="checkbox"/> Other (Please explain: _____)

4. What is your highest level of school completed?:

<input type="checkbox"/> Elementary School	<input type="checkbox"/> Bachelors degree
<input type="checkbox"/> Middle/ Junior high School	<input type="checkbox"/> Some graduate school
<input type="checkbox"/> High School	<input type="checkbox"/> Graduate degree
<input type="checkbox"/> Some college	<input type="checkbox"/> Post- graduate degree

8. What is your annual household income?

<input type="checkbox"/> Less than \$10,000
<input type="checkbox"/> \$10,000 – \$25,000
<input type="checkbox"/> \$25,000 - \$40,000
<input type="checkbox"/> \$40,000 - \$55,000
<input type="checkbox"/> \$55,000 - \$70,000
<input type="checkbox"/> \$70,000 - \$100,000
<input type="checkbox"/> \$100,000+

Appendix C

Disaster Exposure & Evacuation

1. Did you live in New Orleans before Hurricane Katrina? ____ yes ____ no
2. Did you evacuate from New Orleans?
____ Yes, I evacuated before the storm
____ Yes, I evacuated after the storm
____ No, I didn't evacuate.
3. Did your home flood? ____ yes ____ no
4. If your home flooded, about how much did it flood?
____ less than 6 inches
____ 6in – 3ft
____ 3ft – 9ft
____ 9ft +
5. How badly do you think your neighborhood was damaged?
____ not at all
____ not very much
____ moderate damage
____ substantial damage
____ total damage
6. About when did you return to the New Orleans area?
____ I never left
____ One month later
____ 2- 4 months later
____ 5- 7 months later
____ 8-10 months later
____ 10- 13 months later