

**Cumulative Trauma and the Long-Term Health and Recovery of  
Disaster Survivors**

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## **Dedication**

To the RISK participants, for continuing to share your stories after all these years, and for tolerating all of my texts and emails during PK3 data collection.

## **Abstract**

Natural disasters significantly impact the mental health of those who survive them, a group that is growing as natural disasters increase in frequency and intensity due to climate change. Although research indicates significant differences in vulnerability to mental health outcomes such as post-traumatic stress disorder (PTSD) after a natural disaster, there is limited research examining how key factors, such pre-disaster trauma, contribute to these differences. This dissertation investigated the extent to which pre-disaster traumas shape both the experience of disasters, and long-term mental health and recovery of disaster survivors, to clarify processes that produce vulnerability and resilience to disasters.

Manuscript 1 examined the extent to which pre-Katrina traumas predict the number and severity of Katrina-related traumatic events. Results indicate that experiencing traumatic events prior to Hurricane Katrina was associated with greater Katrina-related trauma exposure. Specifically, women who experienced more traumatic events prior to Hurricane Katrina reported a greater number of Katrina-related traumas and had a greater risk for specific Katrina-related traumatic events. Manuscript 2 evaluated the extent to which pre-Katrina traumatic experiences explain differences in long-term trajectories of Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma. After adjusting for Katrina-related trauma, pre-Katrina trauma exposure had little impact on probability of Katrina-specific PTSD trajectory. Of the various types of trauma exposure examined, Chronic-High PTSD was most strongly influenced by cumulative trauma exposure and Katrina-related trauma.

Using qualitative interview data, Manuscript 3 examined sources of resilience identified by Katrina survivors with a history of prior trauma as key to their recovery from Hurricane Katrina. Three main factors that women with a history of pre-Katrina trauma perceived as

influencing their recovery were identified. These factors included the availability of new opportunities post-Katrina that facilitated recovery, relying on religion and using prayer as an important coping strategy, and gaining housing and job stability after the disruption and destruction of Katrina.

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## **List of Abbreviations**

AIC: Akaike Information Criterion,

BIC: Bayesian Information Criterion

CI: Confidence interval

IES-R: Impact of Event Scale-Revised

K6: Kessler-6

LCGA: Latent class growth analysis

LEC: Life Events Checklist

PTSD: Post-traumatic stress disorder

RISK: Resilience in Survivors of Katrina Project

RR: Risk ratio

SD: Standard deviation

## 1. INTRODUCTION & OVERVIEW

In 2022, approximately 185 million people were affected by natural disasters worldwide [1], and research suggests that natural disasters are increasing in both frequency and intensity due to climate change [2]. In 2020, for the first time in US history, 10 hurricanes and tropical storms made landfall in the US [3], and wildfires burned more than four million acres in California, doubling the record of two million acres set in 2018 [3]. As natural disasters become more common, it is crucial to understand how these events affect the health of the rapidly growing population of disaster survivors.

The non-disaster trauma literature indicates that prior trauma exposure is associated with greater risk of subsequent traumatic events [4]. This suggests that prior trauma may lead to more severe disaster-related trauma. Trauma can lead to losses of social, economic, and psychological resources, creating conditions for greater severity of future trauma [5]. For instance, by limiting one's ability to prepare for or evacuate from a natural disaster, a prior trauma may lead to greater exposure to disaster-related traumatic events. However, the association between a history of previous trauma and risk for subsequent traumas has not been comprehensively studied in the context of a natural disaster. In addition, the broader trauma literature has found that people with a history of trauma exposure are at increased risk for developing post-traumatic stress disorder (PTSD) after subsequent traumatic experiences [6]. These findings suggest that previous trauma exposure may be a potentially important determinant of post-disaster mental health, although there is minimal research on how pre-disaster traumas are related to post-disaster mental health. Furthermore, there is evidence that cases of PTSD in individuals with exposure to multiple traumatic events are associated with greater morbidity and impairment [7,8]. As a result, disaster

survivors exposed to non-disaster-related traumatic events likely experience an excess burden of distress and functional impairment that can persist for years [9].

Research on the long-term mental health effects of, and recovery from, disasters has largely focused on experiences during a disaster and in its immediate aftermath, with little consideration given to other exposures across the life course that may increase an individual's risk for more severe disaster-related trauma and post-disaster mental health problems. Approximately 70% of the population will experience at least one traumatic event in their lifetime [10]. Given this high prevalence of trauma exposure and the growing threat of natural disasters, a life course perspective that considers the impacts of disasters within the context of other life course traumas is crucial to understand the long-term health and recovery trajectories of millions of disaster survivors. In addition to understanding the effects of prior trauma on disaster survivors, it is also important to identify coping or resilience factors that can alleviate or prevent negative mental health consequences among disaster survivors who have a history of trauma.

This dissertation addresses knowledge gaps by leveraging unique data from the Resilience in Survivors of Katrina (RISK) study, a mixed-methods, longitudinal study of Hurricane Katrina survivors initially recruited prior to the storm, and subsequently followed for more than a decade. Identifying the relationships between pre-disaster traumatic experiences, disaster-related trauma, and coping factors is a key step in developing supports that will protect those most vulnerable to disasters. Thus, this dissertation examines the following aims.

**1.1. Manuscript 1:** The association of pre-disaster trauma with severity of disaster-related traumatic events among Hurricane Katrina survivors.

**Primary Aim:** Examine the extent to which the number and severity of pre-Katrina traumas

predict the number and severity of Katrina-related traumatic events.

*Hypothesis:* Based on non-disaster research showing an association between previous trauma and risk for more severe future traumatic events, experiencing a greater level of pre-Katrina trauma will be associated with more, and more severe, Katrina-related traumatic events.

**1.2. Manuscript 2:** Predicting post-disaster PTSD symptom trajectories: The role of pre-disaster traumatic experiences.

**Primary Aim:** Evaluate the extent to which pre-Katrina traumatic experiences explain differences in long-term trajectories of Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma.

*Hypothesis:* Experiencing greater pre-Katrina trauma will be associated with increased risk of chronic Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma.

**Secondary Aim:** Characterize the relationship between Katrina-specific PTSD trajectories and Katrina-related, post-Katrina, and cumulative trauma exposure to explore how traumatic events at different points in the life course may impact long-term disaster-related PTSD symptoms.

**1.3. Manuscript 3:** Understanding perceptions of resilience factors: A qualitative study of Hurricane Katrina survivors.

**Primary Aim:** Qualitatively examine sources of resilience identified by Katrina survivors with a history of prior trauma as key to their recovery from Hurricane Katrina.

## **2. BACKGROUND & RATIONALE**

Post-traumatic stress disorder (PTSD) is a mental health condition that is triggered by experiencing or witnessing a traumatic event [11]. It is characterized by intrusive and distressing remembering or reexperiencing of the event, avoidance, hyperarousal or reactivity, and cognition or mood symptoms [12]. Reexperiencing symptoms include frightening thoughts of the traumatic events and flashbacks, where the trauma is relived over and over. People with PTSD often avoid thoughts, places, events, or objects related to the traumatic event. Hyperarousal and reactivity symptoms, such as being easily startled or feeling tense, can be constant, causing some people with PTSD to feel constantly on edge [12]. These symptoms can make the person feel stressed and angry and impair their ability to do daily tasks, such as sleeping or concentrating. Cognition or mood symptoms can begin or worsen after the traumatic event, and include symptoms such as trouble remembering key features of the event, distorted feelings like guilt or blame, and loss of interest in previously enjoyable activities.

PTSD symptoms can cause difficulty in daily functioning [12]. For example, reexperiencing or avoidance symptoms may cause a person to change their everyday routine to avoid situations, people, or activities that may worsen these symptoms. PTSD can make the person feel detached from friends or family members, making it difficult to maintain close relationships [12]. Reexperiencing, avoidance, reactivity, and cognition or mood symptoms can all affect an individual's ability to work [12]. Because of the level of impairment that PTSD can cause, the US Department of Veterans Affairs and Social Security Administration classify severe PTSD as a disability [13,14]. PTSD has been estimated to result in 3.6 days of lost productivity per month and has been called a "life sentence" due to its impact on risk of chronic disease, accelerated aging, and premature mortality [15].

Natural disasters have long been known to cause PTSD, depression, and other forms of psychological distress [16]. Although estimates of the prevalence of PTSD among disaster survivors vary significantly between studies due to differences in disaster type, degree of exposure, and other important factors, a literature review spanning 40 years of disaster research found that 30-40% of direct disaster victims develop PTSD [17].

## **2.1. Variation in vulnerability**

Despite the strong influence of disasters on mental health, not everyone who experiences a disaster develops PTSD and many who do ultimately recover [18]. Researchers who have studied the course of mental health problems following disasters suggest that disaster survivors often follow four distinct prototypical symptom trajectories: resilience, recovery, delayed dysfunction, and chronic dysfunction [18,19]. Many people exhibit resilience and do not experience persistent disaster-related PTSD symptoms [18]. However, others experience a chronic, long-term burden of disaster-related PTSD [18]. Resilience reflects the experience of few or no PTSD symptoms post-disaster, whereas recovery indicates a trajectory where PTSD symptoms initially increase and then decline over time. Those who follow the delayed dysfunction trajectory initially experience few PTSD symptoms, but these symptoms subsequently increase over time. Finally, people with chronic dysfunction have moderate or severe symptoms that persist over time. Both the delayed and chronic dysfunction trajectories represent individuals who experience a long-term burden of disaster-related PTSD. Notably, the severity of disaster-related trauma appears to be only one of many factors that influence post-disaster mental health [20]. It is not yet clear why some people cope well with trauma while others experience chronic dysfunction. Given the variability in psychological responses to natural disasters, understanding who is likely to experience long-term disaster-related PTSD is

crucial for allocating limited disaster recovery resources and informing interventions to build resilience.

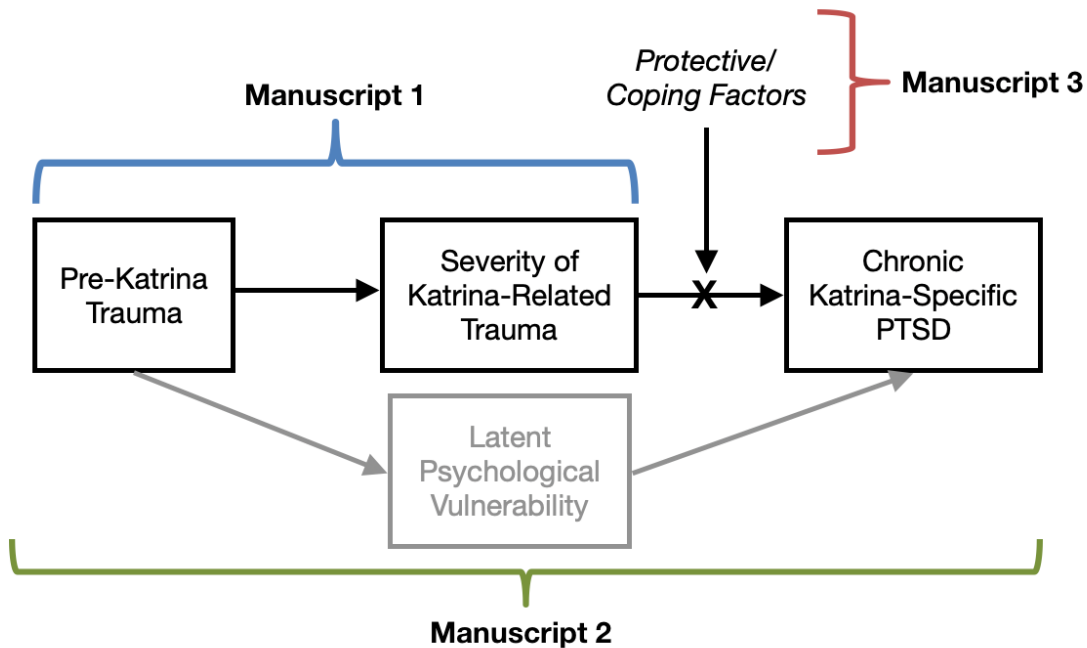
The broader literature on trauma exposure suggests that having a history of exposure to one or more traumatic events can exacerbate the mental health consequences of subsequent traumatic experiences [6]. Exposure to a greater number of traumatic events has been linked to higher risk for, and greater impairment from, adverse mental health outcomes [5,7,9]. The process by which cumulative traumatic events increase mental health problems is thought to occur through “stress sensitization,” in which the stress response systems of individuals exposed to earlier stressors are primed to respond to later stressors in ways that increase the risk for developing adverse mental health outcomes [21,22].

Life course theory provides a framework for understanding the relationship between adversity earlier in the life course and later-life health [23]. Based on life course theory, the development of PTSD is unlikely to be explained by characteristics of the disaster alone. Rather, the consequences of a traumatic event represent the combination of an individual’s biological, psychological, and life experiences before, during, and after a traumatic event.

Per the conservation of resources theory, trauma exposure can lead to losses in social, economic, and psychological resources, which in turn increase risk of further traumatic experiences [24]. These exposures in each life stage interact to create chains of risk that shape health across the life course. Furthermore, psychological distress can undermine an individual’s ability to accurately detect threats and impede adaptive coping, increasing the risk of further trauma exposure [25]. Consequently, trauma or other disadvantages may set an individual on a path towards a later exposure that is directly related to the development of disease.

Despite this evidence, the extent to which these associations between prior trauma and risk for further trauma exposure or enhanced psychological vulnerability to the mental health effects of future trauma hold true in the context of a natural disaster is not yet clear. Non-disaster research suggests that an individual's history of traumatic experiences may be a key factor that explains differences in psychological responses to a disaster, either by increasing the number and severity of future traumatic events (conservation of resources hypothesis), or increasing psychological reactions to future traumatic events (stress sensitization hypothesis), or both. In line with the conservation of resources theory, pre-disaster trauma may lead to losses of social, economic, and psychological resources, creating conditions for greater severity of future traumatic events [5]. For example, individuals who have experienced a loss of resources due to a pre-disaster traumatic event may experience more difficulty preparing for a disaster, or evacuating from their home. Specifically, having greater social resources can facilitate evacuation plans and reduce barriers to evacuation by allowing individuals to more easily find help with transportation or housing during evacuation [26,27]. Similarly, having more material resources, such as owning a car or having a higher income, can reduce barriers to evacuation and limit exposure to disaster-related trauma [26]. Inability to evacuate may then lead to greater exposure to disaster-related traumatic events, such as lacking food, fresh water, or medical care in the aftermath of the disaster, or witnessing a friend or family member be seriously injured or die as a result of the disaster [26]. In line with stress sensitization theory, a pre-disaster trauma may lead to psychological vulnerability, or stress sensitization, wherein exposure to earlier stressors alters the stress response systems such that individuals are more sensitized to the effects of later stressors, such as disaster-related trauma [8,22]. This could result in disaster survivors with a history of trauma being more likely to develop disaster-related PTSD.

Together, this evidence from the non-disaster trauma literature suggests that prior trauma exposure may lead to more severe disaster-related trauma or greater psychological vulnerability after disaster-related trauma, or a combination of both. However, to date, no research has directly investigated whether prior traumatic events can help explain differential responses to disasters. Research on the long-term mental health effects of natural disasters has largely not considered other exposures over the life course that may increase an individual's risk for post-disaster mental health problems [28]. Consequently, it remains unknown how experiences prior to a disaster affect the number and severity of disaster-related traumatic events and the course of individuals' disaster recovery. In addition to pre-disaster and disaster-related trauma, individual differences in psychological responses to a disaster are also likely related to coping strategies and other sources of resilience. This dissertation aimed to quantitatively and qualitatively identify how life course traumatic events and coping factors combine with disaster experiences to predict long-term recovery trajectories. I examined these associations using data from a longitudinal study of Hurricane Katrina survivors initially recruited prior to the storm, and subsequently followed for more than a decade. **Figure 2.1** shows the interrelationships between key variables and how they are examined in this dissertation.



**Figure 2.1.** Dissertation Aims

Notes: Variables in gray font are unmeasured. Gray arrows represent hypothesized pathways involving unmeasured variables.

## 2.2. Conceptual model

The conceptual model presented in **Figure 2.2** is adapted from Glass and McAtee’s society-behavior-biology nexus [29], which situates individuals within nested systems of social organization, encompassing individual-level, interpersonal-level, and macro-level factors that influence health. This framework also depicts the timing of these various factors, allowing for a life course perspective. Because my analyses focus on Hurricane Katrina survivors, the conceptual model specifically references Hurricane Katrina and Katrina-specific PTSD.

Exposure to traumatic events unrelated to Hurricane Katrina is a key determinant of post-Katrina mental health because people with a history of trauma exposure are at increased risk for developing PTSD after subsequent traumatic experiences [5,7]. Pre-Katrina traumatic experiences may also increase the number and severity of Katrina-related traumatic events an individual experiences [5]. Because the degree of disaster-related traumatic events strongly

predicts post-disaster PTSD, pre-Katrina trauma may also impact Katrina-specific PTSD through severity of Katrina-related traumatic events [16]. Other key individual-level determinants of Katrina-specific PTSD include pre- and post-Katrina physical and mental health, income and access to material resources, and psychological resources, including self-efficacy, locus of control, and religiosity [30–36]. Income, employment, and access to other material resources are important because they affect the ability to evacuate before a disaster as well as recovery from trauma [26,27]. At the interpersonal level, social support and family structure are determinants of post-disaster PTSD [30,36,37]. Low social support is associated with higher risk of developing PTSD after traumatic events [37]. Social support can also act as a resilience factor by serving as a buffer against the adverse effects of disaster-related trauma [38]. People with larger pre-disaster social networks have been found to be better able to evacuate before the storm, which can lower severity of exposure to disaster-related trauma [26,27].

At the highest level of social ecology, state and national emergency preparedness, disaster recovery policies, neighborhood characteristics, and economic and racial dynamics all influence mental health outcomes among disaster survivors [16]. During Hurricane Katrina, race and class interacted with the government’s response to the disaster [39,40], with disproportionate negative effects on Black and low-income residents of New Orleans [41]. Because racially and economically segregated neighborhoods experienced some of the most severe flooding, residents of these neighborhoods were displaced for a longer period of time than those who lived in less heavily affected areas [41].

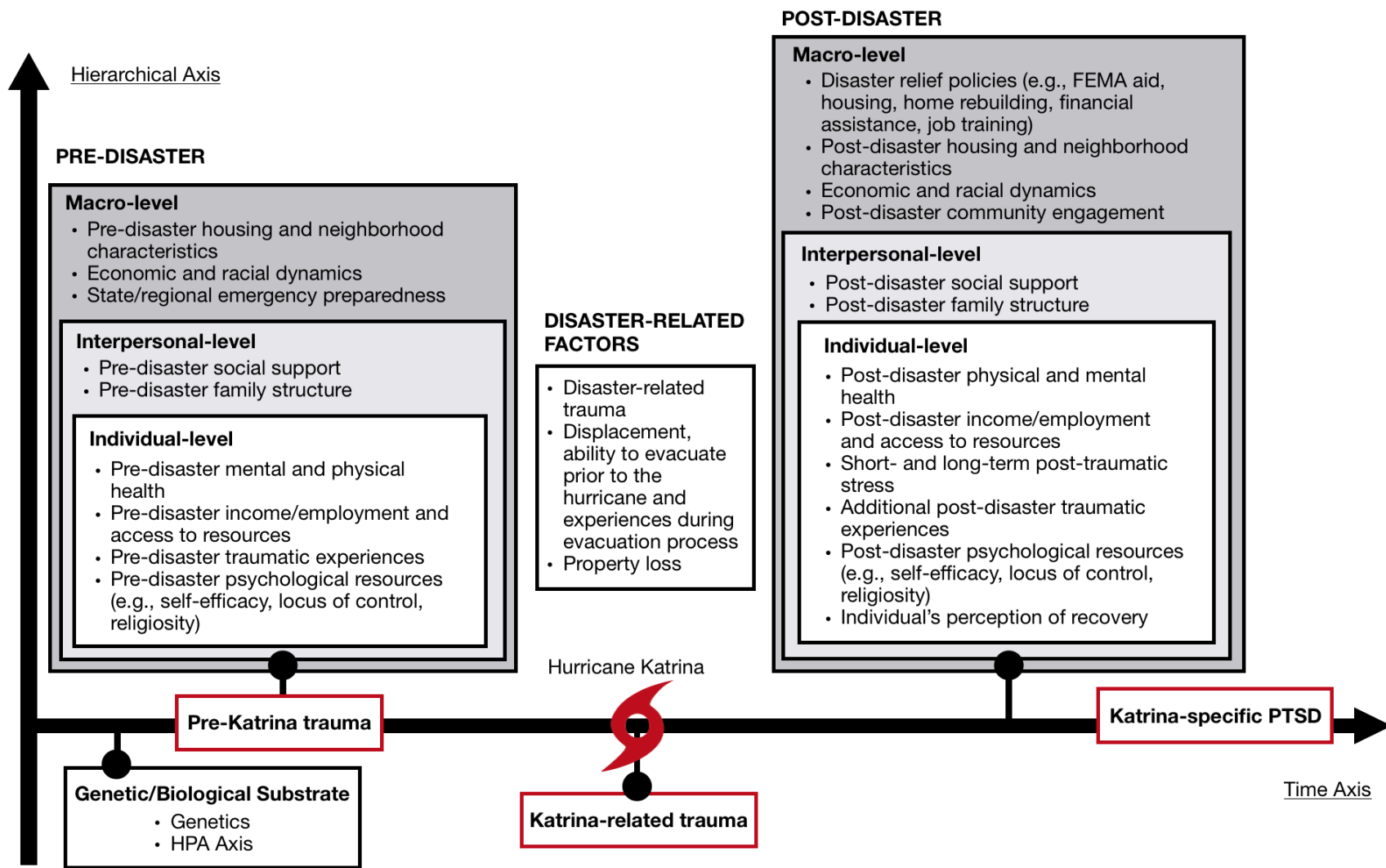


Figure 2.2. Determinants of Katrina-specific PTSD among low-income female survivors of Hurricane Katrina

### **2.3. Dissertation impact**

Disasters have often been viewed as “great equalizers” or “status levelers”—events that impact everyone equally, regardless of race, ethnicity, or socioeconomic status [42]. However, in reality, disasters typically have the most adverse effects on people who are already vulnerable, exacerbating pre-existing disparities [16]. To reduce the potentially devastating mental health effects of disasters, especially for those who are at greatest risk, it is crucial to understand reasons that individuals differ in their vulnerability and resilience. To date, the long-term impact of pre-disaster traumatic events on disaster-related trauma and its mental health consequences remains unknown.

Using quantitative and qualitative data from a longitudinal study of Hurricane Katrina survivors, this dissertation addresses these research gaps by examining how pre-disaster traumatic experiences impact severity of disaster-related trauma (Manuscript 1), long-term disaster-related mental health (Manuscript 2), and factors identified by survivors as key to their disaster recovery and coping (Manuscript 3).

### **3. MANUSCRIPT 1: The association of pre-disaster trauma with severity of disaster-related traumatic events among Hurricane Katrina survivors**

#### **3.1. BACKGROUND & AIMS**

Exposure to disasters is associated with adverse psychological outcomes, including post-traumatic stress disorder (PTSD), depression, anxiety disorders, and non-specific psychological distress [20,43]. The mental health impact of disasters is substantial, with 30-40% of direct disaster victims developing PTSD [17]. PTSD itself has been called a “life sentence” due to its impact on chronic disease, accelerated aging, and premature mortality [15]. Although there are many factors that contribute to post-disaster mental health problems, the factor that most strongly predicts these outcomes is the degree or severity of the disaster-related traumatic events experienced [16]. Therefore, an important part of preventing post-disaster mental health problems is identifying who is most vulnerable to experiencing higher or more severe levels of disaster-related trauma.

Traumatic events across the life course are not independent of each other. Rather, experiencing one traumatic event is associated with an increased risk for further trauma exposure in the future [44]. For example, a study of college students found that experiencing at least one traumatic event prior to college predicted sexual assault during college [45]. The reasons for the links between traumatic events are not certain, but it is likely that prior trauma can enhance vulnerability to subsequent trauma by causing losses in social, economic, and psychological resources that could buffer against future adversity [46]. For instance, exposure to a traumatic event may limit one’s ability to accurately detect threats in the environment and hamper adaptive coping [28]. Losses of resources as a result of a previous trauma can also prevent individuals

from leaving a potentially dangerous situation. For example, loss of employment or income due to an accident or significant injury may decrease economic resources and increase household financial stress. Such traumatic event-related loss of resources has been found to reduce women's means of leaving abusive relationships, increasing their risk of intimate partner violence [47]. The strength of the association between prior trauma and subsequent traumatic events differs by the type of prior trauma experienced [10]. The non-disaster trauma literature has found that assaultive traumas related to interpersonal violence, such as physical abuse or sexual assault, are more strongly associated with risk for future trauma exposure than other types of traumatic experiences [10].

Despite research indicating that prior trauma is a risk factor for future trauma exposure, few studies have investigated whether pre-disaster trauma exposure predicts number and severity of disaster-related traumatic events [4,48]. Although empirical data are scarce, it is highly plausible that resource loss due to an earlier trauma may create conditions for greater severity of disaster-related trauma. For instance, a prior traumatic event may limit one's ability to prepare for, or evacuate from, a natural disaster, leading to greater exposure to disaster-related trauma. In this paper, I assessed the extent to which traumatic events that occurred prior to a major disaster, Hurricane Katrina, are associated with number and severity of Katrina-related traumatic events. Given prior findings that assaultive traumas are more strongly associated with subsequent trauma than other types of prior trauma exposure, I explored whether this association holds in the context of a natural disaster by examining whether assaultive forms of pre-Katrina trauma are more predictive of Katrina-related traumatic events than other types of trauma.

**Primary aim:** Examine the extent to which the number and severity of pre-Katrina traumas predict the number and severity of Katrina-related traumatic events.

*Hypothesis:* Based on non-disaster research showing an association between previous trauma and risk for more severe future traumatic events, experiencing a greater level of pre-Katrina trauma will be associated with more, and more severe, Katrina-related traumatic events.

## **3.2. METHODS**

### **3.2.1. Data**

This paper leveraged survey data from the Resilience in Survivors of Katrina (RISK) study, a longitudinal study of low-income women who lived in New Orleans at the time of Hurricane Katrina. The RISK sample is drawn from the Opening Doors Demonstration, a randomized evaluation of a program designed to increase community college graduation rates and academic achievement among low-income adults with children under age 18. Between November 2003 and June 2005, Opening Doors enrolled 1,019 low-income parents when they registered for classes at one of two community colleges in the New Orleans area, Delgado Community College and Louisiana Technical College-West Jefferson. At enrollment, participants were randomized to a control or intervention group, where those in the intervention group received a small scholarship for maintaining passing grades and mentorship intended to promote academic success. All participants completed a baseline questionnaire about their educational background and goals, employment history, and sociodemographic characteristics. They also completed a short baseline survey about their physical and mental health, attitudes about schooling, and social relationships.

To qualify for Opening Doors, participants needed to be enrolled in community college, be between the ages of 18 and 34, have at least one child under age 18, and earn less than 200% of the poverty line at baseline. Of the 1,019 original participants, 92.4% were women. Because

so few men were enrolled, these 77 men are excluded from these analyses, leaving a sample of 942 women. At baseline (2003-2005), these 942 women had a mean age of 25.3 years and had 1.8 children on average. Reflecting the sociodemographics of low-income community college students living in New Orleans in 2003, 85.9% of the participants are Black and 71.9% received some form of public assistance at baseline [26].

After Hurricane Katrina disrupted data collection for the Opening Doors 12-month follow-up survey in August 2005, the study was redesigned as RISK to examine the consequences of a disaster on the lives of vulnerable individuals and their families. In addition to the pre-Katrina Wave 1 data collected in 2003-2005, the RISK study conducted three post-Katrina follow-up surveys one, four, and 12 years after the hurricane: Wave 2 was collected in 2006-2007 (response rate: 70.8% of original sample; n=667), Wave 3 was collected in 2009-2010 (response rate: 74.5% of original sample; n=702), and Wave 4 was collected in 2016-2018 (response rate: 75.9% of original sample; n=715). Each of the follow-up surveys included questions pertaining to experiences during and after Hurricane Katrina, health resources and outcomes, social networks and support, and economic resources.

### **3.2.2. Measures**

#### *3.2.2.1. Primary exposure*

Pre-Katrina traumatic experiences: Pre-disaster traumatic experiences, unrelated to Hurricane Katrina, were measured retrospectively in the third post-Katrina survey (Wave 4; 12 years after Hurricane Katrina) using an adapted version of the Life Events Checklist (LEC) [49]. The LEC has demonstrated adequate psychometric properties, including good convergent validity and temporal stability [49]. The LEC asks respondents to indicate whether they experienced each of 14 potentially traumatic events. These events are: 1) technological disaster, 2) act of mass

violence, 3) exposure to combat or a war zone, 4) illness or injury of someone close, 5) sudden unexpected death of someone close, 6) sudden unexpected death of your child, 7) witnessed someone being seriously injured or killed, 8) robbed or mugged, 9) physically hurt by parent or caregiver, 10) physically hurt by spouse or partner, 11) physically hurt by someone else, 12) raped or sexually assaulted, 13) experienced a life-threatening illness, and 14) experienced any other situation in which you were seriously injured or feared that you would be seriously injured or killed. Participants who responded “yes” to an item were asked whether they experienced this event before, after, or both before and after Hurricane Katrina. For this analysis, a binary variable (yes/no) was created for each event to indicate that the participant experienced this event prior to Hurricane Katrina. Affirmative responses were summed to create an index of pre-Katrina trauma exposure. Because assaultive traumas are more consistently associated with PTSD and risk for additional future traumatic experiences than non-assaultive traumas, the five events related to personal experiences of assaultive violence (items 8-12 in the list of LEC items) were summed to create counts of pre-Katrina assaultive traumas for separate sub-analyses of assaultive trauma [10,44,50–52]. An index of non-assaultive traumas (items 1-7, 13, and 14) was also created.

#### *3.2.2.2. Outcomes*

##### Indicators of Katrina-related trauma and hardship

In line with previous research using this dataset [53–55], several measures of Hurricane Katrina-related trauma and hardship were used in these analyses. All of these measures were asked in the first post-Katrina follow-up survey (Wave 2).

*Hurricane traumas:* The first measure is an eight-item trauma scale based on a survey of Hurricane Katrina survivors conducted in 2006 [56]. This scale measured hurricane-related

stressors and was jointly designed by the Harvard School of Public Health, the Kaiser Family Foundation, and the Washington Post [56]. Respondents were asked to answer “yes” or “no” to the following questions about their experiences in the week after Katrina: 1) lacked enough fresh water to drink, 2) lacked enough food to eat, 3) felt one's life was in danger, 4) lacked necessary medicine, 5) lacked necessary medical care, 6) family member lacked necessary medical care, 7) lacked knowledge of safety of children, or 8) lacked knowledge about safety of other family members. Responses were summed to create scores ranging from 0-8. Similar items on the hurricane trauma scale were also grouped to create four additional binary measures of Katrina-related trauma to better understand the types of disaster-related trauma that are most strongly associated with prior traumatic experiences. These binary indicators are: 1) lacked enough food to eat or fresh water to drink, 2) lacked knowledge of safety of children or other family members, 3) lacked necessary medicine or medical care, or a family member lacked necessary medical care, and 4) felt one’s life was in danger.

*Bereavement:* Participants were asked whether a family member or friend died as a result of Hurricane Katrina. Participants who indicated the loss of a family member or friend were coded as 1 (yes) and those who did not were coded as 0 (no).

*Home damage:* The third indicator of Katrina-related trauma used in these analyses is a measure of home damage due to Hurricane Katrina. Participants were asked to describe the extent of the damage caused by Hurricane Katrina to the home where they were living when Katrina struck. Answer options included “none” (0), “minimal” (1), “moderate” (2), “substantial” (3), and “enormous” (4). In line with previous studies using this dataset [53–55], home damage was dichotomized by collapsing the bottom two (none or minimal, coded as 0) and

top three categories (moderate, substantial, or enormous, coded as 1), creating a variable that indicates whether a participant experienced moderate to severe home damage.

### *3.2.2.3. Covariates*

Pre-Katrina sociodemographics: Sociodemographic covariates were included based on prior research showing their association with levels of trauma exposure in general as well as disaster-related trauma [16]. These covariates are age in years, race, a binary variable indicating whether a participant was married or cohabitating with a partner, and a count of public benefits received (i.e., social security income, unemployment, welfare, and/or food stamps). All four sociodemographic covariates were measured at baseline (Wave 1).

Pre-Katrina perceived social support: Pre-Katrina perceived social support was measured at baseline using the Social Provisions Scale [57]. This scale is comprised of eight items, such as “there are people I know will help me if I really need it.” Participants indicated the degree to which they agreed or disagreed with each statement. Answer options were “strongly disagree” (1), “disagree” (2), “agree” (3), and “strongly agree” (4). After reverse coding negatively phrased items, total scores were calculated by taking the mean of all items. Scores range from 1-4, with higher scores indicating greater perceived social support.

Pre-Katrina psychological distress: Non-specific psychological distress was measured at baseline using the Kessler-6 (K6) scale, a self-report measure used to assess anxiety and mood disorders [58,59]. This scale is comprised of six items which ask, “in the past 30 days, how often did you feel...”: 1) nervous, 2) hopeless, 3) restless or fidgety, 4) so sad or depressed that nothing could cheer you up, 5) that everything was an effort, and 6) worthless. Answer choices were “none of the time” (0), “a little of the time” (1), “some of the time” (2), “most of the time” (3), and “all of

the time” (4). Responses to the six items were summed to construct scores ranging from 0-24, with higher scores indicating more distress [59].

### **3.2.3. Analysis**

Poisson regression models with robust standard errors were used to examine associations between pre-Katrina traumatic experiences and Katrina-related trauma and hardship. Katrina-related trauma was modeled as a count variable representing the number of Katrina-related traumatic experiences reported on the eight-item hurricane trauma scale (range: 0-8). Summary statistics, histograms, and scatterplots were used to assess overdispersion of the outcome variable (number of Katrina-related traumas). In addition, modified Poisson regression [60] was used to estimate risk ratios and 95% confidence intervals for the six binary indicators of Katrina-related trauma. Missing data was imputed using chained multiple imputation in Stata 15.1.

The independent variable, pre-Katrina trauma exposure, was examined several ways. First, I evaluated the association between any pre-Katrina traumatic experiences and Katrina-related trauma by creating a binary variable that indicates whether the participant experienced any of the traumatic events listed on the Life Events Checklist (LEC) prior to Hurricane Katrina (any pre-Katrina traumatic event = 1, no pre-Katrina traumatic events = 0). I also modeled pre-Katrina trauma as an ordinal variable representing the number of pre-Katrina traumatic events experienced (0, 1, 2, 3+).

Next, following prior research that suggests that assaultive traumas may be more strongly associated with risk for future trauma exposure than non-assaultive traumas [10], I created a second binary variable indicating exposure to any assaultive trauma before Katrina (any pre-Katrina assaultive traumatic event = 1, no pre-Katrina assaultive traumatic events = 0).

Assaultive trauma was also modeled as an ordinal variable representing the number of assaultive

traumas experienced before Hurricane Katrina (0, 1, 2+). A binary variable indicating exposure to any pre-Katrina non-assaultive trauma and an ordinal variable representing the number of non-assaultive traumas experienced (0, 1, 2+) were also created. To assess whether pre-Katrina assaultive trauma is more strongly associated with Katrina-related trauma than non-assaultive trauma, I adjusted for non-assaultive trauma in analyses of the association between pre-Katrina assaultive trauma and Katrina-related trauma.

For each outcome, I began with the crude model, then adding sociodemographic characteristics. Pre-Katrina social support and psychological distress may operate as either confounders or mediators of the association between pre-Katrina trauma and Katrina-related trauma, depending on their timing relative to pre-Katrina trauma, which is not known. Therefore, I ran models with and without these two covariates. Postestimation using the *margins* command in Stata was used to predict the average number of Katrina-related traumas reported by participants who did and did not experience a given level of pre-Katrina trauma, adjusted for all other variables in the model.

### **3.3. RESULTS**

#### **3.3.1. Descriptive statistics**

**Table 3.1** presents descriptive statistics for the participants in the sample. At baseline, the average participant age was 25.3 years (SD=4.5) and 23.4% of participants were married or cohabitating with a partner. The majority of participants identified as non-Hispanic Black (85.9%), 9.9% identified as non-Hispanic White, 2.4% identified as Hispanic, and 1.8% identified as another race or ethnicity. Using the validated K6 score cut points [59], prior to

Hurricane Katrina, 18.0% of participants had probable mild to moderate mental illness and 5.5% had probable serious mental illness.

Overall, 61.1% of participants reported experiencing at least one traumatic event pre-Katrina, 44.9% reported experiencing at least one assaultive traumatic event pre-Katrina, and 46.4% experienced one or more non-assaultive pre-Katrina traumatic events. Katrina-related trauma exposure was also highly prevalent in the sample. Participants experienced 3.0 out of a possible 8 types of Katrina-related trauma on average (SD=2.3). More than a third of the sample experienced the death of a family member or close friend due to Hurricane Katrina (39.1%) and 83.6% reported moderate to severe home damage as a result of Hurricane Katrina.

**Table 3.1.** Descriptive statistics for analytic sample (n=942)

	<b>Mean (SD) or %</b>
<b>Baseline sociodemographics</b>	
Age (years)	25.3 (4.5)
Non-Hispanic Black	85.9%
Married or cohabitating	23.4%
Number of public benefits received (range: 0-4)	0.93 (0.72)
<b>Pre-Katrina trauma</b>	
Any pre-Katrina trauma	61.1%
Number of pre-Katrina traumas (range: 0-14)	1.7 (2.0)
0	38.9%
1	20.7%
2	12.6%
3+	27.8%
Any pre-Katrina assaultive traumas	44.9%
Number of pre-Katrina assaultive traumas (range: 0-5)	0.82 (1.1)
0	55.3%
1	21.9%
2+	22.8%
Any pre-Katrina non-assaultive traumas	46.4%
Number of pre-Katrina non-assaultive traumas (range: 0-9)	0.86 (1.2)
0	53.6%
1	24.1%
2+	22.3%
<b>Katrina-related trauma and hardship</b>	
Number of Katrina-related traumas	3.0 (2.3)
Lost a family member or friend	39.1%

Moderate or severe home damage	83.6%
<i>In the week after Hurricane Katrina hit, was there a time when...</i>	
You didn't have enough food to eat or fresh water to drink?	42.1%
You or a family member who was with you needed medicine or medical care but couldn't get it?	51.7%
You didn't know if your children or other immediate family members were safe?	80.1%
You felt your life was in danger?	34.3%
<b>Pre-Katrina perceived social support</b> (range: 1-4)	3.2 (0.4)
<b>Pre-Katrina psychological distress</b> (range: 0-24)	5.0 (4.1)

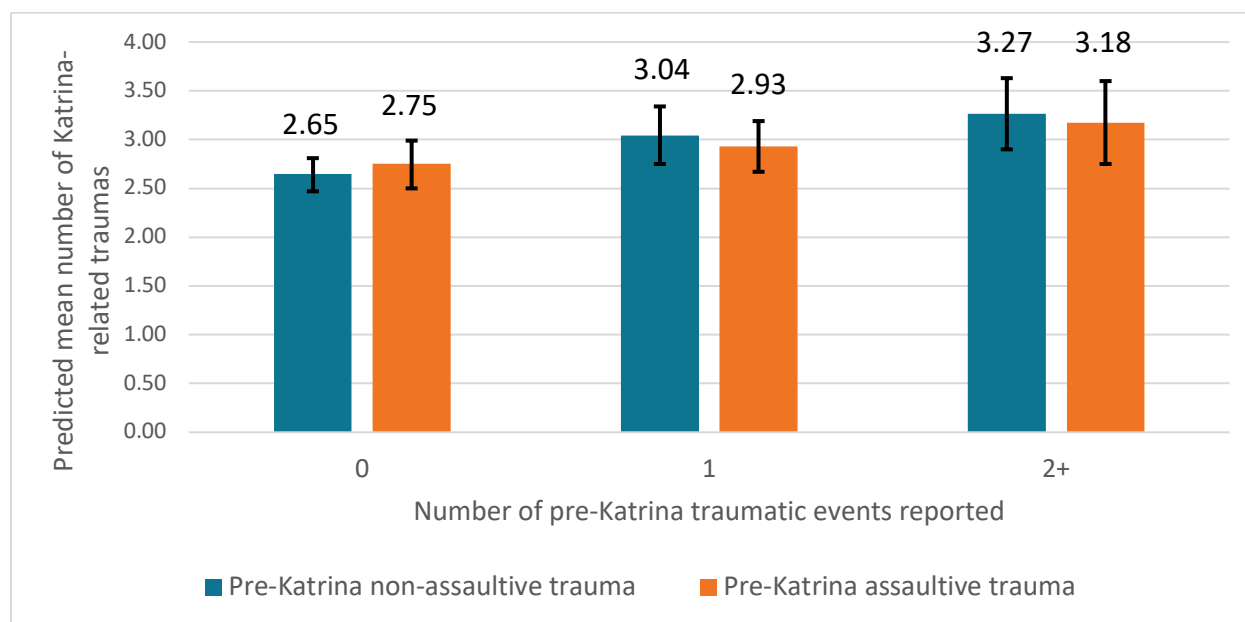
### 3.3.2. Predicted number of Katrina-related traumatic events by pre-Katrina trauma exposure

#### 3.3.2.1. All types of pre-Katrina trauma

**Table 3.2** shows the association of pre-Katrina traumatic events with predicted mean number of Katrina-related traumas. The means reported in this table were estimated using postestimation after running Poisson regression models. After adjustment for pre-Katrina sociodemographics, perceived social support, and psychological distress, participants who experienced any pre-Katrina traumatic events experienced 3.09 (95% CI=2.93, 3.25) Katrina-related traumas (out of a possible 8), compared to 2.55 (95% CI=2.34, 2.76) Katrina-related traumas experienced by participants who did not experience any pre-Katrina traumatic events, a difference of 0.54 (95% CI=0.49, 0.59). When number of pre-Katrina traumas was broken down further, a dose-response association was seen between the number of pre-Katrina traumatic events and number of Katrina-related traumas. On average, participants who reported one pre-Katrina trauma experienced 2.73 Katrina-related traumas (95% CI=2.38, 3.09), those who reported two pre-Katrina traumas experienced 3.07 Katrina-related traumas (95% CI=2.68, 3.45), and those who reported three or more pre-Katrina traumas experienced 3.42 Katrina-related traumas (95% CI=3.14, 3.70).

**Table 3.2.** Association of pre-Katrina traumatic events with predicted mean number of Katrina-related traumas

	<b>Any type of pre-Katrina trauma</b>	<b>Pre-Katrina assaultive trauma</b>	<b>Pre-Katrina non-assaultive trauma</b>		
	Adjusted Mean number of Katrina traumas (95% CI)	Adjusted Mean number of Katrina traumas (95% CI)	Adjusted Mean number of Katrina traumas (95% CI)		
<i>Experienced any pre-Katrina trauma</i>		<i>Experienced any pre-Katrina assaultive trauma</i>	<i>Experienced any pre-Katrina non-assaultive trauma</i>		
Yes	3.09 (2.93, 3.25)	Yes	3.05 (2.85, 3.26)	Yes	3.16 (2.92, 3.40)
No	2.55 (2.34, 2.76)	No	2.75 (2.50, 2.99)	No	2.64 (2.47, 2.81)
Difference	0.54 (0.49, 0.59)	Difference	0.30 (0.27, 0.35)	Difference	0.52 (0.45, 0.59)
<i>Number of pre-Katrina traumas</i>		<i>Number of pre-Katrina assaultive traumas</i>	<i>Number of pre-Katrina non-assaultive traumas</i>		
0	2.55 (2.34, 2.75)	0	2.75 (2.50, 2.99)	0	2.64 (2.47, 2.81)
1	2.73 (2.38, 3.09)	1	2.93 (2.67, 3.19)	1	3.04 (2.75, 3.34)
2	3.07 (2.68, 3.45)	2+	3.18 (2.75, 3.60)	2+	3.27 (2.90, 3.63)
3+	3.42 (3.14, 3.70)				



**Figure 3.1.** Predicted mean number of Katrina-related traumas by number and type of pre-Katrina traumatic events

### 3.3.2.2. *Pre-Katrina assaultive vs. non-assaultive trauma*

Predicted mean number of Katrina-related traumas by number and type of pre-Katrina traumatic event (i.e., assaultive vs. non-assaultive) is shown in **Figure 3.1**. After adjustment for pre-Katrina sociodemographics, perceived social support, psychological distress, and pre-Katrina exposure to non-assaultive trauma, participants who experienced one or more pre-Katrina assaultive traumatic events reported 3.05 (95% CI=2.85, 3.26) Katrina-related traumas (out of a possible 8) compared to 2.75 Katrina-related traumas (95% CI=2.50, 2.99) experienced by participants who did not experience any pre-Katrina assaultive traumatic events, a difference of 0.30 (95% CI=0.27, 0.35). Similar to the findings from the analyses that included all types of pre-Katrina traumatic events, a dose-response relationship was observed between the number of pre-Katrina assaultive traumatic events and number of Katrina-related traumas. On average, participants who reported one pre-Katrina assaultive traumatic event experienced 2.93 Katrina-related traumas (95% CI=2.67, 3.19), and those who reported two or more pre-Katrina assaultive traumatic events experienced 3.18 Katrina-related traumas (95% CI=2.75, 3.60).

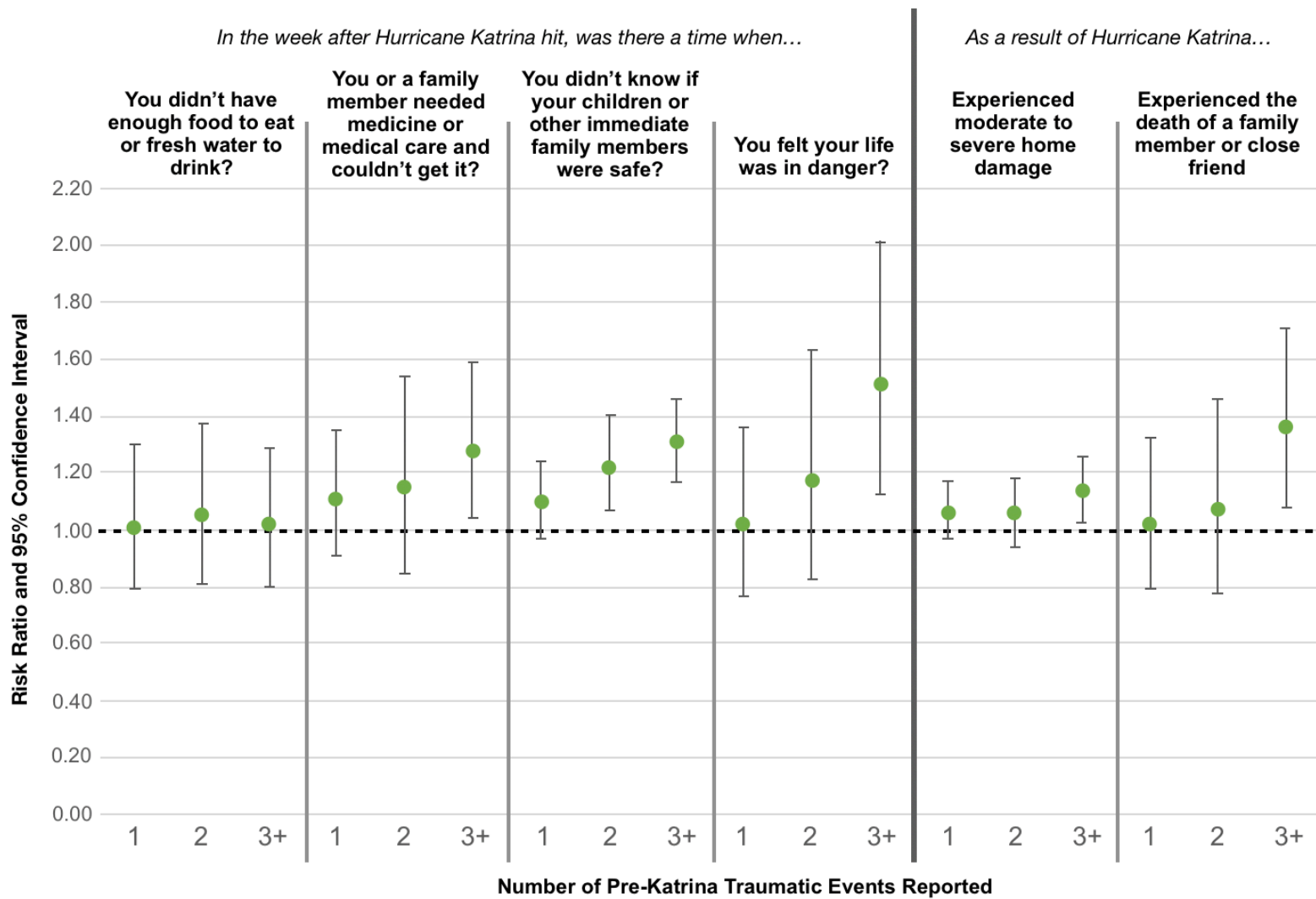
Counter to my hypothesis, the difference in predicted mean number of Katrina-related traumas between women who did and did not experience at least one pre-Katrina traumatic event was not larger for assaultive trauma than for non-assaultive trauma. Adjusting for pre-Katrina sociodemographics, perceived social support, psychological distress, and assaultive trauma exposure, women who reported experiencing one or more non-assaultive traumatic events prior to Hurricane Katrina experienced a mean of 3.16 Katrina-related traumas (95% CI=2.92, 3.40), compared to 2.64 Katrina-related traumas (95% CI=2.47, 2.81) on average for women with no pre-Katrina non-assaultive trauma exposure, a difference of 0.52 (95% CI=0.45, 0.59). There was also a dose-response association between the number of pre-Katrina non-assaultive

traumatic events reported and the predicted mean number of Katrina-related traumas experienced. Women who experienced one non-assaultive trauma before Hurricane Katrina experienced an average of 2.98 Katrina-related traumatic events (95% CI=2.72, 3.25) and women who experienced two or more pre-Katrina non-assaultive traumas experienced 3.42 Katrina-related traumas (95% CI=3.02, 3.82) .

### **3.3.3. Risk of specific Katrina-related traumatic events**

#### *3.3.3.1. All types of pre-Katrina trauma*

**Figure 3.2** shows risk ratios (RRs) and 95% confidence intervals (CIs) for various types of Katrina-related trauma as a function of number of pre-Katrina traumatic events. In the adjusted models, pre-Katrina trauma exposure was modestly associated with risk of lacking necessary medicine or medical care in the week after Hurricane Katrina (RR=1.19, 95% CI=1.00, 1.41), lacking knowledge regarding the safety of one's children or other immediate family members in the week after Katrina (RR=1.21, 95% CI=1.09, 1.33), feeling one's life was in danger in the week after Katrina (RR=1.25, 95% CI=0.99, 1.57), experiencing moderate to severe home damage as a result of Katrina (RR=1.09, 95% CI=1.01, 1.18), and experiencing the death of a family member or close friend due to Katrina (RR=1.17, 95% CI=1.17, 1.44). Experiencing one or more pre-Katrina traumatic event was not associated with risk of lacking sufficient food or fresh water in the week after Katrina (RR=1.02, 95% CI=0.84, 1.24).



**Figure 3.2.** Association of number of pre-Katrina traumatic events with types of Katrina-related trauma

Several types of Katrina-related traumas were associated with number of pre-Katrina traumatic events in a dose-response manner, with the risk of experiencing the Katrina-related traumatic event increasing with the number of pre-Katrina traumas reported. **Table 3.3** presents a summary of the regression results by number and type of pre-Katrina trauma. Full model results for adjusted models can be found in **Appendix A**. Compared to people who experienced no pre-Katrina traumatic events, the RR for lacking knowledge about the safety of one's children or other immediate family members in the week after Hurricane Katrina was 1.10 (95% CI=0.97, 1.24) for those who reported one pre-Katrina traumatic event, 1.22 (95% CI=1.07, 1.40) for those who reported two pre-Katrina traumas, and 1.31 (95% CI=1.17, 1.46) for those who reported three or more pre-Katrina traumas. The association between number of pre-Katrina traumatic events reported and risk of lacking necessary medicine or medical care in the week after Katrina was similar, with RRs of 1.11 (95% CI=0.91, 1.35), 1.15 (95% CI=0.85, 1.54), 1.28 (95% CI=1.04, 1.59) for people who reported 1, 2, or 3+ pre-Katrina traumatic events, respectively. The RR for feeling one's life was in danger in the week after Katrina was 1.02 (95% CI=0.77, 1.36) for people who experienced one pre-Katrina traumatic event, 1.17 (95% CI=0.83, 1.63) for those who experienced two pre-Katrina traumatic events, and 1.51 (95% CI=1.13, 2.01) for those who experienced three or more pre-Katrina traumas.

The risk of lacking sufficient food or fresh water in the week after Hurricane Katrina did not change significantly as the number of pre-Katrina traumatic events increased (1 pre-Katrina trauma: RR=1.01, 95% CI=0.79, 1.30; 2 pre-Katrina traumas: RR=1.05, 95% CI=0.81, 1.37; 3+ pre-Katrina traumas: RR=1.02, 95% CI=0.80, 1.29).

The RR for the association between exposure to pre-Katrina trauma and moderate to severe home damage due to Katrina was 1.06 for people who experienced one or two pre-Katrina

traumatic events (1 pre-Katrina trauma: 95% CI=0.97, 1.17; 2 pre-Katrina traumas: 95% CI=0.94, 1.18), and 1.14 for those who experienced three or more pre-Katrina traumas (95% CI=1.03, 1.26). Experiencing one or two pre-Katrina traumatic events was not associated with risk of experiencing the death of a family member or close friend due to Hurricane Katrina (1 pre-Katrina trauma: RR=1.02, 95% CI=0.79, 1.32; 2 pre-Katrina traumas: RR=1.07, 95% CI=0.78, 1.46), but exposure to three or more pre-Katrina traumatic events was associated with a 36% higher risk of losing a family member or friend as a result of Katrina (RR=1.36, 95% CI=1.08, 1.71).

**Table 3.3.** Summary of findings from adjusted models assessing the association of number and type of pre-Katrina trauma with Katrina-related traumatic events

% <i>with outcome</i>	<i>In the week after Hurricane Katrina hit, was there a time when...</i>				Experienced moderate to severe home damage due to Katrina (83.6%) RR (95% CI)	Lost a family member or close friend due to Katrina (39.1%) RR (95% CI)
	You didn't have enough food to eat or fresh water to drink? (42.1%)	You or a family member needed medicine or medical care but couldn't get it? (51.7%)	You didn't know if your children or other immediate family members were safe? (80.1%)	You felt your life was in danger? (34.3%)		
	RR (95% CI)	RR (95% CI)	RR (95% CI)	RR (95% CI)		
<b>Any type of pre-Katrina trauma<sup>1</sup></b>						
Experienced any pre-Katrina traumatic events						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	1.02 (0.84, 1.24)	1.19 (1.00, 1.41)	1.21 (1.09, 1.33)	1.25 (0.99, 1.57)	1.09 (1.01, 1.18)	1.17 (0.95, 1.44)
Number of pre-Katrina traumatic events reported						
0	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
1	1.01 (0.79, 1.30)	1.11 (0.91, 1.35)	1.10 (0.97, 1.24)	1.02 (0.77, 1.36)	1.06 (0.97, 1.17)	1.02 (0.79, 1.32)
2	1.05 (0.81, 1.37)	1.15 (0.85, 1.54)	1.22 (1.07, 1.40)	1.17 (0.83, 1.63)	1.06 (0.94, 1.18)	1.07 (0.78, 1.46)
3+	1.02 (0.80, 1.29)	1.28 (1.04, 1.59)	1.31 (1.17, 1.46)	1.51 (1.13, 2.01)	1.14 (1.03, 1.26)	1.36 (1.08, 1.71)
<b>Pre-Katrina assaultive trauma<sup>2</sup></b>						
Experienced any pre-Katrina assaultive traumatic events						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	1.04 (0.82, 1.31)	1.08 (0.89, 1.30)	1.12 (1.03, 1.22)	1.17 (0.93, 1.47)	1.06 (0.98, 1.15)	1.13 (0.92, 1.39)
Number of pre-Katrina assaultive traumatic events experienced						
0	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
1	1.05 (0.82, 1.34)	1.07 (0.88, 1.31)	1.07 (0.97, 1.17)	1.07 (0.83, 1.38)	1.05 (0.96, 1.14)	1.07 (0.84, 1.37)
2+	1.03 (0.74, 1.43)	1.04 (0.81, 1.35)	1.20 (1.07, 1.34)	1.25 (0.92, 1.71)	1.07 (0.97, 1.18)	1.18 (0.92, 1.52)
<b>Pre-Katrina non-assaultive trauma<sup>3</sup></b>						
Experienced any pre-Katrina non-assaultive traumatic events						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	1.00 (0.82, 1.22)	1.19 (1.03, 1.39)	1.14 (1.03, 1.26)	1.25 (1.02, 1.53)	1.07 (0.98, 1.16)	1.15 (0.93, 1.42)
Number of pre-Katrina non-assaultive traumatic events experienced						
0	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
1	1.01 (0.82, 1.25)	1.13 (0.96, 1.33)	1.13 (1.01, 1.25)	1.16 (0.91, 1.48)	1.05 (0.96, 1.15)	1.08 (0.84, 1.38)
2+	0.99 (0.76, 1.29)	1.29 (1.06, 1.57)	1.12 (1.00, 1.26)	1.31 (1.01, 1.68)	1.08 (0.97, 1.19)	1.21 (0.94, 1.56)

<sup>1</sup>Models adjusted for baseline age, race/ethnicity, partnership status, number of public benefits received, perceived social support, and psychological distress

<sup>2</sup>Models adjusted for baseline age, race/ethnicity, partnership status, number of public benefits received, perceived social support, psychological distress, and pre-Katrina non-assaultive trauma

<sup>3</sup>Models adjusted for baseline age, race/ethnicity, partnership status, number of public benefits received, perceived social support, psychological distress, and pre-Katrina assaultive trauma

### 3.3.2.2. *Pre-Katrina assaultive vs. non-assaultive trauma*

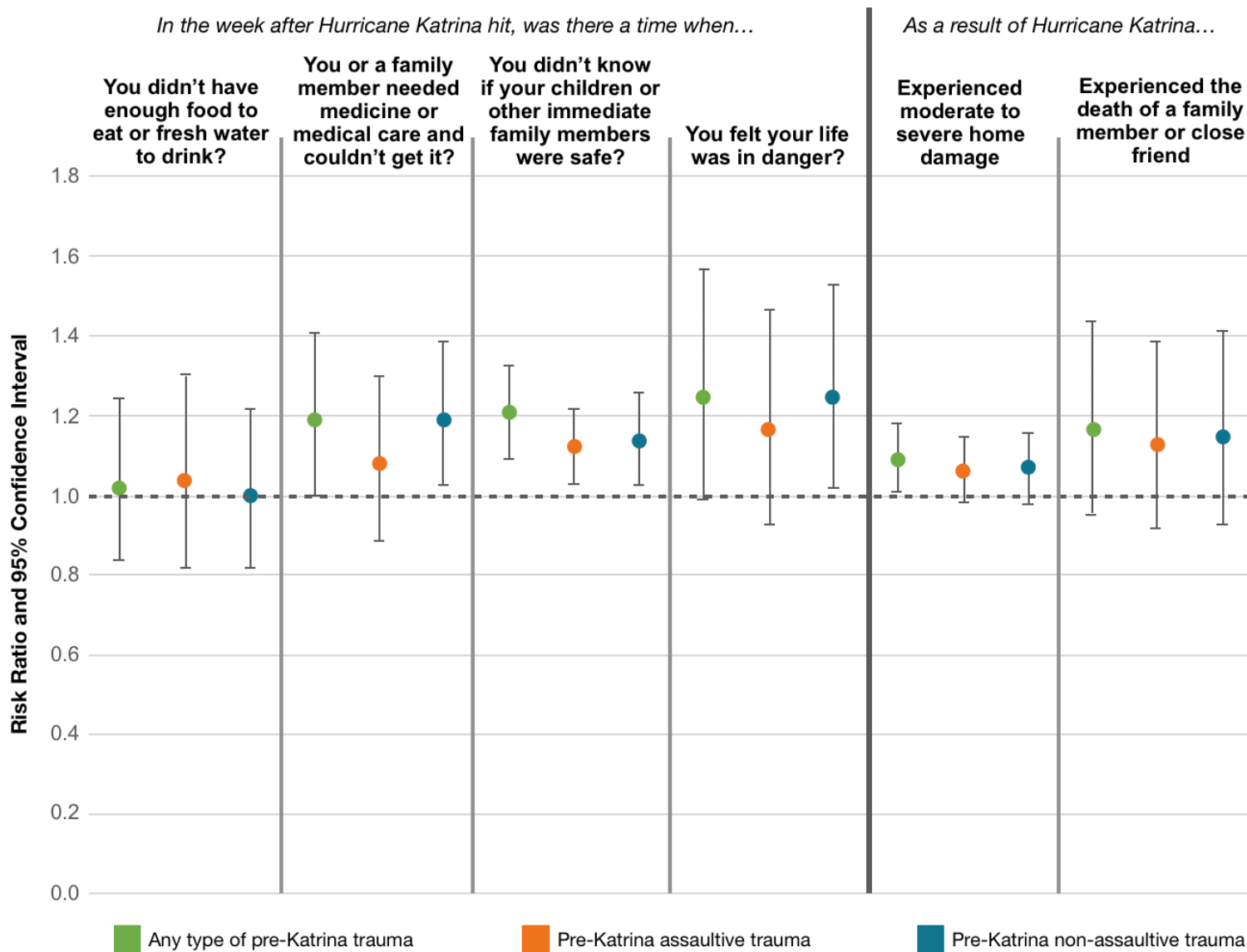
**Figure 3.3** shows the associations between various types of Katrina-related trauma and type of pre-Katrina trauma exposure. After adjusting for pre-Katrina non-assaultive trauma exposure, baseline sociodemographics, and baseline perceived social support and psychological distress, experiencing at least one assaultive traumatic event prior to Hurricane Katrina was modestly associated with several types of Katrina-related trauma. Women exposed to pre-Katrina assaultive traumas had a 12% higher risk of lacking knowledge regarding the safety of their children or other immediate family members in the week after Hurricane Katrina (RR=1.12, 95% CI=1.03, 1.22), a 17% higher risk of feeling their life was in danger in the week after Katrina (RR=1.17, 95% CI=0.93, 1.47), and a 13% higher risk of experiencing the death of a family member or close friend due to Hurricane Katrina (RR=1.13, 95% CI=0.92, 1.39). Weaker associations were found between pre-Katrina assaultive trauma exposure and lacking sufficient food or fresh water in the week after Hurricane Katrina (RR=1.04, 95% CI=0.82, 1.31), lacking necessary medicine or medical care in the week after Katrina (RR=1.08, 95% CI=0.89, 1.30), and experiencing moderate to severe home damage due to Hurricane Katrina (RR=1.06, 95% CI=0.98, 1.15).

In the adjusted models, experiencing at least one non-assaultive traumatic event prior to Hurricane Katrina was associated with similar increases in the risk of several types of Katrina-related trauma as assaultive traumatic events. Women exposed to pre-Katrina non-assaultive trauma had a 14% higher risk of lacking knowledge regarding the safety of their children or other immediate family members in the week after Hurricane Katrina (RR=1.14, 95% CI=1.03, 1.26), a 7% higher risk of experiencing moderate to severe home damage from Hurricane Katrina (RR=1.07, 95% CI=0.98, 1.16), and a 15% higher risk of experiencing the death of a family

member or close friend due to Hurricane Katrina (RR=1.15, 95% CI=0.93, 1.42), compared to women who did not experience any non-assaultive traumas before Hurricane Katrina. Pre-Katrina non-assaultive trauma exposure was not associated with lacking sufficient food or fresh water in the week after Hurricane Katrina (RR=1.00, 95% CI=0.82, 1.22).

Being unable to get necessary medicine or medical care and feeling that one's life was in danger in the week after Katrina were more strongly associated with pre-Katrina non-assaultive trauma exposure than assaultive trauma exposure. Experiencing at least one non-assaultive traumatic event was associated with a 19% higher risk of lacking necessary medicine or medical care (RR=1.19, 95% CI=1.03, 1.39) and a 25% higher risk of feeling one's life was in danger in the week after Hurricane Katrina (RR=1.25, 95% CI=1.02, 1.53). The only Katrina-related traumatic event that was more strongly associated with pre-Katrina assaultive trauma than non-assaultive trauma was lacking sufficient food or fresh water in the week after Katrina, although the RR for assaultive trauma was very small (RR=1.04, 95% CI=0.82, 1.31).

The associations between number of pre-Katrina assaultive and non-assaultive traumatic events and risk of various types of Katrina-related trauma are shown in **Table 3.3**. The risk of lacking sufficient food or fresh water in the week after Hurricane Katrina, lacking necessary medicine or medical care in the week after Katrina, and experiencing moderate to severe home damage due to Hurricane Katrina did not change significantly as the number of pre-Katrina assaultive traumas reported increased. Similarly, the risk of lacking food or fresh water or knowledge regarding the safety of one's children or other immediate family members in the week after Hurricane Katrina and experiencing moderate to severe home damage did not vary by the number of pre-Katrina non-assaultive traumatic events reported.



**Figure 3.3.** Association of type of pre-Katrina trauma with Katrina-related trauma

There was a dose-response relationship between the number of pre-Katrina assaultive traumatic events reported and risk of three types of Katrina-related trauma. For participants who experienced one pre-Katrina assaultive traumatic event, relative to those who experienced none, the RR for lacking knowledge about the safety of one's children or other immediate family members in the week after Katrina was 1.07 (95% CI=0.97, 1.17), and the RR for participants who experienced two or more pre-Katrina assaultive traumas was 1.20 (1.07, 1.34). The RR for feeling one's life was in danger in the week after Katrina was 1.07 (95% CI=0.83, 1.38) for women who experienced one pre-Katrina assaultive traumatic event and 1.25 (95% CI=1.02, 1.53) for those who experienced two or more pre-Katrina assaultive traumas. The RR for experiencing the death of a family member or close friend due to Hurricane Katrina was 1.07 (95% CI=0.84, 1.37) for women who experienced one pre-Katrina assaultive traumatic event and 1.18 (95% CI=0.92, 1.52) for those who experienced two or more pre-Katrina assaultive traumas.

There was also a dose-response relationship between the number of pre-Katrina non-assaultive traumatic events reported and risk of lacking necessary medicine or medical care in the week after Katrina, feeling one's life was in danger in the week after Katrina, and experiencing the death of a family member or close friend as a result of Hurricane Katrina. Relative to women who did not experience any non-assaultive traumatic events prior to Hurricane Katrina, the risk of lacking necessary medicine or medical care in the week after Katrina was 13% higher for women who experienced one pre-Katrina assaultive trauma (RR=1.13, 95% CI=0.96, 1.33), and 29% higher for women who reported two or more pre-Katrina non-assaultive traumas. The dose-response association was similar for risk of feeling one's life was in danger in the week after Hurricane Katrina, with an RR of 1.16 (95% CI=0.91, 1.48) for women who experienced one pre-Katrina non-assaultive traumatic event and an RR of

1.31 (95% CI=1.01, 1.68) for women who experienced two or more pre-Katrina non-assaultive traumas. Women who experienced one non-assaultive traumatic event prior to Hurricane Katrina had an 8% higher risk of experiencing the death of a family member or close friend due to Hurricane Katrina (RR=1.08, 95% CI=0.84, 1.38), compared to a 21% increase in risk for women who reported two or more pre-Katrina non-assaultive traumatic events (RR=1.21, 95% CI=0.94, 1.56).

### **3.4. DISCUSSION**

There were several important findings from the present study, which evaluated the extent to which traumatic events experienced prior to Hurricane Katrina predicted the number and type of Katrina-related traumas reported by a sample of low-income women who experienced Hurricane Katrina. First, I found that experiencing traumatic events prior to Hurricane Katrina was associated with greater Katrina-related trauma exposure. There was a dose-response relationship between the number of pre-Katrina traumatic events and degree of Katrina-related trauma exposure; women who experienced more traumatic events prior to Hurricane Katrina reported a greater number of Katrina-related traumas and had a greater risk for specific Katrina-related traumatic events, particularly feeling that their life was in danger in the week after Hurricane Katrina.

Additionally, compared to women who did not report any pre-Katrina traumas on the Life Events Checklist, women who reported at least one pre-Katrina traumatic event were more likely to feel their life was in danger in the week after Hurricane Katrina, lack knowledge regarding the safety of their children or other family members, be unable to get necessary medicine or medical

care in the week after Katrina, experience the death of a family member or friend due to Hurricane Katrina, and experience moderate to severe home damage as a result of the hurricane.

Of the six Katrina-related traumatic events assessed, pre-Katrina trauma exposure was most strongly associated with feeling one's life was in danger, which is influenced both by exposure to certain events during the hurricane and a subjective assessment of those events as threatening. This is consistent with previous research on non-disaster trauma showing that prior trauma can influence an individual's sensitivity to stress when presented with another stressful experience, such as a disaster, causing them to interpret the new stressor as more threatening [6,61–64]. This also aligns with the results of a study of people affected by multiple hurricanes, which found that people who had already experienced one hurricane were more likely to report extreme fear during a subsequent hurricane [4]. My results indicate that people with a history of trauma exposure prior to a disaster are more vulnerable to experiencing higher and more severe levels of disaster-related trauma. This is consistent with the literature on non-disaster trauma and with the scant literature on disaster-related trauma [4,28,48].

Based on previous research on non-disaster trauma, I hypothesized that pre-Katrina assaultive traumatic events (i.e., those involving interpersonal violence) would be more strongly associated with Katrina-related trauma than non-assaultive pre-Katrina traumatic experiences [10,44,45]. However, I found that pre-Katrina assaultive and non-assaultive trauma exposure predicted similar levels of Katrina-related trauma. Furthermore, non-assaultive pre-Katrina trauma was more strongly associated with risk for several specific Katrina-related traumatic events than assaultive trauma, including lacking necessary medical care and feeling one's life was in danger.

Although previous studies of non-disaster trauma found that experiencing a prior assaultive traumatic event was more strongly associated with subsequent trauma exposure than prior non-assaultive trauma [10,44,45], the findings from this study suggest that pre-disaster assaultive traumas are not more predictive of disaster-related traumatic experiences than non-assaultive pre-disaster traumas. Much of the existing research on the links between prior assaultive traumas and subsequent trauma exposure have focused on the extent to which a history of interpersonal violence or assaultive trauma is associated with risk for future interpersonal violence, whereas this study examined the association between assaultive trauma and risk of disaster-related trauma not involving interpersonal violence. This difference in type of dependent variable may partially explain why these findings differ from what has been reported in the non-disaster trauma literature. Disasters represent a unique set of events that may differ in important ways from interpersonal assaultive traumas [5], and some of the pathways linking disaster-related trauma with prior trauma exposure may differ from those linking prior and subsequent assaultive traumatic experiences.

This study is among the first to examine the association between prior trauma and degree of exposure to a natural disaster. A small number of studies have measured the correlation between pre-disaster traumatic events and disaster-related trauma exposure and found a positive correlation between the two variables [4,28,48]. This study builds on this small body of literature by adjusting for potential confounders of the relationship between pre-disaster trauma and disaster exposure and by assessing how prior traumatic experiences may be differentially associated with a range of disaster-related traumas. Notably, I was able to adjust for pre-Katrina psychological distress, which may affect individuals' perception and reporting of both Katrina

and pre-Katrina trauma. Greater negative affect has been shown to increase the likelihood of reporting adverse experiences [65–69].

This study has several limitations. First, a potential challenge in this study is the retrospective measurement of pre- and post-disaster trauma, which was assessed in Wave 4. Participants were asked whether they had ever experienced each event on the Life Events Checklist. Participants who indicated that they experienced a particular event were then asked whether it occurred before or after Hurricane Katrina, or both before and after Katrina. Because these experiences were retrospectively reported, they may be affected by recall bias. Participants may incorrectly report whether they experienced a given event before or after Hurricane Katrina. However, previous analyses of this sample found that many participants viewed Hurricane Katrina as a turning point, dividing their lives into “pre-Katrina” and “post-Katrina” eras [26]. Because this conceptualization and the severe disruption of Hurricane Katrina are likely to facilitate recall of the timing of these experiences, I do not expect that there was substantial misclassification of the temporality of pre- and post-disaster traumatic events. Second, while I was able to separately evaluate the effects of assaultive and non-assaultive pre-Katrina trauma on specific types of Katrina-related trauma, I was not able to assess which assaultive and non-assaultive events (i.e., intimate partner violence, prior life-threatening illness or injury) are most associated with Katrina-related trauma due to sample size. Future research should further parse out the types of pre-disaster trauma that confer the greatest risk of disaster-related trauma and how these associations operate. Finally, although the analytic sample is representative of the population that is most vulnerable to adverse post-disaster mental health outcomes [16,19], it is not representative of all Hurricane Katrina survivors and the findings may not be generalizable to survivors of other disasters.

Despite these limitations, this study represents an important step towards better understanding why some individuals are likely to experience more disaster-related traumatic events that make them more vulnerable to the mental health effects of disasters than others. Because the degree of disaster-related traumatic events experienced is one of the factors that most strongly predicts post-disaster mental health problems [16], these findings suggest that pre-disaster trauma exposure may partially explain differential psychological responses to disasters. A key priority for future work should be to develop interventions or disaster response strategies that address the increased risk of disaster-related trauma experienced by people with a history of trauma to reduce their disaster exposure and ultimately mitigate the significant mental health effects of disasters.

## **4. MANUSCRIPT 2: Predicting post-disaster PTSD symptom trajectories: The role of pre-disaster traumatic experiences**

### **4.1. BACKGROUND & AIMS**

Approximately 80% of Americans live in counties that experienced at least one weather-related natural disaster between 2007 and 2012, and this number is growing [70]. The population of disaster survivors will continue to grow as climate-related disasters increase in frequency and intensity as a result of climate change [2]. Therefore, it is vital to understand how disasters influence the health and well-being of the millions affected by them.

Exposure to disasters increases risk for post-traumatic stress disorder (PTSD), depression, non-specific psychological distress, and anxiety disorders [16]. The mental health effects of disasters are not equally distributed across survivors. Low household income, racial/ethnic minority status, and female gender are associated with increased vulnerability to adverse mental health outcomes following a disaster [16,19]. These populations also experience a greater burden of pre-disaster traumas, including childhood maltreatment and intimate partner violence, putting them at risk even before they are affected by a disaster [46,71].

The theory of stress sensitization suggests that the stress response systems of individuals exposed to early stressors are primed to respond to later stressors in ways that increase the risk of developing adverse mental health outcomes [21,22]. Repeated traumas have a cumulative effect on health, with increased trauma affecting mental health in a dose-response manner [9], wherein exposure to multiple traumatic events is associated with greater morbidity and impairment in individuals with PTSD [4,8]. As a result, disaster survivors previously exposed to non-disaster-

related traumatic events likely experience an excess risk of disaster-related psychological distress and functional impairment, the burden of which can persist for years [9].

Research on the long-term mental health effects of disasters has largely ignored the effect of other traumatic exposures that may exacerbate disaster-related mental health problems. For non-disaster traumas, a history of exposure to traumatic events has been linked to higher risk for adverse mental health outcomes after a subsequent trauma [5,17]. However, the role of pre-disaster trauma in shaping survivor mental health and recovery has not been comprehensively investigated. The vast majority of research on post-disaster mental health concentrates on experiences during and immediately after a disaster, overlooking potentially important factors that may predict long-term mental health problems, including pre-disaster traumatic experiences, such as earlier life physical or sexual assault. Because cases of PTSD in individuals exposed to multiple traumatic events are associated with greater impairment [9], studying these factors is particularly crucial to understand who is most at risk for PTSD and its impacts, and to mitigate long-term psychological distress among social groups disproportionately affected by trauma [7,8].

Research on post-disaster mental health has found that disaster survivors generally follow distinct trajectories of disaster-related PTSD symptoms. Four prototypical trajectories of dysfunction have been identified [19,72–75]. Many people do not experience persistent disaster-related PTSD symptoms [18]; these individuals either experience few or no PTSD symptoms at all in aftermath of a disaster, or initially experience high PTSD symptoms but these symptoms decline over time [72]. However, others experience a chronic or long-term burden of disaster-related PTSD [18]. For example, some disaster survivors initially experience few PTSD

symptoms, but these symptoms subsequently increase over time. Finally, some disaster survivors have moderate to severe symptoms that persist over time, resulting in chronic dysfunction.

It is not yet clear why some people cope well with trauma while others experience chronic dysfunction. Notably, the severity of disaster-related trauma appears to be only one of many factors that influence mental health in the aftermath of a disaster [19]. Given the variability in psychological responses to natural disasters, understanding who is likely to experience long-term disaster-related PTSD is crucial for allocating limited disaster recovery resources and informing interventions to build resilience. One such reason for variability in responses may be exposure to traumatic events earlier in the life course prior to the disaster.

This study evaluated the extent to which pre-disaster trauma predicts PTSD trajectories in a sample of Hurricane Katrina survivors followed for 12 years after the storm with three post-Katrina follow-up surveys. In each of the follow-up surveys, participants were asked about PTSD symptoms related to Hurricane Katrina. To examine the extent to which pre-Katrina traumatic experiences explain differences in long-term trajectories of Katrina-specific PTSD, I first used latent class growth analysis to identify PTSD trajectory groups based on patterns of Katrina-specific PTSD symptoms over time. After identifying trajectories, I then evaluated the extent to which pre-Katrina trauma exposure predicts the trajectory of Katrina-specific PTSD symptoms an individual will follow. I also examined whether this potential association operates independently of the severity of Katrina-related trauma, which may itself be influenced by pre-Katrina trauma.

*Primary aim:* Evaluate the extent to which pre-Katrina traumatic experiences explain differences in long-term trajectories of Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma.

Hypothesis: Experiencing greater pre-Katrina trauma will be associated with increased risk of chronic Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma.

*Secondary aim*: Characterize the relationship between Katrina-specific PTSD trajectories and Katrina-related, post-Katrina, and cumulative trauma exposure to explore how traumatic events at different points in the life course may impact long-term disaster-related PTSD symptoms.

## **4.2. METHODS**

### **4.2.1. Data**

This paper leveraged survey data from the Resilience in Survivors of Katrina (RISK) study, a longitudinal study of low-income women who lived in New Orleans at the time of Hurricane Katrina [26]. The RISK sample was drawn from the Opening Doors Demonstration, a randomized-design program designed to increase community college graduation rates and academic achievement among low-income adults with children under age 18. Between November 2003 and June 2005, Opening Doors enrolled 1,019 low-income parents when they registered for classes at one of two community colleges in the New Orleans area, Delgado Community College and Louisiana Technical College-West Jefferson. At enrollment, participants were randomized to a control or intervention group, where those in the intervention group received a small scholarship for maintaining passing grades and mentorship intended to promote academic success. All participants completed a baseline questionnaire about their educational background and goals, employment history, and sociodemographic characteristics. They also completed a short baseline survey about their physical and mental health, attitudes about schooling, and social relationships.

After Hurricane Katrina disrupted data collection for the Opening Doors 12-month follow-up survey in August 2005, the study was redesigned as RISK to examine the consequences of a disaster on the lives of vulnerable individuals and their families. To qualify for Opening Doors, participants needed to be enrolled in community college, be between the ages of 18 and 34, have at least one child under age 18, and earn less than 200% of the poverty line at baseline. Of the 1,019 original participants, 92% were women. Because so few men were enrolled, these 77 men were excluded from these analyses, leaving a sample of 942 women. At baseline (2003-2005), these 942 women had a mean age of 25.2 years and had 1.8 children on average. Reflecting the sociodemographics of low-income community college students living in New Orleans in 2003, 86% of the participants are Black and 72% received some form of public assistance at baseline [26].

In addition to the pre-Katrina Wave 1 data collected in 2003-2005, the RISK study conducted three post-Katrina follow-up surveys one, four, and 12 years after the hurricane: Wave 2 was collected in 2006-2007 (response rate: 70% of original sample; n=667), Wave 3 was collected in 2009-2010 (response rate: 75% of original sample; n=702), and Wave 4 was collected in 2016-2018 (response rate: 76% of original sample; n=715). Each of the follow-up surveys included questions pertaining to experiences during and after Hurricane Katrina, health resources and outcomes, social networks and support, and economic resources. The current analysis was limited to women who completed at least two of the three post-Katrina PTSD assessments; 728 of the 942 women in the baseline sample (77%) met these criteria.

## 4.2.2. Measures

### 4.2.2.1. Outcome

Katrina-specific PTSD: Katrina-specific PTSD symptoms were assessed at all post-Katrina timepoints (Waves 2-4) using the Impact of Event Scale-Revised (IES-R), a 22-item scale that evaluates subjective distress related to a specific traumatic event, in this case, Hurricane Katrina [76]. Participants were asked to rate the degree to which they were distressed by hurricane-related difficulties in the past 7 days (e.g., “I stayed away from reminders of it,” “I was jumpy and easily startled”). For each item, respondents indicated whether they were distressed or bothered by this issue “not at all” (0), “a little” (1), “moderately” (2), “quite a bit” (3), or “extremely” (4). A PTSD score ranging from 0-4 was constructed as the mean of all items [68]. Higher scores indicate more severe post-traumatic stress symptoms, and scores above 1.5 are indicative of probable PTSD [77].

### 4.2.2.2. Primary exposure

Pre- and post-Katrina traumatic experiences: Pre-and post-disaster traumatic experiences, unrelated to Hurricane Katrina, were measured retrospectively in the third post-Katrina survey (Wave 4) using an adapted version of the Life Events Checklist (LEC) [49]. The LEC asks respondents to indicate whether they experienced each of 15 potentially traumatic events. These events are: 1) technological disaster, 2) act of mass violence, 3) exposure to combat or a war zone, 4) life-threatening illness or injury of someone close to you, 5) sudden unexpected death of someone close to you, 6) sudden unexpected death of your child, 7) witnessed someone being seriously injured or killed, 8) robbed or mugged, 9) physically hurt by parent or caregiver, 10) physically hurt by spouse or partner, 11) physically hurt by someone else, 12) raped or sexually assaulted, 13) experienced a life-threatening illness, 14) experienced any other situation in which

you were seriously injured or feared that you would be seriously injured or killed, and 15) a natural disaster other than Hurricane Katrina. Participants who responded “yes” to an item were asked whether they experienced this event before, after, or both before and after Hurricane Katrina, with the exception that item 15 only asked about natural disasters that occurred after Hurricane Katrina. For each event, two binary variables (yes/no) were created, with one indicating that the participant experienced this event prior to Hurricane Katrina and the other indicating that they experienced it after Hurricane Katrina.

Affirmative responses were summed to create indices of pre- and post-disaster trauma exposure. Because assaultive traumas are more consistently associated with PTSD and risk for additional future traumatic experiences than non-assaultive traumas [10,44,50–52], the five events related to personal experiences of assaultive violence (items 8-12 in the list of LEC items) were summed to create counts of pre- and post-disaster assaultive traumas for separate sub-analyses of assaultive trauma. An index of non-assaultive traumas (items 1-7 and 13-15) was also created. A cumulative trauma score was created by summing the number of pre-Katrina, post-Katrina, and Katrina-related traumatic events reported, including moderate to severe home damage and death of a family member or close friend due to Hurricane Katrina. To address any non-linearity and to examine the impact of varying levels of trauma on PTSD trajectory in the predictive analyses, the counts of pre- and post-Katrina, and cumulative traumas were also divided into quartiles.

#### *4.2.2.3. Covariates*

Pre-Katrina sociodemographics: Sociodemographic covariates were included based on prior research showing their association with levels of trauma exposure in general as well as disaster-related trauma [16]. These covariates are age in years, race, a binary variable indicating whether

a participant was married or cohabitating with a partner, and a count of public benefits received (i.e., social security income, unemployment, welfare, and/or food stamps). All four sociodemographic covariates were measured at baseline (Wave 1).

Indicators of Katrina-related trauma and hardship: In line with previous research using this dataset [53,55,78], several measures of Hurricane Katrina-related trauma and hardship were used in these analyses. All of these measures were asked in the first post-Katrina follow-up survey (Wave 2). I adjusted for Katrina-related trauma in these analyses to examine the extent to which pre-Katrina traumatic experiences predict PTSD trajectory group among participants who experienced similar levels of Katrina-related trauma.

*Hurricane traumas:* An eight-item trauma scale based on a survey of Hurricane Katrina survivors [56] asked respondents to answer “yes” or “no” to the following questions about their experiences in the week after Katrina: 1) lacked enough fresh water to drink, 2) lacked enough food to eat, 3) felt one's life was in danger, 4) lacked necessary medicine, 5) lacked necessary medical care, 6) family member lacked necessary medical care, 7) lacked knowledge of safety of children, or 8) lacked knowledge about safety of other family members. Responses were summed to create scores ranging from 0-8. To address possible non-linearity, the count of hurricane traumas was also examined in quartiles.

*Katrina-related bereavement:* Participants were asked whether a family member or close friend died as a result of Hurricane Katrina. Participants who indicated the loss of a family member or friend were coded as 1 (yes) and those who did not were coded as 0 (no).

*Katrina-related home damage:* Participants were asked to describe the extent of the damage caused by Hurricane Katrina to the home where they were living when Katrina struck. Answer options included “none” (0), “minimal” (1), “moderate” (2), “substantial” (3), and

“enormous” (4). In line with previous studies using this dataset [53,55,78], home damage was dichotomized by collapsing the bottom two (none or minimal, coded as 0) and top three categories (moderate, substantial, or enormous, coded as 1), creating a variable that indicates whether a participant experienced moderate to severe home damage.

Pre-Katrina perceived social support: Pre-Katrina perceived social support was measured at baseline using the Social Provisions Scale [57]. This scale is comprised of eight items, such as “there are people I know will help me if I really need it.” Participants indicated the degree to which they agreed or disagreed with each statement. Answer options were “strongly disagree” (1), “disagree” (2), “agree” (3), and “strongly agree” (4). After reverse coding negatively phrased items, total scores were calculated by taking the mean of all items. Scores range from 1-4, with higher scores indicating greater perceived social support.

Pre-Katrina psychological distress: Non-specific psychological distress was measured at baseline using the Kessler-6 (K6) scale, a self-report measure used to assess anxiety and mood disorders [58,59]. This scale is comprised of six items that ask, “in the past 30 days, how often did you feel...”: 1) nervous, 2) hopeless, 3) restless or fidgety, 4) so sad or depressed that nothing could cheer you up, 5) that everything was an effort, and 6) worthless. Answer choices were “none of the time” (0), “a little of the time” (1), “some of the time” (2), “most of the time” (3), and “all of the time” (4). Responses to the six items were summed to construct scores ranging from 0-24 [59].

#### **4.2.3. Analysis**

The analytic sample was restricted to participants who completed the PTSD scale in at least two of the three post-Katrina surveys (n=728; 77.3% of the original sample). Data analysis consisted of three steps. All analyses were conducted in Stata 15.1 (Stata Corp, College Station,

TX). First, descriptive statistics were computed for the 728 participants in the analytic sample. T-tests and chi-square tests were used to assess differences between the participants included in these analyses and the participants who are excluded because they completed fewer than two post-Katrina measures of Katrina-specific PTSD symptoms.

The “three-step approach” was used to examine relationships between predictor variables and trajectory group membership (e.g., the extent to which pre-Katrina trauma predicts trajectory group membership) [79]. Step 1 involved fitting a series of models with a varying number of latent classes, and then choosing the best fitting model. To do this, latent class growth analysis (LCGA) was conducted to identify trajectory groups based on patterns of PTSD symptoms reported on the three post-Katrina data collection timepoints. LCGA creates groups of individuals who have similar patterns of PTSD symptoms over time. Further analyses can then examine predictors of membership in each of these trajectory groups [80,81]. Models were run with 1 to 10 classes (trajectories), using the *traj* command in Stata [82]. In these models, Time 1 was anchored at 1, Time 2 at 4, and Time 3 at 12, representing the number of years post-disaster when each outcome measurement (PTSD score) was taken.

To identify the model that best fit the data, I compared Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and mean posterior probabilities [80,83]. For AIC and BIC, lower values indicate better fit. For mean posterior probabilities, higher values indicate better fit; for a well-fitting model, the average posterior probability value should be >0.7 for each subgroup [83]. I also considered theoretical criteria, such as parsimony, clinical significance, and interpretability, when choosing the model that best represented the data. After the final trajectories were identified, descriptive statistics were calculated on the distribution of predictor variables across the subsamples of participants in each trajectory group.

Step 2 involved assigning individuals to their most likely trajectory group using the predicted posterior probabilities of belonging to each group. These classifications were then included as outcomes in multinomial logistic regression models where the probability of belonging to each trajectory group depended on predictor variables (Step 3) [84]. Postestimation using the *margins* command in Stata was used to calculate predicted probabilities of being in a given PTSD trajectory based on predictor variables. Missing data on PTSD symptoms was estimated using maximum likelihood in the LCGA models. Missing data on predictors was imputed using chained multiple imputation in Stata 15.1.

To assess relationships between predictors and trajectory membership (Step 3), I ran a series of models, beginning with the crude model that included only pre-Katrina traumatic experiences as a predictor of PTSD trajectory. Subsequent models added baseline sociodemographic characteristics (age, race, relationship status, and number of public benefits received), indicators of Katrina-related trauma and hardship (e.g., home damage), as well as pre-Katrina social support and psychological distress [53,78]. The table below lists the variables included in Models 1-5 assessing the relationship between pre-Katrina trauma and PTSD trajectory.

<b>Model #</b>	<b>Variables included in model</b>
1 (Crude)	Pre-Katrina trauma
2	Pre-Katrina trauma + pre-Katrina sociodemographics
3	Pre-Katrina trauma + pre-Katrina sociodemographics + pre-Katrina social support + pre-Katrina psychological distress
4	Pre-Katrina trauma + pre-Katrina sociodemographics + pre-Katrina social support + pre-Katrina psychological distress + Katrina-related trauma
5 (Fully adjusted)	Pre-Katrina trauma + pre-Katrina sociodemographics + pre-Katrina social support + pre-Katrina psychological distress + Katrina-related trauma + post-Katrina trauma

Pre-Katrina social support and psychological distress may operate as either confounders or mediators of the association between pre-Katrina trauma and Katrina-related trauma, depending on their timing relative to pre-Katrina trauma, which is not known. Therefore, I ran models with and without these two covariates. I then ran additional models that added post-Katrina traumatic experiences as a predictor of PTSD trajectory because experiencing post-Katrina trauma may hinder recovery, leading to more persistent Katrina-specific PTSD symptoms. Finally, I adjusted for severity of Katrina-related trauma to estimate the controlled direct effect of pre-Katrina trauma on Katrina-specific PTSD that operates through pathways other than Katrina-related trauma. These models rely on several assumptions including that I can control for exposure-outcome confounding and mediator-outcome confounding, and that there is no exposure-mediator interaction [85,86]. Assumptions were examined where possible (e.g., no exposure-mediator interactions), and I found that these assumptions were met.

## **4.3. RESULTS**

### **4.3.1. Descriptive statistics**

**Table 4.1** shows descriptive statistics for the 728 women in the analytic sample. At baseline, the average participant was age was 25.14 years (SD=4.46) and 23.7% of participants were married or cohabitating with a partner. The majority of participants identified as non-Hispanic Black (86.1%), 9.2% identified as non-Hispanic White, 2.8% identified as Hispanic, and 1.8% identified as another race or ethnicity. Using the validated K6 score cut points [58], prior to Hurricane Katrina, 17.9% of participants had probable mild to moderate mental illness and 5.9% had probable serious mental illness. Using the validated IES-R cut point [77], at Time 1 (one year post-Katrina), 48.1% of the sample met the criteria for probable Katrina-specific

PTSD. At Time 2 (four years post-Katrina), 35.8% of participants had probable Katrina-specific PTSD, and at Time 3 (12 years post-Katrina), 18.7% had probable Katrina-specific PTSD.

**Table 4.1.** Descriptive statistics for analytic sample (n=728)

	<b>Mean (SD) or %</b>
<b>Baseline sociodemographics</b>	
Age (years)	25.14 (4.46)
Non-Hispanic Black	86.1%
Married or cohabitating	23.7%
Number of public benefits received (range: 0-4)	0.94 (0.71)
<b>Pre-Katrina perceived social support</b> (range: 1-4)	3.20 (0.44)
<b>Pre-Katrina psychological distress</b> (range: 0-24)	4.97 (4.18)
<b>Cumulative trauma exposure (count of pre-Katrina, Katrina-related and post Katrina traumatic events)</b>	8.44 (4.69)
<b>Pre-Katrina trauma exposure</b>	
Experienced any pre-Katrina trauma	61.3%
Number of pre-Katrina traumas experienced (range: 0-14)	1.66 (1.98)
Experienced any pre-Katrina assaultive traumas	43.8%
Number of pre-Katrina assaultive traumas experienced (range: 0-5)	0.80 (1.12)
Experienced any pre-Katrina non-assaultive traumas	47.1%
Number of pre-Katrina non-assaultive traumas experienced (range: 0-9)	0.87 (1.20)
<b>Katrina-related trauma and hardship</b>	
Number of Katrina-related traumas (range: 0-8)	3.00 (2.29)
Family member or friend died due to Katrina	39.3%
Moderate or severe home damage due to Katrina	83.4%
<b>Post-Katrina trauma exposure</b>	
Experienced any post-Katrina trauma	87.4%
Number of post-Katrina traumas experienced (range: 0-15)	2.60 (1.99)
Experienced any post-Katrina assaultive traumas	28.3%
Number of post-Katrina assaultive traumas experienced (range: 0-5)	0.40 (0.73)
Experienced any post-Katrina non-assaultive traumas	85.4%
Number of post-Katrina non-assaultive traumas experienced (range: 0-10)	2.20 (1.61)
<b>Katrina-specific post-traumatic stress disorder (PTSD)</b>	
Time 1 (one year post-Katrina)	48.1%
Time 2 (four years post-Katrina)	35.8%
Time 3 (12 years post-Katrina)	18.7%

Study participants experienced a high level of trauma exposure before, during, and after Hurricane Katrina. Overall, 61.3% of participants experienced at least one traumatic event prior

to Hurricane Katrina, with a mean of 1.66 pre-Katrina traumatic experiences (SD=1.98). Nearly 90% experienced at least one post-Katrina traumatic event (mean number of post-Katrina traumas=2.60, SD=1.99). A larger proportion of the sample experienced one or more assaultive traumas before Katrina (43.8%), compared to after Katrina (28.3%). On average, women reported experiencing 3.00 Katrina-related traumas on the 8-item hurricane trauma scale (SD=2.29). Nearly 40% of participants experienced the death of a family member or friend due to Katrina and 83.4% had moderate to severe home damage as a result of Hurricane Katrina.

#### **4.3.2. Latent class growth analysis**

**Tables 4.2 and 4.3** show the results of the latent class growth analysis models. Based on the model fit criteria shown in **Table 4.2**, the four-class model was chosen as the model that best represented the data. This model was selected because it had the lowest BIC value, an average posterior probability >0.7, and because the trajectories in the four-class model were distinctive and clinically meaningful. AIC was slightly lower for the five-class model (-2493.54), but the five-trajectory plot showed that two of the five trajectories were very similar in shape, with both characterized as having relatively low PTSD symptoms at Time 1 and decreasing slightly over time. Therefore, I determined that these trajectories were not distinct from each other and did not differ in clinical significance. Although alignment with previous findings was not used to select the best fitting model, the trajectories identified by the four-class model roughly correspond to the four “prototypical” PTSD trajectories [19,72–75].

**Table 4.2.** Fit statistics for the LCGA models  
(model selected as best representation of the data is bolded)

Number of Classes	AIC	BIC	Adj. BIC	Entropy	Mean posterior probability (SD)
1	-2662.18	-2669.07	-2670.51	--	--
2	-2528.34	-2542.11	-2545.00	0.690	0.91 (0.04)
3	-2516.81	-2537.46	-2541.79	0.601	0.80 (0.10)
<b>4</b>	<b>-2494.79</b>	<b>-2522.34</b>	<b>-2528.11</b>	<b>0.634</b>	<b>0.79 (0.06)</b>
5	-2493.54	-2527.97	-2535.18	0.555	0.70 (0.08)
6	-2496.54	-2537.85	-2546.51	0.475	0.51 (0.29)
7	-2499.54	-2547.74	-2557.84	0.398	0.35 (0.30)
8	-2502.54	-2557.62	-2569.17	0.375	0.32 (0.31)
9	-2505.54	-2567.51	-2580.49	0.346	0.27 (0.29)
10	-2504.06	-2572.92	-2587.35	0.379	0.30 (0.33)

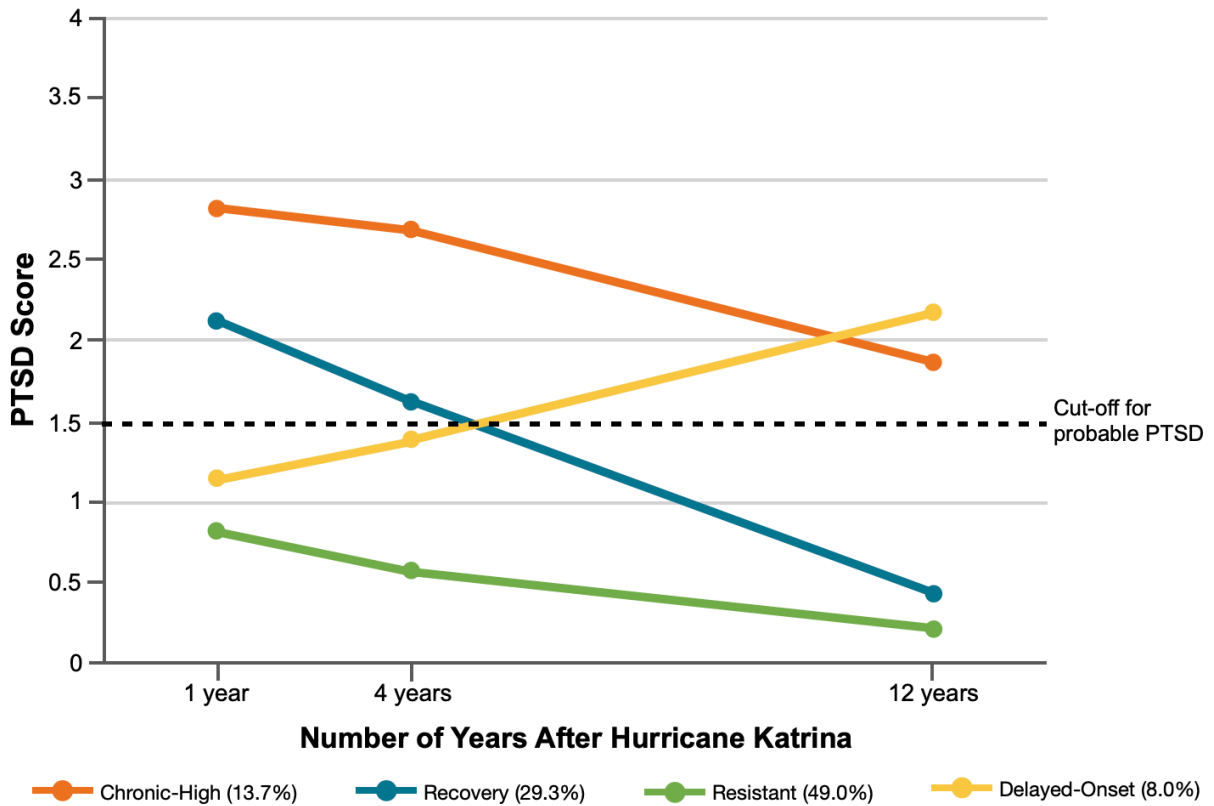
**Table 4.3.** Percentage of participants in each class

Number of Classes	1	2	3	4	5	6	7	8	9	10
1	100.0%									
2	71.8%	28.2%								
3	59.8%	22.3%	17.9%							
4	49.0%	8.0%	29.3%	13.7%						
5	32.5%	33.3%	7.8%	13.3%	13.2%					
6	15.5%	7.8%	17.0%	33.3%	13.3%	13.2%				
7	15.4%	7.8%	17.1%	16.1%	17.2%	13.3%	13.2%			
8	12.5%	7.8%	10.8%	9.2%	15.4%	17.8%	13.3%	13.2%		
9	11.5%	7.8%	11.7%	9.3%	10.9%	11.7%	10.6%	13.3%	13.2%	
10	8.6%	9.6%	8.0%	13.7%	10.7%	12.2%	9.5%	12.6%	13.8%	1.3%

The four final trajectories are shown in **Figure 4.1**. The Resistant trajectory, which encompasses 49.0% of participants, is characterized by low initial Katrina-specific PTSD symptoms that remain low over time. Nearly a third (29.3%) of participants were in a Recovery trajectory in which PTSD symptoms were initially high before decreasing over time.

Approximately 8% of participants were in a Delayed-Onset trajectory characterized by PTSD symptoms that were initially low before increasing over time to cross the cut-off for probable PTSD. The final trajectory, Chronic-High, was the most severe of the four PTSD trajectories I identified. Participants in this trajectory (13.7%) experienced high PTSD symptoms at all three

of the post-Katrina timepoints, with IES-R scores that surpassed the threshold for probable PTSD across the 12-year follow-up period.



**Figure 4.1.** Post-traumatic stress disorder (PTSD) score trajectories from the four-class model

### 4.3.3. Descriptive statistics for trajectory groups

**Table 4.4** shows descriptive statistics for the four subsamples with most likely membership in each trajectory. Prior to Hurricane Katrina, women in the Resistant trajectory, the least severe of the four PTSD trajectories identified, had lower psychological distress scores than women in the Recovery, Delayed-Onset, and Chronic-High trajectories. These women also received fewer public benefits at baseline and were more likely to be married or cohabitating with a partner, less likely to identify as non-Hispanic Black, and had slightly higher perceived social support. This suggests that women in the Resistant trajectory may have had more

advantages prior to Hurricane Katrina than women in the other three trajectory groups, both socioeconomically and in terms of resources such as social support. Other trajectories were similar on sociodemographics

**Table 4.4.** Descriptive statistics for participants with most likely membership in each PTSD symptom trajectory

	<i>Trajectory Group</i>			
	<b>Resistant</b>	<b>Recovery</b>	<b>Delayed-Onset</b>	<b>Chronic-High</b>
	(n=357, 49.0%)	(n=213, 29.3%)	(n=58, 8.0%)	(n=100, 13.7%)
	Mean (SD) or %	Mean (SD) or %	Mean (SD) or %	Mean (SD) or %
<b>Baseline sociodemographics</b>				
Age (years)	24.58 (4.18)	25.54 (4.70)	26.03 (5.05)	26.35 (4.24)
Non-Hispanic Black	80.2%	91.0%	92.7%	92.8%
Married or cohabitating	26.3%	20.2%	22.8%	22.2%
Number of public benefits received (range: 0-4)	0.86 (0.74)	0.99 (0.70)	0.97 (0.59)	1.09 (0.70)
<b>Pre-Katrina perceived social support</b> (range: 1-4)	3.27 (0.42)	3.15 (0.47)	3.17 (0.41)	3.09 (0.45)
<b>Pre-Katrina psychological distress</b> (range: 0-24)	4.31 (3.70)	5.53 (4.34)	5.32 (4.62)	5.92 (4.82)
<b>Cumulative trauma exposure (count of pre-Katrina, Katrina-related and post Katrina traumatic events)</b>	6.82 (3.88)	8.88 (4.14)	10.22 (5.33)	11.85 (5.36)
<b>Pre-Katrina trauma exposure</b>				
Experienced any pre-Katrina trauma	58.2%	59.6%	70.2%	69.2%
Number of pre-Katrina traumas experienced (range: 0-14)	1.45 (1.82)	1.47 (1.61)	2.04 (2.05)	2.52 (2.75)
Experienced any pre-Katrina assaultive traumas	39.9%	42.7%	56.1%	51.1%
Number of pre-Katrina assaultive traumas experienced (range: 0-5)	0.67 (0.99)	0.71 (1.01)	1.09 (1.24)	1.18 (1.50)
Experienced any pre-Katrina non-assaultive traumas	44.1%	46.5%	52.6%	55.0%
Number of pre-Katrina non-assaultive traumas experienced (range: 0-9)	0.77 (1.15)	0.77 (1.01)	0.95 (1.12)	1.33 (1.59)
<b>Katrina-related trauma and hardship</b>				
Number of Katrina-related traumas (range: 0-8)	2.27 (1.93)	3.41 (2.32)	3.46 (2.29)	4.46 (2.44)
Family member or friend died due to Katrina	26.1%	50.2%	35.1%	65.0%
Moderate or severe home damage due to Katrina	78.3%	89.1%	77.4%	92.7%
<b>Post-Katrina trauma exposure</b>				
Experienced any post-Katrina trauma	86.2%	86.9%	93.0%	89.0%
Number of post-Katrina traumas experienced (range: 0-15)	2.19 (1.66)	2.66 (1.94)	3.28 (2.10)	3.45 (2.55)
Experienced any post-Katrina assaultive traumas	21.6%	31.9%	40.4%	35.9%
Number of post-Katrina assaultive traumas experienced (range: 0-5)	0.26 (0.55)	0.43 (0.76)	0.60 (0.84)	0.64 (0.98)
Experienced any post-Katrina non-assaultive traumas	83.9%	84.2%	93.00%	87.9%
Number of post-Katrina non-assaultive traumas experienced (range: 0-10)	1.92 (1.45)	2.21 (1.59)	2.68 (1.61)	2.80 (1.92)

<b>Katrina-specific post-traumatic stress disorder (PTSD)</b>				
Time 1 (one year post-Katrina)	0.82 (0.59)	2.12 (0.64)	1.14 (0.59)	2.82 (0.53)
Time 2 (four years post-Katrina)	0.57 (0.52)	1.61 (0.68)	1.39 (0.76)	2.69 (0.62)
Time 3 (12 years post-Katrina)	0.21 (0.34)	0.43 (0.46)	2.17 (0.60)	1.87 (0.76)

Traumatic events before, during, and after Katrina varied across trajectory groups. Pre-Katrina trauma exposure was highest among women in the Delayed-Onset (70.2% reported at least one pre-Katrina trauma) and Chronic-High trajectories (69.2% had at least one pre-Katrina trauma), compared to 59.6% in the Recovery group and 58.2% in the Resistant group. Katrina-related trauma and hardship showed a slightly different pattern, with women in the Recovery and Chronic-High trajectories experiencing the greatest level of Katrina trauma. The difference in the proportion of participants who experienced moderate to severe home damage or the death of a family member or close friend due to Katrina was particularly noteworthy; 89.1% of women in the Recovery trajectory and 92.7% in the Chronic-High trajectory experienced moderate to severe home damage compared to 78.3% and 77.4% in the Resistant and Delayed-Onset trajectories, respectively. Among women with most likely membership in the Chronic-High trajectory, 65.0% lost a family member or close friend due to Katrina, as did 50.2% of women in the Recovery trajectory. In contrast, 26.1% of women in the Resistant trajectory and 35.1% in the Delayed-Onset trajectory experienced the death of a family member or friend. Women with most likely membership in the Delayed-Onset and Chronic-High trajectories experienced the greatest number of post-Katrina traumatic events. Those in the Delayed-Onset trajectory reported 3.28 post-Katrina traumas on average ( $SD=2.10$ ), and women in the Chronic-High trajectory reported an average of 3.45 ( $SD=2.55$ ) post-Katrina traumas. Women in the Resistant and Recovery trajectories reported means of 2.19 ( $SD=1.66$ ) and 2.66 ( $SD=1.94$ ) post-Katrina traumas, respectively.

Cumulative trauma score increased in tandem with severity of PTSD trajectory. In the Resistant trajectory, in which PTSD symptoms remained low across time, women experienced an average of 6.82 traumas ( $SD=3.88$ ). In the Recovery, Delayed-Onset, and Chronic-High

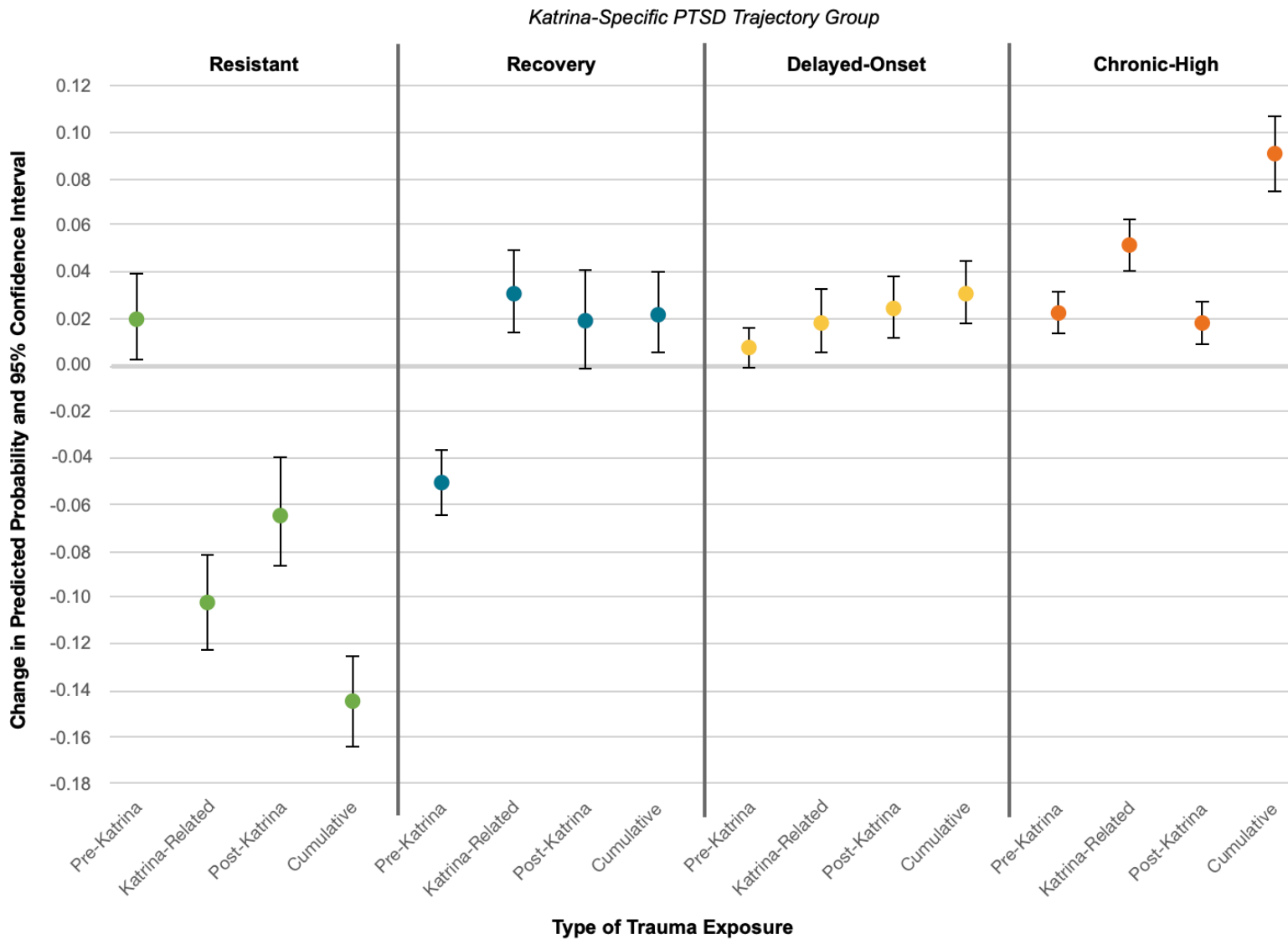
trajectories, women had means of 8.88 (SD=4.14), 10.22 (SD=5.33), and 11.85 (SD=5.36) total traumatic events, respectively.

#### **4.3.4. Predictors of trajectory membership**

##### *4.3.4.1 Primary analyses*

**Figure 4.2** provides an overview of the differences in predicted probability of trajectory membership associated with a one standard deviation increase in number of pre-Katrina, Katrina-related, and post-Katrina traumatic events, as well as cumulative trauma exposure, which is a count of all traumatic events experienced. Estimates for pre-Katrina, Katrina-related, and post-Katrina trauma are mutually adjusted (e.g., the estimates for pre-Katrina trauma are adjusted for Katrina-related and post-Katrina trauma). To create **Figure 4.2**, I estimated the predicted probability of being in a particular trajectory group for women with trauma counts equal to the mean value and at one standard deviation above the mean. I then calculated the difference between these two predicted probabilities to estimate the difference in probability associated with a one standard deviation increase in trauma exposure. For example, women in the analytic sample reported an average of 2.60 post-Katrina traumatic events, with a standard deviation of 1.99. I estimated the predicted probabilities of trajectory membership for women who experienced 2.60 post-Katrina traumas and those who experienced 4.59 post-Katrina traumas. Predicted probability of the Resistant trajectory was 0.49 (95% CI=0.46, 0.52) for women with 2.60 post-Katrina traumas and 0.43 (95% CI=0.37, 0.48) for women with 4.59 post-Katrina traumas; thus, a one standard deviation increase in post-Katrina trauma exposure was associated with a decrease in predicted probability of 0.06.

The subsections below provide more detail on the findings shown in **Figure 4.2**, broken down by Katrina-specific PTSD trajectory group.



**Figure 4.2.** Change in predicted probability of PTSD trajectory group membership associated with a one standard deviation increase in trauma exposure

#### 4.3.4.1.1. Predictors of membership in the Resistant trajectory (49.0%)

**Table 4.5** shows the predicted probability of membership in the Resistant trajectory by type of trauma exposure. Higher pre-Katrina trauma exposure was not associated with a meaningful difference in probability of being in the Resistant trajectory in either the crude or adjusted models. However, greater exposure to Katrina-related trauma and cumulative trauma exposure were both associated with lower predicted probabilities of being in the Resistant trajectory. In particular, women who lost a family member or close friend due to Katrina were less likely to follow the Resistant trajectory; those who experienced the death of a family member or close friend due to Hurricane Katrina had a predicted probability of 0.40 (95% CI=0.34, 0.45) for the Resistant trajectory, compared to a predicted probability of 0.55 (95% CI=0.51, 0.59) for those who did not. After controlling for covariates, a one standard deviation increase in number of Katrina-related traumas and cumulative traumas were associated with decreases in the probability of being in the Resistant trajectory of 0.10 (95% CI=-0.12, -0.08) and 0.14 (95% CI=-0.16, -0.12), respectively.

**Table 4.5.** Predicted probability of membership in the Resistant trajectory by type of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Pre-Katrina Trauma Exposure<sup>1</sup></b>		
Predicted probability at mean level of pre-Katrina trauma exposure	0.50 (0.46, 0.53)	0.50 (0.46, 0.53)
Predicted probability at 1 SD above mean	0.45 (0.39, 0.50)	0.52 (0.46, 0.57)
<i>Difference</i>	-0.05 (-0.07, -0.03)	0.02 (0.002, 0.04)
<i>Percent change in probability</i>	-10.1%	4.2%
<b>Pre-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina assaultive trauma exposure	0.50 (0.46, 0.53)	0.49 (0.46, 0.53)
Predicted probability at 1 SD above mean	0.45 (0.39, 0.50)	0.49 (0.43, 0.55)
<i>Difference</i>	-0.05 (-0.07, -0.03)	-0.003 (-0.03, 0.02)
<i>Percent change in probability</i>	-10.1%	-0.6%
<b>Pre-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina non-assaultive trauma exposure	0.50 (0.46, 0.53)	0.49 (0.46, 0.53)
Predicted probability at 1 SD above mean	0.46 (0.41, 0.52)	0.52 (0.47, 0.57)
<i>Difference</i>	-0.04 (-0.05, -0.02)	0.03 (0.01, 0.05)
<i>Percent change in probability</i>	-7.1%	5.7%
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
Predicted probability at mean level of Katrina-related trauma exposure	0.49 (0.45, 0.53)	0.49 (0.45, 0.52)
Predicted probability at 1 SD above mean	0.32 (0.27, 0.38)	0.39 (0.33, 0.44)
<i>Difference</i>	-0.17 (-0.18, -0.15)	-0.10 (-0.12, -0.08)
<i>Percent change in probability</i>	-34.0%	-21.0%
<b>Moderate to Severe Home Damage Due to Hurricane Katrina</b>		
Predicted probability – Did not experience moderate to severe home damage	0.64 (0.55, 0.73)	0.56 (0.47, 0.65)
Predicted probability – Experienced moderate to severe home damage	0.46 (0.42, 0.50)	0.48 (0.44, 0.51)
<i>Difference</i>	-0.18 (-0.13, -0.23)	-0.09 (-0.14, -0.03)
<i>Percent change in probability</i>	-27.9%	-15.4%
<b>Family Member or Close Friend Died Due to Hurricane Katrina</b>		
Predicted probability – Did not lose a family member or close friend due to Katrina	0.60 (0.55, 0.64)	0.55 (0.51, 0.59)
Predicted probability – Lost a family member or close friend due to Katrina	0.33 (0.27, 0.38)	0.40 (0.34, 0.45)

<i>Difference</i>	-0.27 (-0.28, -0.26)	-0.15 (-0.17, -0.14)
<i>Percent change in probability</i>	-45.1%	-28.1%
<b>Post-Katrina Trauma Exposure<sup>3</sup></b>		
Predicted probability at mean level of post-Katrina trauma exposure	0.49 (0.46, 0.53)	0.49 (0.46, 0.52)
Predicted probability at 1 SD above mean	0.39 (0.34, 0.45)	0.43 (0.37, 0.48)
<i>Difference</i>	-0.10 (-0.12, -0.08)	-0.06 (-0.09, -0.04)
<i>Percent change in probability</i>	-20.1%	-12.9%
<b>Post-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina assaultive trauma exposure	0.49 (0.45, 0.53)	0.49 (0.46, 0.52)
Predicted probability at 1 SD above mean	0.41 (0.35, 0.47)	0.44 (0.38, 0.50)
<i>Difference</i>	-0.08 (-0.11, -0.06)	-0.05 (-0.08, -0.02)
<i>Percent change in probability</i>	-16.9%	-10.2%
<b>Post-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina non-assaultive trauma exposure	0.49 (0.46, 0.53)	0.49 (0.46, 0.52)
Predicted probability at 1 SD above mean	0.41 (0.36, 0.47)	0.46 (0.40, 0.51)
<i>Difference</i>	-0.08 (-0.10, -0.07)	-0.03 (-0.06, -0.01)
<i>Percent change in probability</i>	-16.7%	-6.9%
<b>Cumulative Trauma Exposure<sup>4</sup></b>		
Predicted probability at mean level of cumulative trauma exposure	0.49 (0.45, 0.53)	0.49 (0.45, 0.53)
Predicted probability at 1 SD above mean	0.32 (0.26, 0.37)	0.35 (0.29, 0.40)
<i>Difference</i>	-0.17 (-0.19, -0.16)	-0.14 (-0.16, -0.12)
<i>Percent change in probability</i>	-35.4%	-29.4%

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.

#### 4.3.4.1.2. Predictors of membership in the Recovery trajectory (29.3%)

**Table 4.6** shows the predicted probability of membership in the Recovery trajectory by type of trauma exposure. Of the various types of trauma exposure I assessed, only experiencing pre-Katrina trauma and two specific Katrina-related traumas, home damage and bereavement, significantly impacted predicted probability of the Recovery trajectory. Higher pre-Katrina trauma exposure was associated with a moderate decrease in predicted probability of being in the Recovery trajectory. For women with pre-Katrina trauma scores set at the mean (1.66), the predicted probability of membership in the Recovery group was 0.30 (95% CI=0.26, 0.33). For women with pre-Katrina trauma scores one standard deviation above the mean (3.64), predicted probability was 0.24 (95% CI=0.20, 0.29), a decrease in probability of -0.05 (95% CI=-0.06, -0.04), a relative reduction of 17.2%.

Although number of Katrina-related traumatic events reported on the hurricane trauma scale was not associated with a meaningful change in probability of the Recovery trajectory, experiencing moderate to severe home damage or the death of a family member or close friend due to Hurricane Katrina was associated with increased probability of membership in this trajectory. Moderate to severe home damage was associated with an increase in the probability of 0.09 (95% CI=0.04, 0.13) and losing a family member or close friend increased probability by 0.10 (95% CI=0.09, 0.12), relative increases of 38.7% and 39.3% over the mean, respectively.

**Table 4.6.** Predicted probability of membership in the Recovery trajectory by type of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Pre-Katrina Trauma Exposure<sup>1</sup></b>		
Predicted probability at mean level of pre-Katrina trauma exposure	0.30 (0.26, 0.33)	0.30 (0.26, 0.33)
Predicted probability at 1 SD above mean	0.27 (0.22, 0.32)	0.24 (0.20, 0.29)
<i>Difference</i>	-0.02 (-0.04, -0.01)	-0.05 (-0.06, -0.04)
<i>Percent change in probability</i>	-7.4%	-17.2%
<b>Pre-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina assaultive trauma exposure	0.30 (0.26, 0.33)	0.29 (0.26, 0.33)
Predicted probability at 1 SD above mean	0.28 (0.23, 0.33)	0.27 (0.22, 0.32)
<i>Difference</i>	-0.02 (-0.03, -0.002)	-0.02 (-0.04, -0.01)
<i>Percent change in probability</i>	-5.7%	-8.3%
<b>Pre-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina non-assaultive trauma exposure	0.29 (0.26, 0.33)	0.29 (0.26, 0.33)
Predicted probability at 1 SD above mean	0.27 (0.22, 0.33)	0.26 (0.21, 0.31)
<i>Difference</i>	-0.02 (-0.04, -0.002)	-0.04 (-0.05, -0.02)
<i>Percent change in probability</i>	-6.6%	-12.5%
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
Predicted probability at mean level of Katrina-related trauma exposure	0.31 (0.27, 0.34)	0.31 (0.27, 0.34)
Predicted probability at 1 SD above mean	0.36 (0.31, 0.41)	0.34 (0.28, 0.39)
<i>Difference</i>	0.06 (0.04, 0.07)	0.03 (0.01, 0.05)
<i>Percent change in probability</i>	17.9%	10.3%
<b>Moderate to Severe Home Damage Due to Hurricane Katrina</b>		
Predicted probability – Did not experience moderate to severe home damage	0.19 (0.12, 0.27)	0.22 (0.14, 0.31)
Predicted probability – Experienced moderate to severe home damage	0.31 (0.27, 0.35)	0.31 (0.27, 0.34)
<i>Difference</i>	0.12 (0.08, 0.16)	0.09 (0.04, 0.13)
<i>Percent change in probability</i>	60.8%	38.7%
<b>Family Member or Close Friend Died Due to Hurricane Katrina</b>		
Predicted probability – Did not lose a family member or close friend due to Katrina	0.24 (0.20, 0.28)	0.26 (0.21, 0.30)
Predicted probability – Lost a family member or close friend due to Katrina	0.37 (0.32, 0.43)	0.36 (0.30, 0.42)

<i>Difference</i>	0.13 (0.12, 0.15)	0.10 (0.09, 0.12)
<i>Percent change in probability</i>	56.1%	39.3%
<b>Post-Katrina Trauma Exposure<sup>3</sup></b>		
Predicted probability at mean level of post-Katrina trauma exposure	0.30 (0.26, 0.33)	0.30 (0.27, 0.33)
Predicted probability at 1 SD above mean	0.31 (0.26, 0.37)	0.32 (0.26, 0.37)
<i>Difference</i>	0.02 (-0.002, 0.03)	0.02 (-0.001, 0.04)
<i>Percent change in probability</i>	5.1%	6.6%
<b>Post-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina assaultive trauma exposure	0.30 (0.26, 0.33)	0.30 (0.26, 0.33)
Predicted probability at 1 SD above mean	0.32 (0.27, 0.37)	0.32 (0.27, 0.38)
<i>Difference</i>	0.02 (0.003, 0.04)	0.02 (0.003, 0.05)
<i>Percent change in probability</i>	6.8%	8.2%
<b>Post-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina non-assaultive trauma exposure	0.30 (0.26, 0.33)	0.30 (0.26, 0.33)
Predicted probability at 1 SD above mean	0.31 (0.26, 0.36)	0.30 (0.25, 0.36)
<i>Difference</i>	0.01 (-0.01, 0.03)	0.01 (-0.01, 0.03)
<i>Percent change in probability</i>	2.9%	2.2%
<b>Cumulative Trauma Exposure<sup>4</sup></b>		
Predicted probability at mean level of cumulative trauma exposure	0.31 (0.27, 0.35)	0.31 (0.28, 0.35)
Predicted probability at 1 SD above mean	0.35 (0.30, 0.40)	0.33 (0.28, 0.39)
<i>Difference</i>	0.04 (0.02, 0.06)	0.02 (0.01, 0.04)
<i>Percent change in probability</i>	12.4%	7.2%

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.

#### 4.3.4.1.3. Predictors of membership in the Delayed-Onset trajectory (8.0%)

**Table 4.7** shows the predicted probability of membership in the Delayed-Onset trajectory by type of trauma exposure. Experiencing a greater number of pre-Katrina traumas, Katrina-related traumas, post-Katrina traumas, and cumulative traumas exposure were associated with small to moderate changes in predicted probability of the Delayed-Onset trajectory. The largest differences in predicted probability were observed for home damage due to Hurricane Katrina, total number of post-Katrina traumas, and cumulative trauma exposure.

The Delayed-Onset trajectory was the only trajectory for which there was a meaningful difference between the extent to which assaultive and non-assaultive trauma predicted trajectory membership. For this trajectory, a one standard deviation increase in pre-Katrina assaultive traumatic events was associated with an increase in predicted probability of 0.02 (95% CI=0.01, 0.03), a relative increase of 22.2%. In contrast, a one standard deviation increase in non-assaultive pre-Katrina trauma was associated with a decrease in predicted probability of 0.01 (95% CI=-0.01, -0.001), a relative decrease of 8.9%. This is consistent with prior research showing that assaultive traumas related to interpersonal violence, such as physical abuse or sexual assault, have a greater negative effect on mental health than non-assaultive traumas [10,44,45].

Higher Katrina-related trauma exposure as measured by the eight-item hurricane trauma scale was associated with increased probability of the Delayed-Onset trajectory, while experiencing two additional types of Katrina-related trauma—home damage and the death of a family member or close friend—were associated with a lower predicted probability, although the changes in probability for the hurricane trauma scale and bereavement were small. Experiencing moderate to severe home damage had the greatest association with the probability of Delayed-

Onset PTSD, a decrease in predicted probability of 0.06 (95% CI=-0.11, -0.01), a relative decrease of 45.5%.

A one standard deviation increase in post-Katrina trauma count was associated with an increase in probability of 0.03 (95% CI=0.01, 0.04); a one standard deviation increase in cumulative trauma count was also associated with a probability increase of 0.03 (95% CI=0.02, 0.04).

**Table 4.7.** Predicted probability of membership in the Delayed-Onset trajectory by type of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Pre-Katrina Trauma Exposure<sup>1</sup></b>		
Predicted probability at mean level of pre-Katrina trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.10 (0.07, 0.13)	0.09 (0.06, 0.12)
<i>Difference</i>	0.02 (0.01, 0.03)	0.01 (-0.001, 0.02)
<i>Percent change in probability</i>	21.3%	9.7%
<b>Pre-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina assaultive trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.10 (0.07, 0.13)	0.10 (0.06, 0.13)
<i>Difference</i>	0.02 (0.01, 0.03)	0.02 (0.01, 0.03)
<i>Percent change in probability</i>	26.4%	22.2%
<b>Pre-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina non-assaultive trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.09 (0.06, 0.12)	0.07 (0.05, 0.10)
<i>Difference</i>	0.01 (-0.002, 0.02)	-0.01 (-0.01, -0.001)
<i>Percent change in probability</i>	9.5%	-8.9%
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
Predicted probability at mean level of Katrina-related trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.10 (0.07, 0.13)	0.10 (0.07, 0.14)
<i>Difference</i>	0.01 (0.01, 0.03)	0.02 (0.01, 0.03)
<i>Percent change in probability</i>	17.9%	23.1%
<b>Moderate to Severe Home Damage Due to Hurricane Katrina</b>		
Predicted probability – Did not experience moderate to severe home damage	0.11 (0.05, 0.17)	0.13 (0.06, 0.20)
Predicted probability – Experienced moderate to severe home damage	0.07 (0.05, 0.09)	0.07 (0.05, 0.09)
<i>Difference</i>	-0.04 (-0.07, 0.001)	-0.06 (-0.11, -0.01)
<i>Percent change in probability</i>	-32.7%	-45.5%
<b>Family Member or Close Friend Died Due to Hurricane Katrina</b>		
Predicted probability – Did not lose a family member or close friend due to Katrina	0.09 (0.06, 0.11)	0.09 (0.06, 0.12)
Predicted probability – Lost a family member or close friend due to Katrina	0.07 (0.04, 0.10)	0.07 (0.04, 0.10)

<i>Difference</i>	-0.01 (-0.02, -0.01)	-0.02 (-0.03, -0.02)
<i>Percent change in probability</i>	-16.1%	-26.7%
<b>Post-Katrina Trauma Exposure<sup>3</sup></b>		
Predicted probability at mean level of post-Katrina trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.11 (0.08, 0.14)	0.10 (0.07, 0.14)
<i>Difference</i>	0.03 (0.02, 0.04)	0.03 (0.01, 0.04)
<i>Percent change in probability</i>	35.4%	32.1%
<b>Post-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina assaultive trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.10 (0.07, 0.13)	0.09 (0.06, 0.12)
<i>Difference</i>	0.02 (0.01, 0.03)	0.01 (0.002, 0.02)
<i>Percent change in probability</i>	27.2%	13.5%
<b>Post-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina non-assaultive trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.10 (0.07, 0.13)	0.10 (0.06, 0.13)
<i>Difference</i>	0.02 (0.01, 0.03)	0.02 (0.01, 0.03)
<i>Percent change in probability</i>	30.3%	23.7%
<b>Cumulative Trauma Exposure<sup>4</sup></b>		
Predicted probability at mean level of cumulative trauma exposure	0.08 (0.06, 0.10)	0.08 (0.06, 0.10)
Predicted probability at 1 SD above mean	0.11 (0.08, 0.15)	0.11 (0.08, 0.15)
<i>Difference</i>	0.03 (0.02, 0.04)	0.03 (0.02, 0.04)
<i>Percent change in probability</i>	35.6%	38.5%

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.

#### 4.3.4.1.4. Predictors of membership in the Chronic-High trajectory (13.7%)

**Table 4.8** shows the predicted probability of membership in the Chronic-High trajectory by type of trauma exposure. I found positive relationships of Katrina-related and cumulative trauma exposure with the predicted probability of Chronic-High PTSD. A one standard deviation increase in number of Katrina-related and cumulative traumatic events, respectively, was associated with increases in probability of 0.05 (95% CI=0.04, 0.06) and 0.09 (95% CI=0.07, 0.11). In addition, experiencing moderate to severe home damage or the death of a family member or close friend due to Hurricane Katrina was associated with a higher predicted probability of Chronic-High PTSD. Women who experienced moderate to severe home damage had a probability of 0.14 (95% CI=0.12, 0.17), compared to a probability of 0.08 (95% CI=0.02, 0.14) for women who did not. Similarly, losing a family member or close friend due to Katrina increased predicted probability from 0.10 (95% CI=0.07, 0.13) to 0.18 (95% CI=0.14, 0.22).

**Table 4.8.** Predicted probability of membership in the Chronic-High trajectory by type of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Pre-Katrina Trauma Exposure<sup>1</sup></b>		
Predicted probability at mean level of pre-Katrina trauma exposure	0.13 (0.10, 0.15)	0.13 (0.11, 0.15)
Predicted probability at 1 SD above mean	0.18 (0.14, 0.22)	0.15 (0.12, 0.19)
<i>Difference</i>	0.05 (0.04, 0.07)	0.02 (0.01, 0.03)
<i>Percent change in probability</i>	43.0%	17.3%
<b>Pre-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina assaultive trauma exposure	0.13 (0.10, 0.15)	0.13 (0.11, 0.16)
Predicted probability at 1 SD above mean	0.18 (0.14, 0.21)	0.14 (0.11, 0.18)
<i>Difference</i>	0.05 (0.03, 0.06)	0.01 (0.001, 0.02)
<i>Percent change in probability</i>	35.5%	7.5%
<b>Pre-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of pre-Katrina non-assaultive trauma exposure	0.13 (0.10, 0.15)	0.13 (0.11, 0.16)
Predicted probability at 1 SD above mean	0.18 (0.14, 0.21)	0.15 (0.11, 0.18)
<i>Difference</i>	0.05 (0.03, 0.06)	0.02 (0.01, 0.02)
<i>Percent change in probability</i>	36.5%	12.2%
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
Predicted probability at mean level of Katrina-related trauma exposure	0.12 (0.10, 0.15)	0.12 (0.10, 0.15)
Predicted probability at 1 SD above mean	0.22 (0.18, 0.26)	0.18 (0.14, 0.21)
<i>Difference</i>	0.10 (0.08, 0.11)	0.05 (0.04, 0.06)
<i>Percent change in probability</i>	78.4%	41.7%
<b>Moderate to Severe Home Damage Due to Hurricane Katrina</b>		
Predicted probability – Did not experience moderate to severe home damage	0.06 (0.02, 0.10)	0.08 (0.02, 0.14)
Predicted probability – Experienced moderate to severe home damage	0.15 (0.12, 0.18)	0.14 (0.12, 0.17)
<i>Difference</i>	0.10 (0.08, 0.11)	0.06 (0.03, 0.09)
<i>Percent change in probability</i>	166.1%	74.8%
<b>Family Member or Close Friend Died Due to Hurricane Katrina</b>		
Predicted probability – Did not lose a family member or close friend due to Katrina	0.08 (0.05, 0.10)	0.10 (0.07, 0.13)
Predicted probability – Lost a family member or close friend due to Katrina	0.23 (0.18, 0.28)	0.18 (0.14, 0.22)
<i>Difference</i>	0.15 (0.12, 0.17)	0.08 (0.07, 0.09)

<i>Percent change in probability</i>	187.2%	78.3%
<b>Post-Katrina Trauma Exposure<sup>3</sup></b>		
Predicted probability at mean level of post-Katrina trauma exposure	0.13 (0.10, 0.15)	0.13 (0.11, 0.16)
Predicted probability at 1 SD above mean	0.18 (0.14, 0.22)	0.15 (0.12, 0.19)
<i>Difference</i>	0.06 (0.04, 0.07)	0.02 (0.01, 0.03)
<i>Percent change in probability</i>	43.7%	13.8%
<b>Post-Katrina Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina assaultive trauma exposure	0.13 (0.11, 0.16)	0.13 (0.11, 0.16)
Predicted probability at 1 SD above mean	0.17 (0.13, 0.21)	0.15 (0.11, 0.18)
<i>Difference</i>	0.04 (0.03, 0.05)	0.01 (0.004, 0.02)
<i>Percent change in probability</i>	31.5%	11.0%
<b>Post-Katrina Non-Assaultive Trauma Exposure</b>		
Predicted probability at mean level of post-Katrina non-assaultive trauma exposure	0.13 (0.10, 0.15)	0.13 (0.11, 0.16)
Predicted probability at 1 SD above mean	0.18 (0.14, 0.22)	0.14 (0.11, 0.18)
<i>Difference</i>	0.05 (0.04, 0.06)	0.01 (0.001, 0.02)
<i>Percent change in probability</i>	38.8%	6.9%
<b>Cumulative Trauma Exposure<sup>4</sup></b>		
Predicted probability at mean level of cumulative trauma exposure	0.11 (0.09, 0.14)	0.12 (0.09, 0.14)
Predicted probability at 1 SD above mean	0.22 (0.18, 0.26)	0.21 (0.16, 0.25)
<i>Difference</i>	0.11 (0.09, 0.12)	0.09 (0.07, 0.11)
<i>Percent change in probability</i>	92.4%	78.5%

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.

#### 4.3.4.2. *Secondary analyses*

To examine potential non-linearities between trauma exposure and PTSD trajectories, I examined quartiles of pre-Katrina, Katrina-related, post-Katrina and cumulative traumatic events. Most findings were similar to those from the primary analyses. However, in a few places, traumatic exposures appeared to have a somewhat non-linear relationship with PTSD trajectories. First, the probability of the Recovery trajectory was the same across the first three quartiles of pre-Katrina trauma exposure, and decreased only at the fourth quartile. This differs from the moderate negative association between pre-Katrina trauma exposure and probability of the Recovery trajectory that I observed in the primary analyses.

Second, when number of Katrina-related traumas was examined in quartiles, I observed a possible threshold effect for women in the Resistant and Chronic-High trajectories that indicates that number of Katrina-related traumas only impacts PTSD trajectory for people who experienced three or more Katrina traumas. The secondary analyses also showed a clear dose-response relationship between quartile of Katrina-related trauma exposure and probability of Delayed-Onset PTSD.

Third, when the association between cumulative trauma exposure and probability of the Recovery trajectory was analyzed across quartiles of trauma exposure, there was a positive dose-response association for women in the first three quartiles of cumulative trauma exposure, with predicted probability increasing from 0.22 (95% CI=0.16, 0.28) for women in the first quartile to 0.29 (95% CI=0.22, 0.36) in the second quartile, and 0.41 (95% CI=0.32, 0.49) in the third quartile. Predicted probability then decreased to approximately the baseline probability of the Recovery trajectory (0.31; 95% CI=0.23, 0.38) for women in the highest quartile of cumulative trauma exposure. These differences in the association between probability of trajectory group

membership and level of cumulative trauma exposure were obscured in the primary analyses, which evaluated the overall effect of an increase in cumulative trauma exposure and showed no association between total number of traumatic events reported and probability of the Recovery trajectory. The full findings from the secondary analyses are described in **Appendix B**.

#### **4.4. DISCUSSION**

There were several key findings from the present study, which evaluated the extent to which pre-Katrina traumatic experiences can explain differences in long-term trajectories of Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma. This study also examined the impact of Katrina-related, post-Katrina, and cumulative trauma exposure on PTSD trajectories. First, four PTSD trajectories were identified. These trajectories roughly correspond to the four “prototypical” PTSD trajectories [19,72–75]. Nearly half (49.0%) of participants were in the Resistant trajectory, which is the least severe of the four trajectories and is characterized by PTSD symptoms that remained low over the 12 years of follow-up. The proportion of women who were in the Resistant trajectory was lower than anticipated based on findings from previous studies. For example, a meta-analysis that examined the prevalence of PTSD trajectories in 35 studies [87] found that 69.5% of trauma survivors followed a trajectory similar to my Resistant trajectory, in which PTSD symptoms are low in the initial post-disaster period and remain low over time. The lower proportion of participants in my sample following this trajectory may be partially attributable to the fact that the majority of the participants identified as Black and all were female and low-income at baseline, all of which are characteristics associated with higher risk of post-disaster mental health problems [16,19]. In addition, this study population is more highly traumatized than the majority of participants in studies included in the meta-analysis [87], which may reduce the probability of following a

trajectory in which PTSD symptoms are low in both the short- and long-term aftermath of a disaster.

#### **4.4.1. Pre-Katrina Trauma**

My primary hypothesis was that experiencing greater pre-Katrina trauma would be associated with higher risk of experiencing more severe Katrina-specific PTSD, corresponding to the Chronic-High trajectory I found. Although I found that experiencing a higher number of traumatic events prior to Hurricane Katrina was associated with increased probability of Chronic-High PTSD in the unadjusted models, after adjusting for covariates, including pre-Katrina psychological distress and Katrina-related and post-Katrina trauma, pre-Katrina trauma exposure was not associated with the probability of long-term, chronic Katrina-specific PTSD. Of the various types of trauma exposure examined, Chronic-High PTSD was most strongly influenced by cumulative trauma exposure and Katrina-related trauma. When covariates were added to the model one at a time, the association between pre-Katrina trauma and Chronic-High PTSD was attenuated most by the addition of Katrina-related trauma. This suggests that while pre-Katrina trauma may impact PTSD through other factors that affect Katrina-related PTSD, such as by increasing severity of Katrina-related trauma, pre-Katrina trauma exposure does not have a strong direct effect on chronic Katrina-specific PTSD.

Higher pre-Katrina trauma exposure moderately decreased the probability of being in the Recovery trajectory, in which Katrina-specific PTSD symptoms are initially high before declining over time. Pre-Katrina trauma did not have a significant effect on probability of the Resistant and Delayed-Onset PTSD trajectories.

The motivating factor for these analyses was to examine how pre-Katrina trauma exposure may impact long-term Katrina-specific PTSD. In order to do this comprehensively, I also considered the other types of trauma Katrina survivors may have experienced.

#### **4.4.2. Katrina-Related Trauma**

In the adjusted models, experiencing a greater number of Katrina-related traumas was associated with lower probability of being in the least severe PTSD trajectory (Resistant) and higher probability of being in one of the more severe trajectories (Delayed-Onset and Chronic-High). This aligns with prior research that found that the degree or severity of the disaster-related traumatic events experienced is the factor that most strongly predicted post-disaster mental health problems [16].

Experiencing the death of a family member or close friend due to Katrina was associated with a lower probability of being in the Resistant or Delayed-Onset trajectories, but a higher probability of the Recovery and Chronic-High trajectories. Both the Recovery and Chronic-High trajectories are characterized by initially high Katrina-specific PTSD symptoms, whereas the women in the Resistant and Delayed-Onset had low PTSD symptoms at the first post-Katrina follow-up. Findings for moderate to severe home damage due to Katrina were similar. This aligns with prior research showing that bereavement is associated with post-disaster PTSD [36,88–90]. These results also suggest that bereavement and home damage related to Katrina may result in shorter-term elevations in PTSD symptoms that do not persist over time.

Like home damage, higher scores on the hurricane trauma scale, which is a count of Katrina-related traumas including lacking food, water, or medical care, or feeling that one's life was in danger, were associated with large increases in probability of the Chronic-High trajectory. However, in contrast to home damage, higher scores on the hurricane trauma scale were also

associated with a large increase in probability of the Delayed-Onset trajectories. These types of traumatic experiences were associated with a concomitant decrease in probability of the Resistant trajectory. This indicates that, controlling for pre-Katrina sociodemographics, social support and psychological distress, and pre- and post-Katrina trauma, the types of Katrina-related trauma listed on this scale, which are less acute stressors than bereavement or home damage, may be associated with higher long-term PTSD symptoms after Katrina.

My findings suggest that experiencing a severe trauma such as the death of a loved one or losing one's home may trigger an immediate response that causes PTSD symptoms to increase. Katrina-related traumas measured using the eight-item hurricane trauma scale, such as lacking food or water, or not knowing whether family members were safe in the week after Katrina, are less acute traumatic events than home damage or bereavement. These events may be easier to suppress in the short-term aftermath of a disaster but become more chronic, low-lying stressors that ultimately result in higher long-term PTSD symptoms.

#### **4.4.3. Post-Katrina Trauma**

In the primary analyses, post-Katrina trauma exposure had little effect on predicted probability of the Resistant, Recovery, and Chronic-High trajectories. However, when I examined the association between quartiles of post-Katrina trauma exposure and PTSD trajectory, higher levels of post-Katrina trauma exposure decreased probability of the Resistant trajectory and increased probability of Chronic-High PTSD. Post-Katrina trauma exposure had the largest impact on probability of Delayed-Onset PTSD. This indicates that experiencing further trauma after Hurricane Katrina may have exacerbated Katrina-specific PTSD symptoms, causing PTSD scores to increase from below the cut-off for probable PTSD in the short-term aftermath of Hurricane Katrina to above the cut-off in the long term.

#### **4.4.4. Cumulative Trauma**

I also examined the extent to which cumulative trauma exposure—as measured by a count of the total number of pre-Katrina, Katrina-related, and post-Katrina traumatic events experienced—affected post-Katrina PTSD trajectory. A one standard deviation increase in total number of traumatic events reported was associated with a decrease in probability of the Resistant trajectory and increases in probability of the Delayed-Onset and Chronic-High trajectories, suggesting that more traumatic events across the life course shift disaster survivors from less severe to more severe PTSD trajectories (i.e., Resistant to Chronic-High).

#### **4.4.5. Limitations and Conclusions**

This study has several limitations. First, PTSD symptoms were assessed using a self-reported measure, which may be less accurate than a clinical assessment and cannot provide a definitive diagnosis of PTSD. Second, there is a significant time lag between the second and third post-Katrina PTSD assessments, and the number of years between surveys is not consistent. It is possible that the trajectories I identified in these analyses may be different from the trajectories I may have identified if I had access to additional waves of data collected between the second and third post-Katrina surveys. Third, although I examined the extent to which assaultive vs. non-assaultive traumas had differing effects on Katrina-specific PTSD, I was not able to assess which specific traumatic events are most associated with post-disaster PTSD trajectory due to sample size. Future research should further parse out the types of trauma that confer the greatest risk of chronic post-disaster PTSD. Fourth, because pre- and post-Katrina trauma were retrospectively reported, they may be affected by recall bias. Finally, although this sample is representative of the population that is most vulnerable to adverse post-disaster mental

health outcomes [16,19], it is not representative of all Hurricane Katrina survivors and these findings may not be generalizable to survivors of other disasters.

Despite these limitations, this study provides important insight into the course of disaster recovery among the most vulnerable disaster survivors, including people with a high burden of trauma. My results indicate that non-disaster traumas, particularly post-disaster traumatic events, may partially explain differences in long-term trajectories of disaster-specific PTSD among people with similar levels of disaster-related trauma exposure. Experiencing a greater number of traumatic events after Hurricane Katrina was associated with higher probability of being in the more severe PTSD trajectory groups (Delayed-Onset or Chronic-High). Another important finding from this study is that Katrina-related, post-Katrina, and cumulative trauma exposure drastically reduced the probability of being in the Resistant trajectory, the least severe of the four PTSD trajectories identified in this study.

These findings have implications for the development of disaster response strategies to diminish the long-term burden of disaster-related PTSD. Because these findings indicate that cumulative trauma exposure and experiencing further post-disaster traumas have an important impact on PTSD trajectories, a key aim of post-disaster interventions should be to reduce further trauma exposure among disaster survivors. This would also decrease cumulative trauma exposure. In line with the conservation of resources theory, disasters may result in losses of physical, social, economic, and psychological resources, creating conditions for greater severity of post-disaster traumatic events [24,25]. For example, job loss due to a disaster may contribute to increased household financial stress, which has been found to reduce women's means of leaving abusive relationships, increasing their risk of intimate partner violence [47]. Therefore, interventions that help to rebuild these resources after a disaster could prevent future trauma

exposure. In addition, interventions should ensure that mental health treatment and support is provided to disaster survivors who experience additional post-disaster trauma to mitigate the extent to which disaster-related PTSD is exacerbated by distress resulting from these subsequent traumas. Applying these findings to the development of disaster response strategies and interventions has the potential to prevent the most vulnerable disaster survivors from experiencing years of disaster-related PTSD.

## **5. MANUSCRIPT 3: Understanding perceptions of resilience factors: A qualitative study of Hurricane Katrina survivors**

### **5.1. BACKGROUND & AIMS**

Post-traumatic stress disorder (PTSD) is a mental health condition that is triggered by experiencing or witnessing a traumatic event, such as a natural or human-made disaster [11]. PTSD characterized by intrusive and distressing remembering or reexperiencing of the event, avoidance, hyperarousal or reactivity, and cognition or mood symptoms [12]. Although some people experience psychological distress, PTSD, or other adverse mental health consequences after a disaster, many exhibit resilience, which is defined as the ability to successfully adapt and “bounce back” from adversity [18]. Research on the determinants of resilience has identified a number of biological, psychological, and social factors that can help individuals adapt and recover from disasters [91]. Much of the existing research on post-disaster resilience has focused on psychological or personality-based determinants of resilience, such as self-efficacy, sense of mastery, and personality traits such as hardiness [18,38]. These types of resilience factors are relatively fixed and not easily changed [72]. Although understanding these factors is important, some researchers have argued that it is not pragmatic for disaster recovery research to focus on resources that are unlikely to be enhanced through post-disaster interventions [38]. Identifying modifiable sources of resilience to inform interventions is a key focus of research on disaster recovery and preparedness.

Because context influences the likelihood of resilience and what determinants affect it [72,91,92], interventions to enhance resilience may not be equally effective across different populations of disaster survivors [30,33]. Disaster survivors with a history of pre-disaster trauma

may be a particularly vulnerable group. The limited number of studies that examine resilience among disaster survivors who have experienced previous traumatic events suggest that people with additional, non-disaster-related traumatic experiences are less likely to be resilient than people with no history of trauma [33,73]. Experiencing a high level of trauma has been found to be associated with psychological and physiological changes that can cause an individual with a history of trauma to have heightened sensitivity to new stressors [63,93–96]. For example, people with greater prior trauma exposure form more negative appraisals of subsequent stressors unrelated to their previous trauma, causing them to interpret these new stressors as more stressful and threatening [97]. As a result of this heightened state of fear, individuals with a history of trauma often prioritize ensuring that their basic needs for shelter, food, and security are met [94,98]. Therefore, it is likely that individuals with pre-disaster trauma require a greater sense of security that their basic needs are met than those without pre-disaster trauma.

However, there has been little research that assesses the perceptions of people who have experienced multiple traumatic events regarding the factors that helped them cope with and recover from a disaster. To my knowledge, no qualitative studies have examined how disaster survivors with a history of prior trauma describe the sources of resilience that have helped them cope. The majority of research on factors that promote resilience in disaster survivors has been quantitative, which limits our understanding of the complexity and contextual variability of resilience factors. Qualitative research offers an opportunity to examine resilience in a more nuanced manner. By its nature, qualitative data provides greater insight into the individual response, timing, and context of traumatic events than is obtainable from quantitative, standardized survey data [92]. Additionally, because of the open-ended nature of qualitative data, participants can share which factors they felt were key to their recovery and ability to be

resilient in the face of trauma. These additional resilience factors may not be evident from the survey data because survey items are limited to factors thought by the survey developers to be important for resilience. More qualitative research is needed to understand the dynamic processes that shape resilience. This level of detail is crucial for developing effective interventions to build resilience among disaster survivors [33,73].

This study aimed to fill this gap in the literature by leveraging qualitative data from the Resilience in Survivors of Katrina (RISK) project. Data from in-depth interviews were used to understand the perspectives of Hurricane Katrina survivors with a history of prior trauma on the factors that helped or hindered their ability to recover from Katrina. I examined factors identified by participants as keys to coping and recovery from Katrina and explored potential differences between participants with and without prior traumatic experiences. Given the qualitative nature of this study, I had few a priori hypotheses. However, because of past work showing that individuals with a history of trauma place a greater emphasis on security and meeting their basic needs, I hypothesized that participants with high levels of pre-Katrina trauma exposure would emphasize these factors as important for their resilience.

*Primary aim:* Qualitatively examine sources of resilience identified by Katrina survivors with a history of prior trauma as key to their recovery from Hurricane Katrina.

## **5.2. METHODS**

### **5.2.1. Data**

This paper leveraged data from the Resilience in Survivors of Katrina (RISK) study, a longitudinal study of low-income women who lived in New Orleans at the time of Hurricane Katrina. The RISK sample is drawn from the Opening Doors Demonstration, a randomized-design program designed to increase community college graduation rates and academic

achievement among low-income adults with children under age 18. After Hurricane Katrina disrupted data collection for the Opening Doors 12-month follow-up survey in August 2005, the study was redesigned as RISK to examine the consequences of a disaster on the lives of vulnerable individuals and their families. In addition to the pre-Katrina Wave 1 data collected in 2003-2005, the RISK study conducted three post-Katrina follow-up surveys one, four, and 12 years after the hurricane. Each of the follow-up surveys included questions pertaining to experiences during and after Hurricane Katrina, health resources and outcomes, social networks and support, and economic resources. The RISK study also conducted three rounds of semi-structured qualitative interviews in 2006-2007, 2009-2012, and 2018-2019. The interview guides covered a range of topics, including experiences of loss and trauma during the hurricane, post-hurricane disaster relief, post-disaster physical and mental health, decisions about housing, education and employment, subjective mobility, post-traumatic growth and recovery, other important life events, and thoughts and hopes for the future. In-depth interview participants were selected using purposive sampling to capture heterogeneity in post-disaster residential location (New Orleans vs. Houston, Dallas, and Baton Rouge) and to represent the variation in post-Katrina mental health outcomes observed in the post-Katrina surveys, making these data ideal for examining factors that shaped the impact of trauma on mental health over time [26]. Factors considered in selection of qualitative interviewees are listed in **Table 5.1**. For the Round 1 interviews, a mixture of participants with and without Katrina-specific PTSD based on the first post-Katrina survey were chosen. Prior to Round 2, latent class growth analysis was used to identify six trajectories of non-specific psychological distress in the RISK sample [99]. Round 2 interviewees were selected to ensure that members of each trajectory were represented in the interview sample. For Round 3, the study attempted to re-interview previously interviewed

participants and selected additional participants to capture heterogeneity in Katrina-specific PTSD symptoms observed in the third post-Katrina survey. In total, 178 interviews were completed with 112 women, with many participants interviewed more than once over a 13-year period. Interviews were conducted in mutually convenient locations (e.g., the interviewee’s home or a coffee shop) and lasted 1-2 hours. Participants provided written informed consent, and interviews were audio-recorded with the participants’ permission.

**Table 5.1.** Sampling criteria for qualitative interviews

Interview round	Dates	N	Selection criteria	
			<i>Residential location</i>	<i>Mental health</i>
1	2006-2007	57	New Orleans, Baton Rouge, Dallas, Houston	Post-hurricane data indicate PTSD vs. no indication of PTSD
2	2009; 2011-2012	68	New Orleans, Dallas, Houston	Six trajectories of psychological distress
3	2018-2019	53	New Orleans and Houston	Pattern of Katrina-specific PTSD symptoms

This paper leveraged these unique longitudinal qualitative data to examine sources of resilience that were perceived as important factors for recovery from Katrina by survivors with a history of pre-Katrina trauma. In addition, this paper aimed to examine whether perceived sources of resilience differed between participants with low, moderate, and high pre-Katrina trauma. These categories were defined by dividing number of pre-Katrina traumatic events into tertiles, resulting in 32.5%, 32.8%, and 34.7% of the total sample falling into each category, respectively. Because qualitative research generally requires a much smaller sample size to reach saturation than quantitative research [100,101], a subset of interviews (82 interviews, conducted with 46 participants) was randomly selected for inclusion in these analyses. Sampling was stratified by level of pre-Katrina trauma to ensure equal representation of women from each

group. Of these 46 participants, 16 participants were interviewed once, 24 were interviewed twice, and six were interviewed three times.

### **5.2.2. Analysis**

All qualitative interviews conducted by the RISK study were transcribed verbatim from audio recordings of the interviews. Transcripts were examined using thematic analysis, a method for identifying and analyzing patterns or themes within qualitative data [102]. As part of the larger RISK study, graduate students working with the RISK data had previously applied index codes to the transcripts. Index coding involves applying codes to the transcripts to index or organize the data by interview question and broad topic area [103]. These previously applied codes were used to help identify the most relevant sections of the transcript to be coded for this analysis.

To examine factors identified by participants as keys to coping and recovery, I began by reading the full transcripts to gain familiarity with the data. While reading through the transcripts, I verified previously applied index coding of sections related to coping and resilience. I also added codes that indicated whether a given participant had a history of pre-Katrina trauma. Through the first reading of the full transcripts, I developed an initial list of analytic codes and identified emerging themes.

Next, index codes were used to display only the portions of the transcripts that were relevant to the aim of this paper. Through a second reading of these excerpts, the list of analytic codes was refined. Once codes were finalized, the relevant sections of the transcripts were coded in NVivo using the final codebook. After coding was complete, codes were quantified to find recurring points across interviews. Themes were compared across participants with varying

levels of pre-Katrina trauma to examine potential differences in participant descriptions of protective factors.

### 5.3. RESULTS

Characteristics of all included participants, as well as characteristics of participants in the low, moderate, and high pre-Katrina trauma groups, are listed in **Table 5.2**. Women in the lowest level of pre-Katrina trauma reported experiencing no traumatic events prior to Katrina. Women in the moderate group reported one to two pre-Katrina traumatic events, and women in the high pre-Katrina trauma group reported three or more pre-Katrina traumas.

**Table 5.2.** Characteristics of participants included in analysis

	All participants (n=46)	Pre-Katrina trauma level		
		Low (n=15)	Moderate (n=15)	High (n=16)
		Mean (SD) or %		
<b>Baseline sociodemographics</b>				
Age	24.7 (4.2)	24.7 (3.5)	24.5 (4.8)	24.9 (4.6)
Non-Hispanic Black	91.1%	93.3%	80.0%	100.0%
Married or cohabitating	17.4%	6.7%	20.0%	25.0%
Number of public benefits received (0-4)	1.2 (0.7)	1.2 (0.9)	1.1 (0.7)	1.4 (0.6)
<b>Number of pre-Katrina traumas (0-8)</b>	2.0 (2.2)	0	1.3 (0.5)	4.6 (1.7)
<b>Hurricane exposure</b>				
Number of Katrina-related traumas (0-8)	3.7 (2.5)	3.3 (2.4)	3.4 (2.7)	4.2 (2.4)
Family member or friend died	43.5%	20.0%	46.7%	62.5%
Moderate or severe home damage	93.5%	86.7%	93.3%	100.0%

Several factors were identified by participants as being key to recovery from Katrina. The aim of this paper was to examine factors that women with high pre-Katrina trauma exposure perceived as being important for their coping and recovery. Because women with the most pre-Katrina trauma are likely at greatest risk, the analysis focused first on identifying factors the highest-tertile participants identified as protective. A similar approach was taken with the other tertiles, and factors were then compared across groups. Therefore, these results highlight the

themes that arose from the interviews with women in the highest tertile of pre-Katrina trauma exposure. Themes and subthemes are presented below in descending order of frequency.

### **5.3.1. Theme 1: New opportunities facilitated recovery**

More than half of the women with a high level of pre-Katrina trauma exposure (n=9) noted that taking advantage of new opportunities that became available to them after Hurricane Katrina improved their lives and aided in their recovery. Prior to Katrina, most interviewees had never lived outside of the New Orleans area, and experienced living somewhere new for the first time when they were forced to leave their homes due to the storm.

Compared to interviewees in the highest category of pre-Katrina trauma exposure, relatively few women with low or moderate pre-Katrina trauma exposure identified new opportunities presented to them after the hurricane as key to their recovery from Katrina. Only a few women in the low pre-Katrina trauma (n=3) and moderate pre-Katrina trauma (n=2) groups felt that Katrina offered new opportunities that ultimately improved their lives, whereas more than half of women with the highest level of pre-Katrina trauma (n=9) described such opportunities. Because the theme of new opportunities was much more common in the high-trauma group, subthemes for that group are described here.

After evacuating from New Orleans, some women in the high pre-Katrina trauma group realized that they had been “trapped” in New Orleans and that Katrina helped them “wake up.” One woman explained that although the hurricane was “a bad thing,” it provided a way for her to escape from a place in which the opportunities for her life were limited:

“So, I mean, I think the hurricane was a bad thing. But at the same token, I feel like, would I ever have left, would I have been just stuck in this trap? To me, New Orleans is a

trap, a bondage place, especially when you get out and you see it's so much better.”

(P118; interviewed one year post-Katrina; high pre-Katrina trauma)

The majority of women who described new post-disaster opportunities as facilitating their recovery from Katrina did not return to New Orleans; instead, they permanently relocated elsewhere, primarily to Houston or other areas of Texas. Women described four types of opportunities that they perceived as having improved their lives after Hurricane Katrina, with most women experiencing more than one type of opportunity (e.g., new job opportunities and a better environment for their children).

#### *5.3.1.1. Subtheme 1a: New job or economic opportunities (n=5)*

Many women described having better job opportunities after relocating, both in terms of the number and the type of jobs available to them and their family. One interviewee described the positive impact that new job opportunities in Texas had on her family:

“I have more opportunities out here, and I'm seizing them. Out there in New Orleans, my husband was—I don't know. He couldn't really flourish in New Orleans either, because it was hard for him to make it. He's doing the exact same thing he was doing in New Orleans, but like now he's making twice as much more money. So it makes him feel better about himself, and that helps out in the family, with him feeling that way. It helps with him as a father, because he's able to encourage my son more than he was in New Orleans.” (P115; interviewed one year post-Katrina; high pre-Katrina trauma)

However, some women noted that better job opportunities came at the expense of being separated from family who returned to New Orleans. One participant described feeling “torn” about whether to stay in Texas to pursue new opportunities or return to New Orleans to be near her family:

“Am I supposed to stay in Texas, or should I go back to New Orleans? I was just so—I didn’t know what I was going to do. If I go back to New Orleans, I know that economically it’s not good right now because everything is just not functioning properly...If I stayed out here [in Texas], things were looking up as far as job-wise, like opportunity-wise, but my family’s not here...no one is here with me. But New Orleans is fun. I know people. I’m comfortable [there], but I’m not going to get anywhere. I’m like—so that’s my little battle.” (P121; interviewed one year post-Katrina; high pre-Katrina trauma)

Another interviewee moved back to New Orleans after Katrina to be closer to family but returned to Houston a few months later because she felt that there were fewer job opportunities in New Orleans post-Katrina:

“I did go back to New Orleans after Katrina for three months and I just felt like it was not the same...so I just, I was like, you know what, there is better opportunities in Houston as far as the job market is concerned.” (P112; interviewed 12 years post-Katrina; high pre-Katrina trauma)

#### *5.3.1.2. Subtheme 1b: Better environment for children (n=5)*

Several women noted that relocating after Katrina enabled them to enroll their children in better schools and live in neighborhoods that they felt provided a better environment for their children. One interviewee described “everything” as being better in Houston than in New Orleans, and explained that she chose to stay in Houston because her family was able to live in a safer neighborhood:

“The neighborhood, the schools, the area, the city is thriving. The city of Houston is like a breath of life...it’s hard to become stagnant in what you do when you’re in Houston.

But in New Orleans it's kind of like—it's so routine...The neighborhood I grew up in was a slum, still is a slum, it was crime ridden all my life. I mean, I saw my first dead body when I was 8 years old, and I mean fights, crime, that was the norm. And I never wanted my children to be a part of it. That's why I was like, 'I'm going to stay put [in Houston].' We have been blessed. My children don't know what that is." (P204; interviewed four years post-Katrina; high pre-Katrina trauma)

Another woman noted that she valued Texas' emphasis on education and the diversity of her children's school. These factors influenced her decision to stay in Texas despite being separated from her extended family and losing her support system:

"[Education] plays a major factor in me staying here, because I know they're getting a good education. I don't have to send them to a private school to get a good education. And there is so much concern about education. It's emphasized deeply here in Texas. Whereas at home [in New Orleans], I mean, they want you to get an education, but it's not a major necessity. So I think that being here has been very rewarding for me and my children. Because there's opportunities that I doubt they would ever have—going to a mixed school, having friends that are of other cultures, they wouldn't have never had those opportunities." (P118; interviewed one year post-Katrina; high pre-Katrina trauma)

#### *5.3.1.3. Subtheme 1c: Seeing different possibilities for life and personal growth (n=4)*

A number of women explained that leaving New Orleans allowed them to envision different possibilities for their future. "Surviving" somewhere new changed some participants' life goals and showed them that they were strong enough to achieve more ambitious goals. One participant noted that Katrina facilitated personal growth and made her realize that she wanted to experience "life on a greater level":

“I believe Katrina changed the trajectory of wanting to experience more things beyond the walls of New Orleans, Louisiana and wanting to experience life on a greater level...so being able to grow as a person coming out of New Orleans and experiencing new things...I think my experience from Katrina removed any fear of not wanting to expand my horizons.” (P202; interviewed 12 years post-Katrina; high pre-Katrina trauma)

When asked later in the interview whether she believed the possibilities for her life changed due to Katrina, this participant stated, “Yes. I think it allowed me to have exponential growth.”

Another interviewee who remained in Texas after Hurricane Katrina started a catering business, which she felt she would not have been able to do successfully in New Orleans:

“Being here [in Houston] has gave me a different outlook that I can accomplish what I set out to do...There’s more opportunity, and you can see, okay, well, I intend to do this...it worked. Last year I started doing catering...and at home it would be so many people doing the same thing. But here not a whole lot of people do it, and then they don’t cook the foods that I cook, which is New Orleans food...and it’s been successful.” (P118; interviewed four years post-Katrina; high pre-Katrina trauma)

#### *5.3.1.4. Subtheme 1d: Improved living conditions or housing (n=3)*

Although most participants who described post-Katrina opportunities as key to their recovery moved out of New Orleans, some interviewees were able to use post-Katrina assistance to improve their living conditions within New Orleans. For example, one participant described Katrina as a “blessing in disguise” because it gave her the funds to rebuild her home and get “things that needed to be done” completed:

“The stress was horrible with the rebuilding and everything, but the outcome is beautiful. I look at Katrina kind of like a blessing in disguise in a sense...[We got] the funds to rebuild our homes, I mean it still got done and it was things that needed to be done. Like I needed my kitchen to be upgraded. I needed new flooring. I needed upgrades in the children’s room, you know what I’m saying? So it was a blessing.” (P110; interviewed four years post-Katrina; high pre-Katrina trauma)

### **5.3.2. Theme 2: Religious coping**

In alignment with previous research using this dataset [35,104], approximately two-thirds of interviewees identified prayer and religion as very important in coping with and recovering from Katrina. The vast majority of participants who utilized religious coping identified as Christians. Interviewees at all levels of pre-Katrina trauma exposure described their faith as a key resilience factor; nearly two-third of participants in the low (n=10), moderate (n=9), and high pre-Katrina trauma (n=10) groups stated that religion helped them cope with Katrina.

Participants described religion as important in the aftermath of Katrina because it “gave us hope” (P124; interviewed one year post-Katrina; low pre-Katrina trauma), and “made you feel like you always had something more or something better to look forward to,” (P128; interviewed four years post-Katrina; low pre-Katrina trauma) while going through the challenges of Katrina. For some women, their faith made them feel safe because they knew that “God is going to protect us”:

“There wasn’t times that I felt unsafe because my thing is, I know God. And had I not known God, then I probably would be panicking or losing my mind or going crazy or something because of the weight of what was going on. But by me having a relationship with him then I know that every place that my foot shall tread upon, whatever I’m going

through, if he ordained it, then he allowed it to happen. That's my safety, knowing that God is going to protect us." (P114; interviewed one year post-Katrina; moderate pre-Katrina trauma)

Although the theme of religious coping was shared across categories of pre-Katrina trauma, women with different levels of trauma described different degrees of importance to religion in their coping. Specifically, among the 10 women in the high pre-Katrina trauma group who described religion and prayer as an important strategy for coping with Katrina, over a third (n=4) described their faith or becoming involved with a church as the *only* strategy they used to cope with Katrina. One interviewee explained:

"The only thing that really helped me get through was finding a church and getting a better/closer relationship with God...I really had no choice because there was nothing else really available." (P118; interviewed four years post-Katrina; high pre-Katrina trauma)

In contrast, among women for whom religion was a key resilience factor, few women in the low (n=2) and moderate (n=1) pre-Katrina trauma groups described religious coping as the only coping strategy they employed to cope with Hurricane Katrina.

### **5.3.3. Theme 3: Sense of stability**

Gaining or returning to a sense of stability after the disruption of Katrina was crucial for many women's recovery. For many women, this meant moving into stable housing—either returning to their pre-Katrina housing or finding a different stable home—and returning to work. More women in the high and moderate pre-Katrina trauma groups described housing stability as a key resilience factor than women in the lowest tertile of pre-Katrina trauma exposure. The extent to which women perceived returning to work as an important factor affecting recovery

was similar across levels of pre-Katrina trauma, with just under half the women interviewed describing work-related concerns as helping or hindering recovery.

### *5.3.3.1. Theme 3a: Stable housing*

Women across all levels of pre-Katrina trauma exposure emphasized that finding and maintaining stable housing after Katrina was essential for their recovery. When asked at what point she felt like her life was back on track, one interviewee explained that receiving the key to a stable home for her and her children approximately 10 months after Katrina was the moment she felt that her life was back on track:

“When the man gave me the key to this door, I felt my life is back...I feel like everything is back together.” (P119; interviewed one year post-Katrina; low pre-Katrina trauma)

Furthermore, some interviewees defined recovery itself as having a stable home. A woman who was interviewed five years after Katrina described herself as “coping” rather than “recovered” from Katrina because she is “still moving” and not “settled in one place.” To her, owning a home would mean she was fully recovered:

“For me, I think recovery would be to have more stability and to be more settled in one place. I’m still moving. I’m still moving. From 2005 to 2006, I had an apartment. From 2006 to 2007, I moved to a different apartment and then from 2007 to 2009, here I am in a different place and talking about moving home again within this year...I think once we establish some stability, once home buying is part of the equation, I think I’ll feel more recovered.” (P202, interviewed five years post-Katrina; high pre-Katrina trauma)

Although the majority of interviewees described stable housing as an important resilience factor (24 out of 46 respondents), the proportion of interviewees who identified stable housing as a key part of their recovery increased alongside pre-Katrina trauma level. This variation in

perceived importance may arise from the greater emphasis that is placed on safety and security by people with higher trauma exposure [98,105].

### *5.3.3.2. Subtheme 3b: Work*

Another key aspect of stability described in the interviews was returning to work. Many interviewees reported that their ability to find work to support their families impacted their ability to recover from Katrina. Two subthemes emerged related to work in the post-Katrina context, with some participants expressing only one work-related theme and others experiencing both themes.

First, just under a quarter of all respondents (10 out of 46) noted that finding a steady job after Katrina facilitated recovery. When asked whether she had recovered from Katrina and what recovery meant to her, an interviewee who relocated to Houston after the storm explained that once she started working again, recovery “pretty much came naturally”:

“At one time I used to not necessarily be depressed, just be like, ‘Dang,’ like especially when I didn’t have a job at first, right after the storm. Like then I couldn’t work here, have money coming in, living a normal life. But once I started working and getting on my feet...it pretty much came naturally.” (P127; interviewed four years post-Katrina; moderate pre-Katrina trauma)

Others saw finding work as a way to take control of their situation after having their lives disrupted by Hurricane Katrina:

“I felt like I was in control when I had a job. When I was able to provide for my family. Seeing my family down like that, that really tore me to pieces...When I don’t have control of a situation that I know I can get control of, I just lost it...Just in general, I feel

like I need to be in control at all times or I'm going to lose it.” (P111; interviewed one year post-Katrina; high pre-Katrina trauma)

Second, many interviewees (13 out of 46) described difficulty finding work as a barrier to recovery. Describing what she perceived as the most difficult aspect of her recovery in the first year after Hurricane Katrina, one woman said:

“[The most difficult part of it all was] keeping a job, a steady hourly job. Back in New Orleans [before Katrina], I was the same security guard for the full eight months. I had a secondary job working warehouse, and prior to that I was at McDonald's for three years. I have never had this problem of keeping employment... That's my biggest thing, finding a job, a job that has decent hours and the pay is decent.” (P131; interviewed one year post-Katrina; moderate pre-Katrina trauma)

Although a similar proportion of women at all levels of pre-Katrina trauma exposure identified work as key to their recovery, the prevalence of each work-related theme differed by degree of pre-Katrina trauma exposure. Women in the high pre-Katrina trauma group emphasized how their recovery was negatively impacted by difficulty finding work, whereas women with low and moderate pre-Katrina trauma exposure emphasized the positive effect that returning to work had on their recovery. This may suggest that women with the greatest pre-Katrina trauma exposure had more difficulty finding employment than women with lower levels of prior trauma.

#### **5.4. DISCUSSION**

The aim of this study was to examine factors identified by women affected by Hurricane Katrina as keys to coping with and recovering from Katrina, and to examine potential differences between women with higher and lower levels of pre-Katrina trauma. Three main factors that

women perceived as influencing their recovery were identified. First, they reported that new opportunities they found after Katrina facilitated their recovery. These new opportunities included the availability of better jobs, the ability to provide what they saw as a better environment for their children, perceiving new possibilities for their lives, and improved living conditions or housing. More than half of women with the highest levels of pre-Katrina trauma noted these types of experiences as a resilience factor, whereas far fewer women with low or moderate pre-Katrina trauma exposure described new opportunities as being key to their recovery.

Second, around two-thirds of all interviewees identified their religion as an essential resilience factor, and prayer or reliance on God as an important coping strategy. Although women across all levels of pre-Katrina trauma noted the importance of religion, women in the high pre-Katrina trauma group were more likely than women in the low and moderate groups to describe faith or prayer as the only or primary strategy they used to cope with the stress of Katrina. These findings regarding the importance of religion in coping with Katrina are consistent with the results of previous studies using these data, although no previous studies examined how the use of religious coping may vary by pre-Katrina trauma exposure [35,104].

Third, many women noted that gaining housing and job stability after the disruption and destruction of Katrina was key to their perceived recovery. The majority of participants identified stable housing as an important resilience factor; however, the proportion of women who described housing as important for recovery was greater among women with higher levels of pre-Katrina trauma exposure.

Many women who experienced a high level of pre-Katrina trauma perceived Katrina as ultimately having a positive effect on their lives because it led to more employment

opportunities, better living conditions, and new possibilities for their future. One possible explanation for this finding is that women with prior trauma exposure felt that the possibilities for their life were so limited in New Orleans that the disruption of Katrina was, on net, positive because it forced them out of that environment into a better life trajectory. One interviewee described New Orleans as a prison, a “bondage place,” that she would not have been able to escape if Katrina had not happened. Per the conservation of resources theory, trauma exposure can lead to losses of social, economic, and psychological resources [24]. Losses of resources can prevent individuals from leaving a potentially dangerous situation or a situation in which one’s opportunities are severely limited [47]. Therefore, it is plausible that women with the highest pre-Katrina trauma exposure were in fact the most disadvantaged and trapped by their pre-disaster circumstances. Future research should explore ways in which these types of negative situations could be disrupted to create new opportunities without an event as traumatic and life-threatening as Katrina.

The finding that women with greater pre-Katrina trauma exposure were more likely to emphasize housing stability and concerns about finding work may reflect the ways in which prior trauma affects an individual’s psychosocial needs. Maslow’s hierarchy of needs provides a potential framework for understanding the differences we observed in perceived resilience factors among women with differing levels of pre-Katrina trauma exposure [98,105]. Because people with prior trauma exposure, and particularly those who develop PTSD as a result, are more likely to interpret stressors as potential threats [63,93–97], the women with high pre-Katrina trauma exposure may have perceived Katrina as even more threatening than women with lower prior trauma exposure. According to Maslow’s hierarchy, people in a state of fear are focused on meeting their most fundamental needs, and all other needs become secondary until

their basic physiological and safety requirements are fulfilled [98,105]. Consequently, women with the highest pre-Katrina trauma exposure may have been focused primarily on meeting their needs for safety and security in the aftermath of Katrina. Therefore, ensuring that their family's basic needs, such as safe and stable housing, were met became the most important factor affecting their level of distress.

Several of the resilience factors identified in this study are modifiable and therefore may have implications for the development of post-disaster interventions to facilitate recovery. In particular, findings regarding the importance of housing stability and returning to work for recovery suggest that disaster relief efforts should focus on helping survivors find stable housing and employment. For example, several interviewees described attending job fairs specifically for Katrina evacuees, where they were quickly able to find steady employment. Recovery efforts for future disasters could involve similar events to connect disaster survivors with employers. Interventions should also prioritize helping survivors establish stable housing as soon as possible post-disaster.

There are several limitations to this study. First, because this study focuses on low-income mothers who experienced Hurricane Katrina, these findings may not be generalizable to all disaster survivors. In addition, pre-Katrina trauma exposure was retrospectively self-reported and therefore may be affected by recall bias. Finally, this paper did not examine community-level resources that may impact individual resilience, such as community social capital and engagement or collective efficacy [38,106]. Community resources in areas to which disaster survivors evacuate or resettle may be good targets for post-disaster interventions to promote resilience, as community-level interventions can reach a large number of people at once.

Despite these limitations, this study represents a step towards understanding the experiences of a vulnerable group of disasters survivors as they recovered from Hurricane Katrina, and fills an important gap in the disaster recovery literature. Because prior research suggests that people with pre-disaster trauma exposure are less likely to exhibit resilience or “bounce back” quickly from a disaster, these findings have important implications for understanding how to mitigate distress and facilitate recovery among people with pre-disaster trauma exposure [33,73].

## 6. SUMMARY

This dissertation aimed to assess the impact of exposure to pre-Katrina traumatic events on number and severity of disaster-related traumas, the long-term mental health impacts of disasters, and the factors that women perceive as keys to their disaster recovery and coping.

Manuscript 1 examined the extent to which pre-Katrina traumas predict the number and severity of Katrina-related traumatic events. Results indicate that experiencing traumatic events prior to Hurricane Katrina was associated with greater Katrina-related trauma exposure.

Specifically, women who experienced more traumatic events prior to Hurricane Katrina reported a greater number of Katrina-related traumas and had a greater risk for specific Katrina-related traumatic events, particularly feeling that their life was in danger in the week after Hurricane Katrina. Because the degree of disaster-related traumatic events experienced is one of the factors that most strongly predicts post-disaster mental health problems, these findings suggest that pre-disaster trauma exposure may partially explain differential psychological responses to disasters.

Manuscript 2 evaluated the extent to which pre-Katrina traumatic experiences explain differences in long-term trajectories of Katrina-specific PTSD among survivors with similar levels of Katrina-related trauma. Four PTSD trajectories were identified: 1) a Resistant trajectory characterized by low initial Katrina-specific PTSD symptoms that remain low over time, 2) a Recovery trajectory, in which PTSD symptoms were initially high before decreasing over time, 3) a Delayed-Onset trajectory characterized by PTSD symptoms that were initially low before increasing over time to cross the cut-off for probable PTSD, and 4) a Chronic-High trajectory, where participant experienced high PTSD symptoms that remained elevated across all three post-Katrina timepoints. After adjusting for covariates, including pre-Katrina psychological distress and Katrina-related and post-Katrina trauma, pre-Katrina trauma exposure was not associated

with the probability of long-term, chronic Katrina-specific PTSD. Of the various types of trauma exposure examined, Chronic-High PTSD was most strongly influenced by cumulative trauma exposure and Katrina-related trauma. When covariates were added to the model one at a time, the association between pre-Katrina trauma and Chronic-High PTSD was attenuated most by the addition of Katrina-related trauma. This suggests that while pre-Katrina trauma may impact PTSD through other factors that affect Katrina-related PTSD, such as by increasing severity of Katrina-related trauma, pre-Katrina trauma exposure does not have a strong direct effect on chronic Katrina-specific PTSD.

Using qualitative interview data, Manuscript 3 examined sources of resilience identified by Katrina survivors with a history of prior trauma as key to their recovery from Hurricane Katrina. Three main factors that women with a history of pre-Katrina trauma perceived as influencing their recovery were identified. First, they reported that new opportunities they found after Katrina facilitated their recovery, including the availability of better jobs, the ability to provide what they saw as a better environment for their children, perceiving new possibilities for their lives, and improved living conditions or housing. Second, around two-thirds of participants identified their religion as an essential resilience factor, and prayer or reliance on God as an important coping strategy. Third, many women noted that gaining housing and job stability after the disruption and destruction of Katrina was key to their perceived recovery. Several of the resilience factors identified in this study are modifiable and therefore may have implications for the development of post-disaster interventions to facilitate recovery. In particular, findings regarding the importance of housing stability and returning to work for recovery suggest that disaster relief efforts should focus on helping survivors find stable housing and employment.

The results of the manuscripts presented in this dissertation indicate that although pre-disaster trauma exposure may not have a strong direct effect on chronic disaster-related PTSD, it is associated with greater disaster-related trauma exposure, which in turn is one of the strongest predictors of post-disaster mental health problems [16]. Pre-disaster traumatic events also influenced the factors that women perceived as helping or hindering their disaster recovery.

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## 8. APPENDICES

### Appendix A – Full results from Manuscript 1 adjusted models

**Table A.1.** Association of pre-Katrina traumatic events with Katrina-related trauma

	<i>In the week after Hurricane Katrina hit, was there a time when...</i>				Experienced moderate to severe home damage due to Katrina	Lost a family member or close friend due to Katrina
	You didn't have enough food to eat or fresh water to drink?	You or a family member needed medicine or medical care but couldn't get it?	You didn't know if your children or other immediate family members were safe?	You felt your life was in danger?		
	(42.1%)	(51.7%)	(80.1%)	(34.3%)		
<i>% with outcome</i>	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)
Experienced any pre-Katrina traumatic events						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	1.02 (0.84, 1.24)	1.19 (1.00, 1.41)	1.21 (1.09, 1.33)	1.25 (0.99, 1.57)	1.09 (1.01, 1.18)	1.17 (0.95, 1.44)
Baseline age (years)	1.01 (0.99, 1.03)	1.02 (1.00, 1.03)	0.99 (0.98, 1.00)	1.01 (0.98, 1.03)	1.00 (0.99, 1.00)	1.04 (1.02, 1.06)
Race						
Not non-Hispanic Black	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Non-Hispanic Black	1.69 (1.15, 2.49)	1.22 (0.92, 1.60)	1.13 (0.98, 1.30)	1.31 (0.90, 1.92)	1.12 (0.97, 1.29)	1.53 (1.11, 2.10)
Baseline partnership status						
Not married or cohabitating	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Married or cohabitating	0.72 (0.55, 0.94)	0.87 (0.72, 1.05)	1.05 (0.96, 1.16)	0.79 (0.57, 1.11)	0.92 (0.83, 1.01)	0.97 (0.79, 1.20)
Number of public benefits received at baseline (0-4)	1.06 (0.95, 1.19)	0.99 (0.91, 1.09)	1.02 (0.96, 1.09)	1.00 (0.87, 1.15)	1.10 (1.05, 1.15)	1.07 (0.95, 1.22)
Baseline perceived social support (1-4)	0.79 (0.65, 0.96)	0.89 (0.74, 1.08)	0.92 (0.84, 1.02)	0.67 (0.51, 0.88)	0.97 (0.89, 1.05)	0.89 (0.70, 1.12)
Baseline psychological distress (0-24)	1.02 (0.99, 1.04)	1.02 (1.00, 1.04)	0.99 (0.98, 1.00)	1.01 (0.98, 1.03)	1.00 (0.99, 1.00)	1.00 (0.98, 1.02)

**Table A.2.** Association of number of pre-Katrina traumatic events with Katrina-related trauma

	<i>In the week after Hurricane Katrina hit, was there a time when...</i>				<b>Experienced moderate to severe home damage due to Katrina</b>	<b>Lost a family member or close friend due to Katrina</b>
	<b>You didn't have enough food to eat or fresh water to drink?</b>	<b>You or a family member needed medicine or medical care but couldn't get it?</b>	<b>You didn't know if your children or other immediate family members were safe?</b>	<b>You felt your life was in danger?</b>		
	(42.1%)	(51.7%)	(80.1%)	(34.3%)		
<i>% with outcome</i>	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	
Number of pre-Katrina traumatic events experienced						
0	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
1	1.01 (0.79, 1.30)	1.11 (0.91, 1.35)	1.10 (0.97, 1.24)	1.02 (0.77, 1.36)	1.06 (0.97, 1.17)	1.02 (0.79, 1.32)
2	1.05 (0.81, 1.37)	1.15 (0.85, 1.54)	1.22 (1.07, 1.40)	1.17 (0.83, 1.63)	1.06 (0.94, 1.18)	1.07 (0.78, 1.46)
3+	1.02 (0.80, 1.29)	1.28 (1.04, 1.59)	1.31 (1.17, 1.46)	1.51 (1.13, 2.01)	1.14 (1.03, 1.26)	1.36 (1.08, 1.71)
Baseline age (years)	1.01 (0.99, 1.03)	1.01 (1.00, 1.03)	0.99 (0.98, 1.00)	1.00 (0.98, 1.03)	0.99 (0.99, 1.00)	1.03 (1.02, 1.05)
Race						
Not non-Hispanic Black	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Non-Hispanic Black	1.69 (1.16, 2.48)	1.23 (0.93, 1.62)	1.14 (0.99, 1.31)	1.34 (0.92, 1.95)	1.13 (0.98, 1.30)	1.56 (1.14, 2.13)
Baseline partnership status						
Not married or cohabitating	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Married or cohabitating	0.72 (0.55, 0.94)	0.87 (0.72, 1.05)	1.06 (0.96, 1.16)	0.80 (0.57, 1.12)	0.92 (0.84, 1.01)	0.98 (0.80, 1.21)
Number of public benefits received at baseline (0-4)	1.06 (0.95, 1.19)	0.99 (0.90, 1.09)	1.02 (0.95, 1.08)	0.99 (0.86, 1.14)	1.10 (1.05, 1.15)	1.07 (0.94, 1.21)
Baseline perceived social support (1-4)	0.79 (0.65, 0.95)	0.89 (0.74, 1.07)	0.92 (0.84, 1.01)	0.66 (0.51, 0.87)	0.97 (0.89, 1.05)	0.88 (0.70, 1.11)
Baseline psychological distress (0-24)	1.02 (0.99, 1.04)	1.01 (0.99, 1.03)	0.99 (0.98, 1.00)	1.01 (0.98, 1.03)	1.00 (0.99, 1.00)	1.00 (0.97, 1.02)

**Table A.3.** Association of pre-Katrina assaultive and non-assaultive traumatic events with Katrina-related trauma (mutually adjusted)

	<i>In the week after Hurricane Katrina hit, was there a time when...</i>				<b>Experienced moderate to severe home damage due to Katrina</b>	<b>Lost a family member or close friend due to Katrina</b>
	<b>You didn't have enough food to eat or fresh water to drink?</b>	<b>You or a family member needed medicine or medical care but couldn't get it?</b>	<b>You didn't know if your children or other immediate family members were safe?</b>	<b>You felt your life was in danger?</b>		
	(42.1%)	(51.7%)	(80.1%)	(34.3%)		
<i>% with outcome</i>	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	
Experienced any pre-Katrina assaultive traumatic events						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	1.04 (0.82, 1.31)	1.08 (0.89, 1.30)	1.12 (1.03, 1.22)	1.17 (0.93, 1.47)	1.06 (0.98, 1.15)	1.13 (0.92, 1.39)
Experienced any pre-Katrina non-assaultive traumatic events						
No	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Yes	1.00 (0.82, 1.22)	1.19 (1.03, 1.39)	1.14 (1.03, 1.26)	1.25 (1.02, 1.53)	1.07 (0.98, 1.16)	1.15 (0.93, 1.42)
Baseline age (years)	1.01 (0.99, 1.03)	1.01 (1.00, 1.03)	0.99 (0.98, 1.00)	1.00 (0.98, 1.03)	0.99 (0.99, 1.00)	1.04 (1.02, 1.06)
Race						
Not non-Hispanic Black	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Non-Hispanic Black	1.70 (1.16, 2.48)	1.22 (0.93, 1.61)	1.13 (0.98, 1.31)	1.33 (0.91, 1.94)	1.13 (0.98, 1.30)	1.54 (1.12, 2.11)
Baseline partnership status						
Not married or cohabitating	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Married or cohabitating	0.72 (0.55, 0.94)	0.87 (0.72, 1.06)	1.06 (0.96, 1.16)	0.79 (0.57, 1.11)	0.92 (0.84, 1.01)	0.98 (0.79, 1.20)
Number of public benefits received at baseline (0-4)	1.06 (0.95, 1.19)	0.99 (0.90, 1.08)	1.02 (0.95, 1.08)	0.99 (0.86, 1.14)	1.10 (1.05, 1.14)	1.07 (0.94, 1.21)
Baseline perceived social support (1-4)	0.79 (0.65, 0.95)	0.89 (0.74, 1.07)	0.92 (0.84, 1.01)	0.67 (0.51, 0.88)	0.97 (0.89, 1.05)	0.89 (0.70, 1.12)
Baseline psychological distress (0-24)	1.02 (0.99, 1.04)	1.01 (0.99, 1.03)	0.99 (0.98, 1.00)	1.01 (0.98, 1.04)	1.00 (0.99, 1.00)	1.00 (0.97, 1.02)

**Table A.4.** Association of number of assaultive and non-assaultive pre-Katrina traumatic events with Katrina-related trauma (mutually adjusted)

	<i>In the week after Hurricane Katrina hit, was there a time when...</i>				<b>Experienced moderate to severe home damage due to Katrina</b>	<b>Lost a family member or close friend due to Katrina</b>
	<b>You didn't have enough food to eat or fresh water to drink?</b>	<b>You or a family member needed medicine or medical care but couldn't get it?</b>	<b>You didn't know if your children or other immediate family members were safe?</b>	<b>You felt your life was in danger?</b>		
	<i>% with outcome</i> (42.1%)	(51.7%)	(80.1%)	(34.3%)		
	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)	<u>Adj</u> RR (95% CI)
Number of pre-Katrina assaultive traumatic events experienced						
0	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
1	1.05 (0.82, 1.34)	1.07 (0.88, 1.31)	1.07 (0.97, 1.17)	1.07 (0.83, 1.38)	1.05 (0.96, 1.14)	1.07 (0.84, 1.37)
2+	1.03 (0.74, 1.43)	1.04 (0.81, 1.35)	1.20 (1.07, 1.34)	1.25 (0.92, 1.71)	1.07 (0.97, 1.18)	1.18 (0.92, 1.52)
Number of pre-Katrina non-assaultive traumatic events experienced						
0	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
1	1.01 (0.82, 1.25)	1.13 (0.96, 1.33)	1.13 (1.01, 1.25)	1.16 (0.91, 1.48)	1.05 (0.96, 1.15)	1.08 (0.84, 1.38)
2+	0.99 (0.76, 1.29)	1.29 (1.06, 1.57)	1.12 (1.00, 1.26)	1.31 (1.01, 1.68)	1.08 (0.97, 1.19)	1.21 (0.94, 1.56)
Baseline age (years)	1.01 (0.99, 1.03)	1.01 (1.00, 1.03)	0.99 (0.98, 1.00)	1.00 (0.98, 1.03)	0.99 (0.99, 1.00)	1.04 (1.02, 1.05)
Race						
Not non-Hispanic Black	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Non-Hispanic Black	1.69 (1.15, 2.49)	1.22 (0.93, 1.60)	1.14 (0.99, 1.32)	1.34 (0.92, 1.96)	1.13 (0.98, 1.30)	1.55 (1.13, 2.12)
Baseline partnership status						
Not married or cohabitating	(ref)	(ref)	(ref)	(ref)	(ref)	(ref)
Married or cohabitating	0.72 (0.55, 0.94)	0.88 (0.73, 1.06)	1.06 (0.96, 1.16)	0.79 (0.57, 1.11)	0.92 (0.84, 1.01)	0.98 (0.79, 1.20)
Number of public benefits received at baseline (0-4)	1.06 (0.95, 1.19)	0.99 (0.90, 1.09)	1.02 (0.95, 1.08)	0.99 (0.86, 1.14)	1.10 (1.05, 1.14)	1.07 (0.94, 1.21)
Baseline perceived social support (1-4)	0.79 (0.65, 0.96)	0.88 (0.73, 1.06)	0.93 (0.84, 1.02)	0.67 (0.51, 0.88)	0.97 (0.89, 1.05)	0.88 (0.88, 1.12)
Baseline psychological distress (0-24)	1.02 (0.99, 1.04)	1.01 (0.99, 1.03)	0.99 (0.98, 1.00)	1.01 (0.98, 1.03)	1.00 (0.99, 1.00)	1.00 (0.97, 1.02)

## Appendix B – Results from Manuscript 2 secondary analyses

To examine potential non-linearities between trauma exposure and PTSD trajectories, I examined quartiles of pre-Katrina, Katrina-related, post-Katrina and cumulative traumatic events. Most findings were similar to those from the primary analyses. However, in a few places, traumatic exposures appeared to have a somewhat non-linear relationship with PTSD trajectories. For example, the probability of the Recovery trajectory was the same across the first three quartiles of pre-Katrina trauma exposure, and decreased only at the fourth quartile. In addition to assessing the association of an overall increase in each type of trauma exposure with PTSD trajectories, I also examined whether the association of trauma exposure with predicted probability of each trajectory varied by level of trauma exposure by analyzing quartiles of trauma exposure. **Table B.1** shows the proportion of women in each quartile of trauma exposure by PTSD trajectory group.

### *Predictors of membership in Resistant trajectory (49.0%)*

**Table B.2** and **Figure B.1** show the predicted probability of membership in the Resistant trajectory by quartile of trauma exposure. In accordance with my findings in the primary analyses, pre-Katrina trauma exposure did not affect probability of the Resistant trajectory at any level of exposure. When I assessed the effect of level of Katrina-related trauma exposure on probability of the Resistant trajectory, I found that predicted probability was approximately the same for women in the lowest two quartiles of Katrina-related trauma, and then decreased in a dose-response manner from the second to third quartiles and the third to fourth quartiles. This indicates a possible threshold effect that was not observed in the primary analyses.

Similarly, predicted probability of the Resistant trajectory was approximately the same in the first and second quartiles of post-Katrina trauma exposure, before decreasing from 0.52 (95%

CI=0.44, 0.59) for women in the second quartile to 0.47 (95% CI=0.40, 0.54) and 0.38 (95% CI=0.27, 0.48) in the third and fourth quartiles of post-Katrina trauma, respectively. This also suggests a potential threshold effect. When I examined the effect of assaultive and non-assaultive post-Katrina traumas, I found that only assaultive trauma decreased probability of the Resistant trajectory. In contrast, the primary analyses did not show a significant impact of any type of post-Katrina trauma on predicted probability of the Resistant trajectory. Finally, probability of the Resistant trajectory steadily decreased as cumulative trauma exposure increased.

*Predictors of membership in Recovery trajectory (29.3%)*

**Table B.3** and **Figure B.2** show the predicted probability of membership in the Recovery trajectory by quartile of trauma exposure. Probability of the Recovery trajectory was inconsistent in direction across the first three quartiles of pre-Katrina trauma exposure; predicted probability was 0.33 (95% CI=0.27, 0.39), 0.27 (95% CI=0.20, 0.35), and 0.31 (95% CI=0.24, 0.38) for women in the first, second, and third quartiles of pre-Katrina trauma exposure, respectively. Probability then decreased substantially to 0.22 (95% CI=0.14, 0.30) for women in the fourth quartile. This differs from the moderate negative association between pre-Katrina trauma exposure and probability of the Recovery trajectory that I observed in the primary analyses. For level of Katrina-related and post-Katrina trauma exposure, my findings in the primary and secondary analyses were similar; Katrina-related and post-Katrina trauma were associated with small increases in probability of the Recovery trajectory.

When the association between cumulative trauma exposure and probability of the Recovery trajectory was analyzed across quartiles of trauma exposure, there was a positive dose-response association for women in the first three quartiles of cumulative trauma exposure, with predicted probability increasing from 0.22 (95% CI=0.16, 0.28) for women in the first quartile to

0.29 (95% CI=0.22, 0.36) in the second quartile, and 0.41 (95% CI=0.32, 0.49) in the third quartile. Predicted probability then decreased to approximately the baseline probability of the Recovery trajectory (0.31; 95% CI=0.23, 0.38) for women in the highest quartile of cumulative trauma exposure. These differences in the association between probability of trajectory group membership and level of cumulative trauma exposure were obscured in the primary analyses, which evaluated the overall effect of an increase in cumulative trauma exposure and showed no association between total number of traumatic events reported and probability of the Recovery trajectory.

*Predictors of membership in Delayed-Onset trajectory (8.0%)*

**Table B.4** and **Figure B.3** show the predicted probability of membership in the Delayed-Onset trajectory by quartile of trauma exposure. Like the findings from the primary analyses, level of pre-Katrina trauma exposure had little association with the predicted probability of the Delayed-Onset trajectory. For Katrina-related trauma, there was a clear dose-response relationship between number of Katrina-related traumatic events experienced and the probability of Delayed-Onset PTSD. Predicted probability was approximately the same for women in the first and second quartiles of post-Katrina trauma exposure, before increasing in a dose-response manner for women in the third and fourth quartiles. Probability of Delayed-Onset PTSD for women in the highest quartile of post-Katrina trauma exposure (0.14; 95% CI=0.07, 0.21) is more than double the probability among women in the first quartile (0.06; 95% CI=0.02, 0.09). This aligns with the positive association between number of post-Katrina traumatic events and probability of the Delayed-Onset trajectory I observed in the primary analyses. Both assaultive and non-assaultive post-Katrina trauma increased probability of Delayed-Onset PTSD, although the effect of assaultive trauma was larger in magnitude than the effect of non-assaultive trauma.

With regard to level of cumulative trauma exposure, the probability of Delayed-Onset PTSD is roughly the same across the first three quartiles of trauma exposure but increases from 0.07 (95% CI=0.03, 0.11) for women in the third quartile to 0.12 (95% CI=0.07, 0.17) for women in the fourth quartile. This suggests a possible threshold effect.

*Predictors of membership in Chronic-High trajectory (13.7%)*

**Table B.5** and **Figure B.4** show the predicted probability of membership in the Chronic-High trajectory by quartile of trauma exposure. The association between level of pre-Katrina trauma exposure and predicted probability of Chronic-High PTSD was similar to the association observed in the primary analyses; in both sets of analyses, pre-Katrina trauma exposure had little effect on probability of the Chronic-High trajectory in the fully adjusted models. Number of Katrina-related traumatic events was positively associated with probability of Chronic-High PTSD for women in the third and fourth quartile of Katrina-related trauma exposure. Predicted probability was approximately the same for women in Quartiles 1 and 2, and then increased for women in the third and fourth quartiles, with a particularly large increase in probability for women in the highest quartile of Katrina-related trauma exposure. Probability increased from 0.09 (95% CI=0.03, 0.15) for women in the second quartile to 0.14 (95% CI=0.10, 0.18) and 0.23 (95% CI=0.16, 0.31) for the third and fourth quartiles, respectively.

Predicted probability of Chronic-High PTSD was similar across the first three quartiles of post-Katrina trauma exposure but increased moderately for women in the fourth quartile.

Number of post-Katrina assaultive traumatic events had a much greater impact on predicted probability of the Chronic-High trajectory than non-assaultive trauma. Predicted probability was 0.13 (95% CI=0.10, 0.16) for women who experienced no post-Katrina assaultive traumas and 0.10 (95% CI=0.05, 0.14) for women who reported one post-Katrina assaultive traumatic event.

Women who experienced two or more post-Katrina assaultive traumas were more than twice as likely to have Chronic-High PTSD, with a predicted probability of 0.27 (95% CI=0.15, 0.38), although the confidence interval around this estimate is fairly wide.

Finally, predicted probability of the Chronic-High trajectory increased in a dose-response manner across the first, second, and third quartiles of cumulative trauma exposure before increasing substantially between the third and fourth quartiles; women with cumulative trauma scores in the third quartile had a predicted probability of 0.14 (95% CI=0.08, 0.20) and women in the fourth quartile had a predicted probability of 0.25 (95% CI=0.18, 0.32). This corresponds with the large increase in probability of Chronic-High PTSD associated with cumulative trauma exposure that I observed in the primary analyses.

**Table B.1.** Quartile of trauma exposure for participants with most likely membership in each PTSD trajectory

	<i>Trajectory Group</i>			
	<b>Resistant</b> (n=357, 49.0%) Mean (SD) or %	<b>Recovery</b> (n=213, 29.3%) Mean (SD) or %	<b>Delayed-Onset</b> (n=58, 8.0%) Mean (SD) or %	<b>Chronic-High</b> (n=100, 13.7%) Mean (SD) or %
<b>Pre-Katrina trauma exposure</b>				
Number of pre-Katrina traumas experienced (range: 0-14)	1.45 (1.82)	1.47 (1.61)	2.04 (2.05)	2.52 (2.75)
Quartile 1 (0 traumas)	41.8%	40.4%	29.8%	30.8%
Quartile 2 (1 trauma)	24.0%	18.0%	22.8%	17.6%
Quartile 3 (2-3 traumas)	20.4%	27.3%	22.8%	25.3%
Quartile 4 (4-14 traumas)	13.8%	14.2%	24.6%	26.4%
<b>Katrina-related trauma and hardship</b>				
Number of Katrina-related traumas (range: 0-8)	2.27 (1.93)	3.41 (2.32)	3.46 (2.29)	4.46 (2.44)
Quartile 1 (0-1 traumas)	46.9%	28.4%	25.0%	14.4%
Quartile 2 (2 traumas)	19.4%	11.9%	13.5%	8.3%
Quartile 3 (3-5 traumas)	25.8%	38.3%	36.5%	38.1%
Quartile 4 (6-8 traumas)	7.9%	21.4%	25.0%	39.2%
<b>Post-Katrina trauma exposure</b>				
Number of post-Katrina traumas experienced (range: 0-15)	2.19 (1.66)	2.66 (1.94)	3.28 (2.10)	3.45 (2.55)
Quartile 1 (0-1 traumas)	40.5%	29.0%	21.1%	20.9%
Quartile 2 (2 traumas)	22.0%	21.3%	17.5%	19.8%
Quartile 3 (3-4 traumas)	28.3%	36.0%	35.1%	29.7%
Quartile 4 (5-15 traumas)	9.2%	13.7%	26.3%	29.7%
<b>Cumulative trauma exposure (count of pre-Katrina, Katrina-related and post Katrina traumatic events)</b>				
Total number of traumas (range: 0-35)	6.82 (3.88)	8.88 (4.14)	10.22 (5.33)	11.85 (5.36)
Quartile 1 (0-5 traumas)	43.6%	21.6%	23.5%	12.6%
Quartile 2 (6-8 traumas)	29.3%	25.7%	23.5%	16.1%
Quartile 3 (9-11 traumas)	14.3%	26.9%	15.7%	20.7%
Quartile 4 (12-35 traumas)	12.9%	25.7%	37.3%	50.6%

**Table B.2.** Predicted probability of membership in the Resistant trajectory by level of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Level of Pre-Katrina Trauma Exposure<sup>1</sup></b>		
<i>Number of pre-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.53 (0.47, 0.59)	0.47 (0.42, 0.53)
Quartile 2	0.55 (0.47, 0.63)	0.51 (0.44, 0.58)
Quartile 3	0.44 (0.36, 0.52)	0.48 (0.41, 0.56)
Quartile 4	0.40 (0.31, 0.50)	0.53 (0.44, 0.62)
<i>Number of pre-Katrina assaultive traumatic events experienced</i>		
0	0.52 (0.47, 0.57)	0.49 (0.44, 0.53)
1	0.49 (0.41, 0.57)	0.50 (0.44, 0.57)
2+	0.42 (0.33, 0.50)	0.50 (0.42, 0.59)
<i>Number of pre-Katrina non-assaultive traumatic events experienced</i>		
0	0.52 (0.47, 0.57)	0.47 (0.42, 0.52)
1	0.51 (0.43, 0.59)	0.52 (0.45, 0.59)
2+	0.41 (0.33, 0.49)	0.51 (0.43, 0.58)
<b>Level of Katrina-Related Trauma Exposure<sup>2</sup></b>		
<i>Number of hurricane traumas (0-8; quartiles)</i>		
Quartile 1	0.66 (0.60, 0.71)	0.59 (0.53, 0.66)
Quartile 2	0.62 (0.53, 0.72)	0.58 (0.49, 0.67)
Quartile 3	0.39 (0.33, 0.46)	0.43 (0.36, 0.49)
Quartile 4	0.22 (0.15, 0.30)	0.31 (0.21, 0.40)
<b>Level of Post-Katrina Trauma Exposure<sup>3</sup></b>		
<i>Number of post-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.60 (0.53, 0.66)	0.54 (0.48, 0.61)
Quartile 2	0.52 (0.43, 0.60)	0.52 (0.44, 0.59)
Quartile 3	0.45 (0.38, 0.52)	0.47 (0.40, 0.54)
Quartile 4	0.32 (0.22, 0.41)	0.38 (0.27, 0.48)
<i>Number of post-Katrina assaultive traumatic events experienced</i>		
0	0.53 (0.49, 0.58)	0.52 (0.48, 0.56)
1	0.45 (0.37, 0.54)	0.46 (0.38, 0.54)

2+	0.24 (0.12, 0.36)	0.31 (0.18, 0.45)
<i>Number of post-Katrina non-assaultive traumatic events experienced</i>		
0	0.54 (0.44, 0.63)	0.49 (0.40, 0.58)
1	0.62 (0.54, 0.69)	0.56 (0.48, 0.64)
2+	0.44 (0.39, 0.48)	0.47 (0.42, 0.51)

**Level of Cumulative Trauma Exposure<sup>4</sup>**

*Total number of traumatic events experienced (quartiles)*

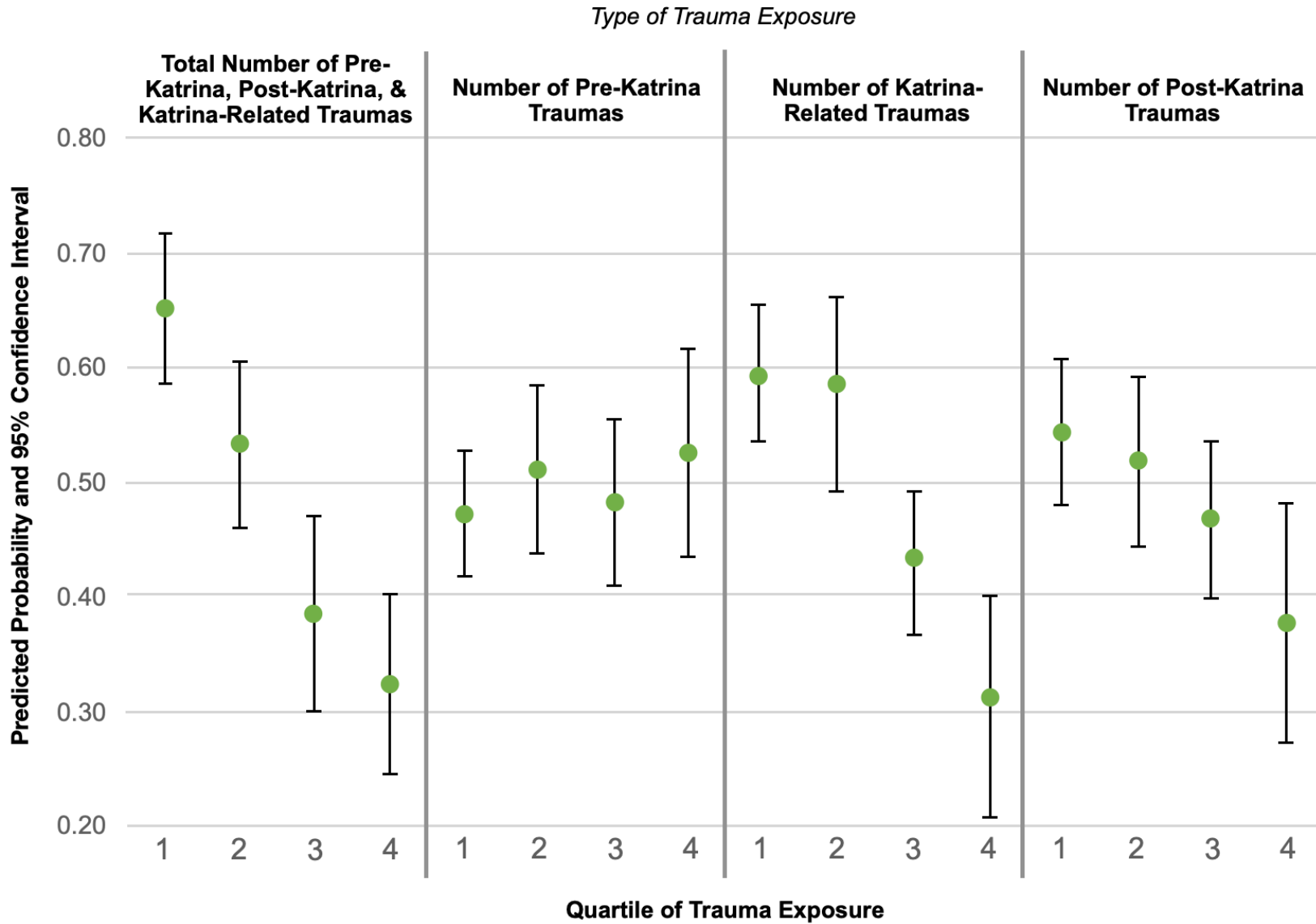
Quartile 1	0.68 (0.61, 0.74)	0.65 (0.59, 0.72)
Quartile 2	0.55 (0.48, 0.63)	0.53 (0.46, 0.61)
Quartile 3	0.38 (0.30, 0.47)	0.39 (0.30, 0.47)
Quartile 4	0.28 (0.20, 0.35)	0.32 (0.24, 0.40)

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.



**Figure B.1.** Predicted probability of membership in Resistant trajectory group by quartile and type of trauma exposure

**Table B.3.** Predicted probability of membership in the Recovery trajectory by level of trauma exposure

	Model	
	Crude	Fully Adjusted
	Predicted probability (95% CI)	Predicted probability (95% CI)
<b>Level of Pre-Katrina Trauma Exposure<sup>1</sup></b>		
<i>Number of pre-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.30 (0.25, 0.36)	0.33 (0.27, 0.39)
Quartile 2	0.26 (0.18, 0.33)	0.27 (0.20, 0.35)
Quartile 3	0.33 (0.26, 0.41)	0.31 (0.24, 0.38)
Quartile 4	0.26 (0.17, 0.34)	0.22 (0.14, 0.30)
<i>Number of pre-Katrina assaultive traumatic events experienced</i>		
0	0.30 (0.25, 0.34)	0.31 (0.26, 0.36)
1	0.32 (0.25, 0.39)	0.31 (0.24, 0.38)
2+	0.25 (0.18, 0.32)	0.24 (0.17, 0.32)
<i>Number of pre-Katrina non-assaultive traumatic events experienced</i>		
0	0.30 (0.25, 0.34)	0.31 (0.26, 0.36)
1	0.30 (0.23, 0.37)	0.30 (0.23, 0.37)
2+	0.27 (0.20, 0.35)	0.25 (0.18, 0.33)
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
<i>Number of hurricane traumas (0-8; quartiles)</i>		
Quartile 1	0.23 (0.18, 0.28)	0.27 (0.21, 0.33)
Quartile 2	0.23 (0.15, 0.31)	0.25 (0.17, 0.34)
Quartile 3	0.35 (0.29, 0.42)	0.34 (0.28, 0.40)
Quartile 4	0.36 (0.28, 0.45)	0.34 (0.25, 0.43)
<b>Level of Post-Katrina Trauma Exposure<sup>3</sup></b>		
<i>Number of post-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.26 (0.20, 0.32)	0.28 (0.22, 0.34)
Quartile 2	0.29 (0.22, 0.36)	0.28 (0.21, 0.35)
Quartile 3	0.33 (0.27, 0.40)	0.32 (0.26, 0.39)
Quartile 4	0.28 (0.19, 0.37)	0.31 (0.21, 0.41)
<i>Number of post-Katrina assaultive traumatic events experienced</i>		
0	0.28 (0.24, 0.32)	0.28 (0.24, 0.32)
1	0.35 (0.27, 0.43)	0.35 (0.27, 0.43)

2+	0.26 (0.15, 0.37)	0.29 (0.16, 0.43)
<i>Number of post-Katrina non-assaultive traumatic events experienced</i>		
0	0.31 (0.22, 0.40)	0.32 (0.23, 0.42)
1	0.25 (0.18, 0.32)	0.28 (0.20, 0.35)
2+	0.30 (0.26, 0.35)	0.30 (0.25, 0.34)

**Level of Cumulative Trauma Exposure<sup>4</sup>**

*Total number of traumatic events experienced (quartiles)*

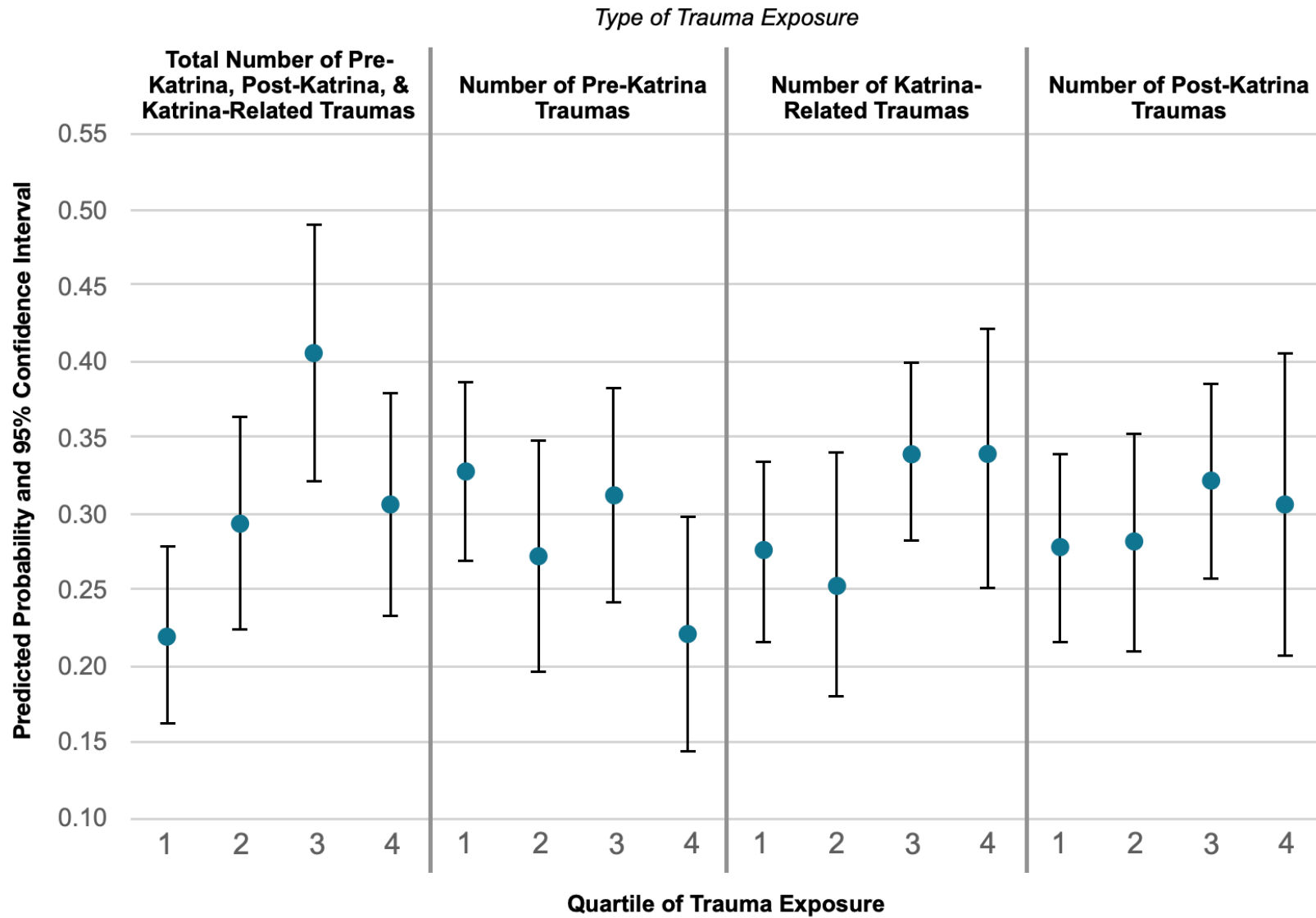
Quartile 1	0.20 (0.15, 0.26)	0.22 (0.16, 0.28)
Quartile 2	0.28 (0.21, 0.35)	0.29 (0.22, 0.36)
Quartile 3	0.41 (0.32, 0.49)	0.41 (0.32, 0.49)
Quartile 4	0.33 (0.25, 0.40)	0.31 (0.23, 0.38)

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.



**Figure B.2.** Predicted probability of membership in Recovery trajectory group by quartile and type of trauma exposure

**Table B.4.** Predicted probability of membership in the Delayed-Onset trajectory by level of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Level of Pre-Katrina Trauma Exposure<sup>1</sup></b>		
<i>Number of pre-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.06 (0.03, 0.09)	0.06 (0.03, 0.10)
Quartile 2	0.08 (0.04, 0.13)	0.09 (0.04, 0.13)
Quartile 3	0.08 (0.04, 0.12)	0.08 (0.04, 0.12)
Quartile 4	0.12 (0.06, 0.18)	0.10 (0.04, 0.16)
<i>Number of pre-Katrina assaultive traumatic events experienced</i>		
0	0.06 (0.04, 0.09)	0.07 (0.04, 0.09)
1	0.09 (0.04, 0.13)	0.08 (0.04, 0.13)
2+	0.12 (0.07, 0.17)	0.11 (0.06, 0.16)
<i>Number of pre-Katrina non-assaultive traumatic events experienced</i>		
0	0.07 (0.05, 0.10)	0.08 (0.05, 0.11)
1	0.09 (0.04, 0.13)	0.08 (0.04, 0.12)
2+	0.10 (0.05, 0.14)	0.08 (0.04, 0.12)
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
<i>Number of hurricane traumas (0-8; quartiles)</i>		
Quartile 1	0.06 (0.03, 0.09)	0.06 (0.03, 0.09)
Quartile 2	0.07 (0.02, 0.13)	0.08 (0.02, 0.13)
Quartile 3	0.09 (0.05, 0.13)	0.10 (0.06, 0.14)
Quartile 4	0.11 (0.05, 0.17)	0.12 (0.05, 0.18)
<b>Level of Post-Katrina Trauma Exposure<sup>3</sup></b>		
<i>Number of post-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.05 (0.02, 0.08)	0.06 (0.02, 0.09)
Quartile 2	0.07 (0.03, 0.11)	0.06 (0.03, 0.10)
Quartile 3	0.09 (0.05, 0.13)	0.09 (0.05, 0.13)
Quartile 4	0.14 (0.07, 0.21)	0.14 (0.06, 0.21)
<i>Number of post-Katrina assaultive traumatic events experienced</i>		
0	0.07 (0.05, 0.09)	0.07 (0.05, 0.09)
1	0.10 (0.05, 0.15)	0.09 (0.04, 0.14)

2+	0.15 (0.06, 0.25)	0.13 (0.04, 0.21)
<i>Number of post-Katrina non-assaultive traumatic events experienced</i>		
0	0.04 (0.002, 0.08)	0.05 (0.002, 0.09)
1	0.05 (0.02, 0.09)	0.06 (0.02, 0.10)
2+	0.10 (0.07, 0.13)	0.09 (0.07, 0.12)

**Level of Cumulative Trauma Exposure<sup>4</sup>**

*Total number of traumatic events experienced (quartiles)*

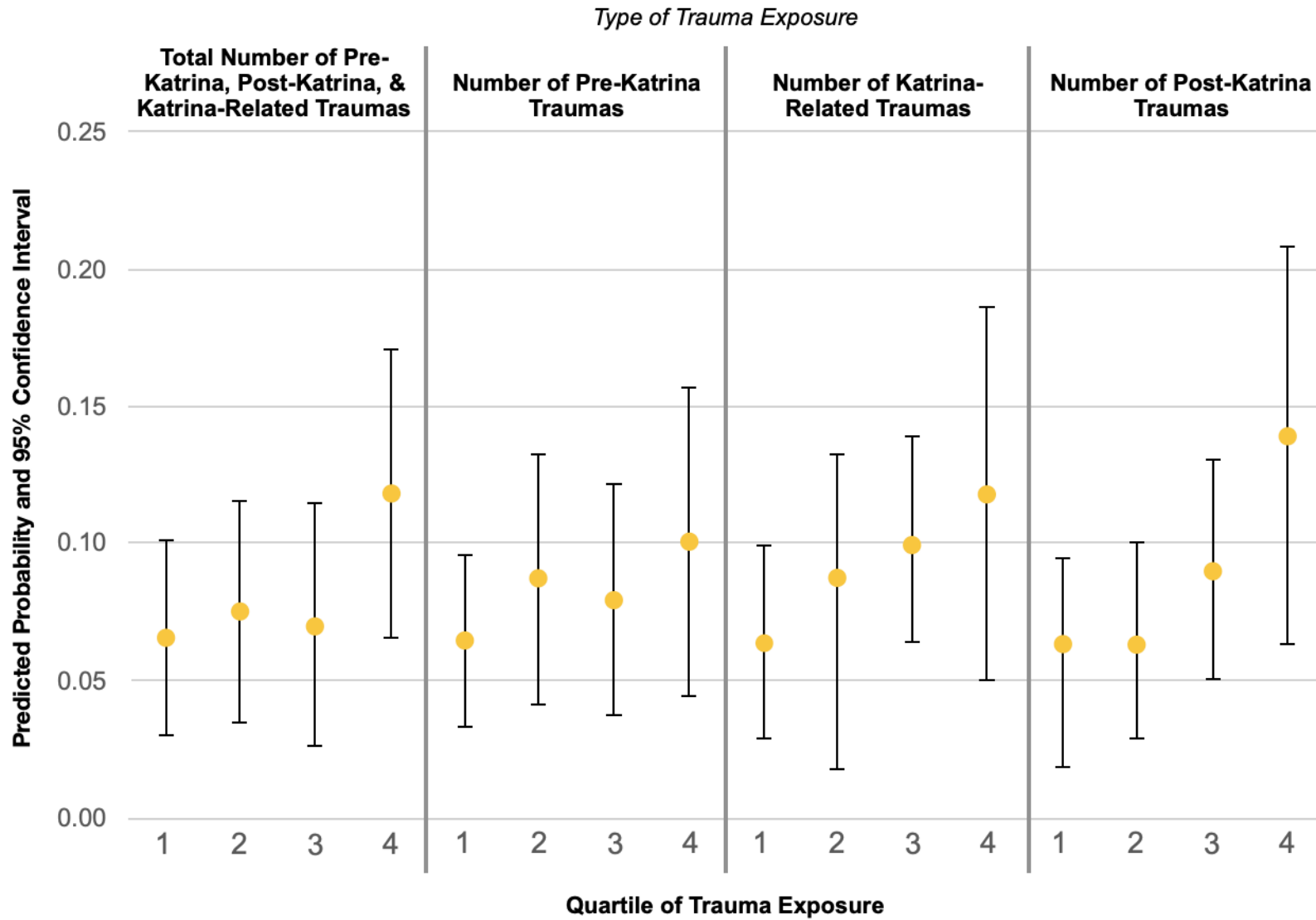
Quartile 1	0.07 (0.03, 0.10)	0.07 (0.03, 0.10)
Quartile 2	0.07 (0.03, 0.11)	0.08 (0.03, 0.12)
Quartile 3	0.07 (0.03, 0.11)	0.07 (0.03, 0.11)
Quartile 4	0.12 (0.07, 0.17)	0.12 (0.07, 0.17)

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.



**Figure B.3.** Predicted probability of membership in Delayed-Onset trajectory group by quartile and type of trauma exposure

**Table B.5.** Predicted probability of membership in the Chronic-High trajectory by level of trauma exposure

	Model	
	Crude Predicted probability (95% CI)	Fully Adjusted Predicted probability (95% CI)
<b>Level of Pre-Katrina Trauma Exposure<sup>1</sup></b>		
<i>Number of pre-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.11 (0.07, 0.14)	0.14 (0.09, 0.18)
Quartile 2	0.11 (0.06, 0.16)	0.13 (0.07, 0.19)
Quartile 3	0.15 (0.09, 0.20)	0.13 (0.08, 0.17)
Quartile 4	0.22 (0.14, 0.29)	0.15 (0.09, 0.21)
<i>Number of pre-Katrina assaultive traumatic events experienced</i>		
0	0.12 (0.08, 0.15)	0.14 (0.10, 0.18)
1	0.11 (0.06, 0.16)	0.11 (0.06, 0.15)
2+	0.21 (0.14, 0.28)	0.15 (0.09, 0.20)
<i>Number of pre-Katrina non-assaultive traumatic events experienced</i>		
0	0.11 (0.08, 0.15)	0.14 (0.10, 0.17)
1	0.10 (0.06, 0.15)	0.10 (0.06, 0.14)
2+	0.22 (0.15, 0.28)	0.17 (0.11, 0.22)
<b>Katrina-Related Trauma Exposure<sup>2</sup></b>		
<i>Number of hurricane traumas (0-8; quartiles)</i>		
Quartile 1	0.06 (0.03, 0.09)	0.08 (0.04, 0.12)
Quartile 2	0.08 (0.02, 0.13)	0.09 (0.03, 0.15)
Quartile 3	0.16 (0.11, 0.21)	0.14 (0.10, 0.18)
Quartile 4	0.31 (0.23, 0.39)	0.23 (0.16, 0.31)
<b>Level of Post-Katrina Trauma Exposure<sup>3</sup></b>		
<i>Number of post-Katrina traumatic events experienced (quartiles)</i>		
Quartile 1	0.09 (0.05, 0.12)	0.12 (0.07, 0.17)
Quartile 2	0.13 (0.07, 0.18)	0.14 (0.08, 0.19)
Quartile 3	0.13 (0.08, 0.17)	0.12 (0.08, 0.16)
Quartile 4	0.26 (0.18, 0.35)	0.18 (0.11, 0.25)
<i>Number of post-Katrina assaultive traumatic events experienced</i>		
0	0.12 (0.09, 0.15)	0.13 (0.10, 0.16)
1	0.10 (0.05, 0.15)	0.10 (0.05, 0.14)

2+	0.34 (0.22, 0.47)	0.27 (0.15, 0.38)
<i>Number of post-Katrina non-assaultive traumatic events experienced</i>		
0	0.11 (0.05, 0.18)	0.14 (0.07, 0.21)
1	0.08 (0.04, 0.12)	0.11 (0.05, 0.16)
2+	0.16 (0.13, 0.19)	0.14 (0.11, 0.17)

**Level of Cumulative Trauma Exposure<sup>4</sup>**

*Total number of traumatic events experienced (quartiles)*

Quartile 1	0.05 (0.02, 0.09)	0.06 (0.03, 0.10)
Quartile 2	0.09 (0.05, 0.13)	0.10 (0.05, 0.14)
Quartile 3	0.14 (0.08, 0.20)	0.14 (0.08, 0.20)
Quartile 4	0.28 (0.21, 0.35)	0.25 (0.18, 0.32)

<sup>1</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and post-Katrina trauma exposure. Models for pre-Katrina assaultive trauma also control for pre-Katrina non-assaultive trauma, and vice versa.

<sup>2</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and pre-Katrina and post-Katrina trauma exposure.

<sup>3</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, pre-Katrina psychological distress and perceived social support, and Katrina-related and pre-Katrina trauma exposure. Models for post-Katrina assaultive trauma also control for post-Katrina non-assaultive trauma, and vice versa.

<sup>4</sup>Adjusted model includes baseline age, race, partnership status and number of public benefits received, and pre-Katrina psychological distress and perceived social support.

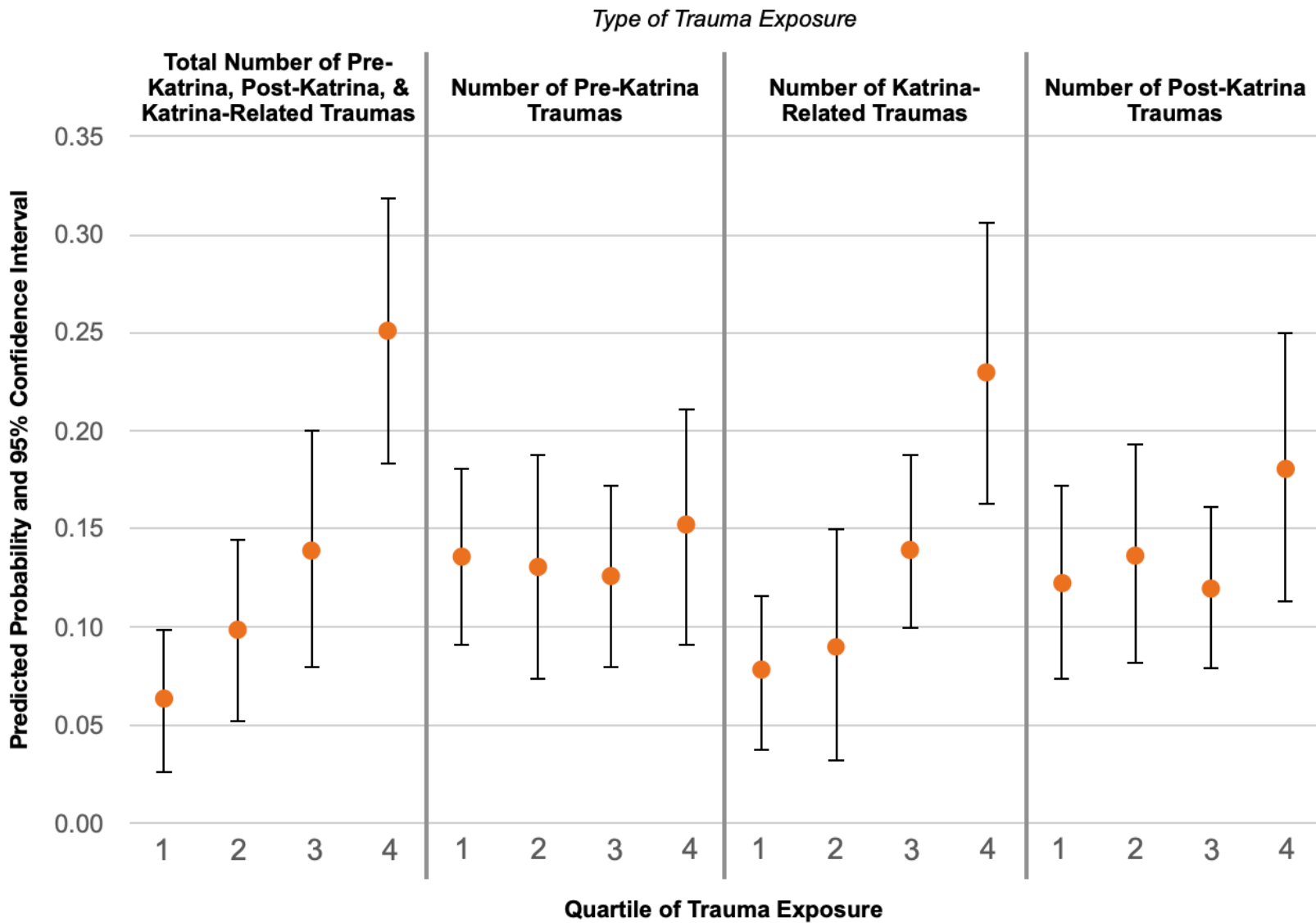


Figure B.4. Predicted probability of membership in Chronic-High trajectory group by quartile and type of trauma exposure