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WEATHERING THE STORM: THE LONG-TERM EFFECTS OF HURRICANE
KATRINA ON MENTAL HEALTH, MOBILITY, AND RECOVERY

By

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ABSTRACT OF THE DISSERTATION

Weathering the Storm: The Long-Term Effects of Hurricane Katrina on Mental Health,
Mobility, and Recovery

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This dissertation uses the Gulf Coast Child and Family Health (G-CAFH) Study to examine the long-term mental health patterns of individuals highly affected by Hurricane Katrina, and establish trajectories of mental health recovery. To do so, I use a multidimensional perspective to identify the mechanisms that illustrate why mental health recovery is often an unequal process for disaster survivors. I examine sociodemographic, household, and social frameworks to tell a comprehensive story of mental health recovery and how it is connected to mobility. In the first analysis, I consider how mobility rates differ depending on various social characteristics, and how such relationships can reproduce and reinforce inequalities during the recovery process. These analyses also consider how different rates of mobility are associated with the likelihood of vulnerable populations experiencing mental health distress. Results demonstrate that disasters often work to sustain inequalities that existed prior to the event and that mental health distress is tied to high rates of mobility. In the second analysis, I consider how the addition or subtraction of household members can affect an adult respondent's mental health and

how household instability might mitigate or exacerbate the negative mental health effects of disasters. Results from these analyses suggest that respondents experienced high rates of mobility coupled with household instability in the four years following Katrina. Somewhat surprisingly, there is a significant negative effect on mental health for living in a household that expanded but not for when a household contracted. In the third and final analysis, I examine the relationship between perceived social support and mental health using different types and levels of social support. Results suggest that emotional support—rather than instrumental—provides the greatest positive influence on mental health over the course of recovery. Most importantly, these findings suggest that perceived social support mediates the effect of mobility on mental health distress. Lastly, I conclude with a discussion about mental health trajectories following disasters and argue that mental health recovery patterns can be categorized in three ways, including *resilient mental health*, *stalled mental health*, and *downward mental health*.

DEDICATIONS

For NICOLE BERGSTROM,
who loves me unconditionally and challenges me every day

For MY FAMILY,
who encouraged my curiosity and gave me the freedom to explore

For MY TEACHERS & MENTORS,
who instilled a love of writing and showed me there's always more to learn

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Chapter 1: Introduction

Considering the Long-Term Mental Health of Hurricane Katrina Survivors

Hurricane Katrina struck the Gulf Coast over a decade ago leaving behind a path of devastation and destruction that remains unmatched in modern U.S. history. In the years that followed, researchers thoroughly studied and examined the aftermath of Katrina and its consequences for those who lived through the storm. Generally, these studies found that survivors suffered various consequences, including loss of property (Donato et al. 2007), unemployment (Hori & Schafer 2010), family difficulties (Reid & Rezcek 2011) and mental distress (Galea et al. 2007). Katrina also revealed that while a storm might strike a particular area, differences in socioeconomic status, health, social support, and geography could mean that survivors had profoundly different experiences of the same event. For some survivors, the effects dissipated after a few weeks or months while others continued to experience difficulties more than a year after the storm. What remains relatively unknown is why some affected residents experience greater lasting mental health consequences post-disaster than others, and how these vary over time.

A majority of disaster research focuses on the immediate aftermath of a traumatic event such as evacuation success, housing availability, financial losses, and casualties, while the intermediate and long-term effects remain overlooked (Sastry 2009). Katrina is no exception. Despite numerous studies detailing the repercussions of the storm, most research uses cross-sectional data collected shortly after Katrina. Subsequently, there is minimal research regarding the lasting implications, especially as they relate to mental health outcomes and overall recovery. This dissertation addresses this gap by using longitudinal data collected at four points after Katrina (2006, 2007, 2008, and 2009) to

examine mental health outcomes over the course of four years. By examining data on individuals and households from Louisiana and Mississippi that were affected by Hurricane Katrina, my research uses a multidimensional perspective to identify the mechanisms that illustrate why mental health recovery is often an unequal process. I identify sociodemographic, household, and social explanatory frameworks to tell a comprehensive story of mental health recovery. Additionally, displacement and geographic mobility were central to the experiences of households affected by Katrina, and have important ramifications for all aspects of their lives, including mental health. High rates of mobility and migration can disrupt social networks, strain resources and perpetuate a sense of uncertainty during recovery. Thus, I consider the role of mobility and displacement in mental health recovery, and introduce a concept called *perpetual migration* that I argue is critical to understanding the recovery patterns of individual's mental health in the years after Katrina.

There are several mental health consequences associated with experiencing a traumatic event. According to Cutter et al. (2003), being exposed to a stressor like Katrina can lead to decreased psychological and physical well-being, often in the form of depression and health problems.¹ Common mental health problems following a disaster include anxiety (especially posttraumatic stress disorder), somatic complaints, phobic reactions, and depression (Cohan & Cole 2002; Ironson et al. 1997; Norris 1992; Shore, Tatum, & Vollmer 1986). Researchers also acknowledge that disasters can be both acute

¹ Fortunately for Hurricane Katrina researchers, we can make claims regarding the impact of the storm on residents' mental health because the National Comorbidity Survey Replication (NCS-R) coincidentally surveyed the psychological well-being of New Orleans residents shortly before the storm (Ursano et al., 2008). In the six months after the storm, researchers found that compared to the NCS-R results that there was a 15 to 30 percent increase in reported mental health problems (Ursano et al., 2008; Galea et al., 2007; Kessler et al., 2008).

and chronic mental stressors (Reid & Rezcek 2011; Baum, O'Keefe & Davidson 1990; Dimsdale 2008; Norris 2006). Survivors often deal with stress before, during, and directly following the disaster, and also face long-term strain and anxiety throughout the recovery process. Generally, mental health problems following a disaster exhibit themselves in the one to three years following the event (Adams & Adams 1984; Freedy, Kilpatrick, & Resnick 1993; Kaniasty & Norris 1993; Shore et al. 1986); however, most studies do not survey survivors more than a year or two after the disaster, which leaves questions regarding how mental health effects may decrease, fluctuate or dissipate over time. Although experts have a more comprehensive understanding of the mental health outcomes immediately and shortly following a disaster, further research is needed in order to better identify vulnerable populations and provide effective interventions for long-term mental health recovery.

According to Phillips (2009), the recovery stage is the most under-researched phase of a disaster. Thus, an overarching goal of this research is to explore the mental health patterns of adults affected by Hurricane Katrina in order to provide further insight into the disaster recovery process. Ultimately, I aim to broaden understandings regarding why some disaster survivors experience greater lasting mental health consequences than others. As Katrina caused high rates of displacement and mobility, I also consider whether geographic mobility rates affect mental health, and whether mobility could account for mental health differences. Most importantly, I consider whether mobility influences the effects that individual, household, and social factors can have on mental health. Examining mental health outcomes using sociodemographic, household, and social explanatory frameworks will provide further insight into whether particular groups

(e.g. female racial minorities; those with numerous household transitions; survivors with low social support) experience stalled mental health recovery or chronic mental distress, and also detail how mental health patterns might be tied to place stability.

The Implications of Mobility and Displacement in the Context of Hurricane Katrina

Hurricane Katrina displaced approximately 1.5 million residents across the Gulf Coast to towns and cities in each of the fifty states (Weber & Peek 2012; Graif & Waters 2011). More than five years after the storm, tens of thousands of residents remained displaced (Weber & Peek 2012). It was the largest displacement of U.S. residents since the 1930s dust bowl migration (Graif & Waters 2011; Falk et al. 2006; Picou & Marshall 2007), which emphasizes how rare such widespread displacement can be in developed countries. While the size of displacement caused by Katrina was unprecedented, disasters often cause people to evacuate, which has been termed “forced migration” (Fussell, VanLandingham & Sastry 2010). Following a forced migration, residents are faced with a decision on whether or not to return (Fussell, VanLandingham & Sastry 2010). The authors argue that demographic and socioeconomic characteristics shape this decision, as these factors can constrain or enable residents to return to their pre-disaster homes, neighborhoods, and towns. Using G-CAFH data, I explore the possibility that post-Katrina migration was unique from previous disaster migration—and therefore, different from forced migration. I argue that Katrina residents often found themselves experiencing *perpetual migration* where they moved several times even after they had been displaced to another town or city. I posit that this combination of forced migration with high mobility could have lasting implications for mental health recovery.

Many studies have examined how the poor, minority groups, and the elderly

suffered disproportionately from the storm, including long-term displacement. In the case of Katrina, displaced Black residents lived in neighborhoods that experienced greater flooding and housing damage and thus returned to New Orleans at a slower rate than Whites (Fussell, VanLandingham & Sastry 2010). Similarly, Elliot et al. (2009) found that more disadvantaged neighborhoods experienced lower return rates than neighborhoods that were less disadvantaged before Katrina. Beyond the return of residents to New Orleans, there remain questions regarding the quality and complexity of movement of displaced residents. For this reason, I explore whether these geographic mobility rates are intimately connected to issues of mental health, sociodemographic characteristics, household stability, and social support.

Post-disaster migration also differs considerably from more general patterns of migration (Morrow-Jones & Morrow-Jones 1991). Using national-level data, Morrow-Jones and Morrow-Jones (1991) demonstrate that disaster migration is more likely to include low-income, female-headed families, Blacks, and the less educated. While some of these residents may have decided to move and make changes, others were likely forced to move (Morrow-Jones & Morrow-Jones 1991). In contrast, homeowners are unlikely to move after a disaster, opting instead to pay for repairs and move back (Belcher & Bates 1983). Those with higher socioeconomic status are also more likely to secure housing that reflected their pre-disaster home than those of lower-income (Morrow-Jones & Morrow-Jones 1991). Morrow-Jones and Morrow-Jones (1991) also argue that forced and unexpected mobility could lead to stress. Displaced residents might suffer from higher levels of distress because of the unexpected and forced loss of their homes, the loss of ties with friends and family, or the need to find new employment in an unfamiliar

area (Morrow-Jones & Morrow-Jones 1991).

Not only did Katrina cause evacuation and long-term displacement, the amount of movement and housing instability following Hurricane Katrina was unprecedented. While some residents moved only once or twice following the storm, most moved three or four times (Weber & Peek 2012). This made the movement in the years following Katrina extremely complex. Additionally, the most popular receiving communities included cities in states as far from the Gulf Coast as Colorado, Georgia, Missouri, South Carolina, and Texas (Weber & Peek 2012). Whether post-Katrina displacement was unexpectedly forced or perceived as a fresh start, the theme of mobility and displacement is apparent throughout every aspect of recovery. Therefore, the theoretical and empirical implications of migration, residential mobility and long-term displacement run through each area of inquiry in this research as well.

The Sociodemographic Framework: Intersectional Dimensions of Disaster Recovery

Disaster researchers have only recently begun to deepen our knowledge of vulnerable populations including women, minorities, and the poor, as all disaster victims were initially viewed as equal targets of the event (Fothergill et al. 1999). Researchers now recognize that race, ethnicity, class, age, and gender can influence disaster recovery, especially as these social characteristics relate to mental health; however, important questions remain as to how and when these statuses are most salient during the recovery process. Hicken et al. (2013) notes that those who experience social disadvantage are especially vulnerable to environmental hazards and disasters, which can lead to negative health effects. In the case of Hurricane Andrew, when controlling for class, Blacks (23 percent) and Latinos (38 percent) exhibited higher rates of PTSD than Whites (15

percent) over six months after the storm struck (Perilla et al. 2002). Such differences are often attributed to racism and prejudicial attitudes (Green et al. 1990; Fothergill et al. 1999), the disruption of important social networks (LaJoie, Sprang & McKinney 2010), and religious differences (Fothergill et al. 1999). In regards to gender, earlier studies argue that men and women experience similar psychological consequences from disasters while more recent research posits that women suffer far greater emotional and mental health consequences than men, including stress, depression, PTSD, and anxiety (Fothergill 1996). Enarson and Morrow (1998) reason that women are especially vulnerable to disaster due to their role as caregivers during the recovery phase. By providing support to friends, family, and neighbors, women are burdened with the emotional work of helping others recover rather than focusing on their own recovery. Net of race and gender, a lack of resources can also hinder recovery, as an individual or family may experience difficulty paying rent or maintaining mortgage payments, paying for home repairs, or finding sufficient funds to pay for food and utilities. For these reasons, lower income persons can experience higher levels of emotional distress following a disaster (Lavelle & Feagin 2006).

Age can also influence vulnerability to a disaster, as the elderly are often socially isolated, which leads to difficulties during recovery (Klinenberg 2002). While the link between vulnerability to an event and age is clearly understood, the relationship between age and mental health recovery is more ambiguous. Some researchers argue that health problems among the elderly are typically exacerbated by traumatic events like Katrina while others suggest that seniors are more resilient because life-experience protects against stressors (Gatz, Kasl-Godley & Karel 1996; Knight et al. 2000). However, most

age-related studies following a disaster have been cross-sectional, creating limited knowledge regarding the long-term relationship between age, mental health, and stress.

While there may be independent effects of social characteristics like race, class, gender, and age disadvantaged populations can also face cumulative effects of environmental, material, psychological, and social stressors during the recovery process (Geronimus et al. 2010). Fothergill (1996) argues that when analyzing the inequalities revealed by disaster that a complete analysis demands the use of a “feminist lens,” which examines the intersection of multiple social structures. There are several intersections of these characteristics to consider, which can lead to greater risk of exposure to an environmental hazard, as well as higher risk of health problems post-disaster (Reid 2013). Pertaining to psychological reactions, Aptekar (1990) found that both social class and race contributed to how residents’ perceived the Loma Prieta Earthquake and Hurricane Hugo, especially in regards to collective memory. Research on race and gender demonstrates that minority women are extremely vulnerable to disasters because of their relative lack of resources and power when compared to White men and women (Szalay et al. 1986). Minority women are also more likely to be single parents, which equates to a stressful burden during the response, rescue, and recovery periods of a disaster (Pardee 2014).

Previous research also notes the importance of continuing to collect data on disaster survivors, as health outcomes may change for particular groups over time. In a follow-up study of the 1972 Buffalo Creek flood, researchers found that more Blacks exhibited signs of delayed PTSD than Whites even though Blacks had higher survival rates and similar class status (Green et al. 1990). In a study on psychological disorders

following the World Trade Center disaster on September 11th, 2001, Adams and Boscarino (2005) found that race and ethnicity had little effect on the rates of post-traumatic stress disorder or other psychological disorders; however, they did find a high association with “emotional reactions to trauma” such as panic attacks (262). More importantly, the authors emphasize that it may take longer for individuals to exhibit signs of psychological distress caused by a technological disaster (i.e. Katrina), arguing for a continued examination of these populations over time.² Similarly, Elo (2009) argues that individual pathways are likely to vary over time by social and economic context (House et al. 1990, 2001; Lieberman 1985; Link & Phelan 2008; Preston & Taubman 1994), making not only longitudinal studies but the timing of data collection essential to furthering our knowledge of the link between traumatic events, social characteristics and mental health.

These findings demonstrate that sociodemographic characteristics can shape exposure to “multiple biomedical, environmental, and psychosocial risk factors for health” (Elo 2009: 554). It is also clear that pre-existing inequalities endure—and can even be exacerbated—in the face of extreme social disruption and demonstrate powerful links with various health outcomes. However, due to the problems typically associated with collecting data on disaster survivors, such as locating sampled respondents, completing surveys with disrupted residents, and maintaining contact over time, there is limited knowledge of how overlapping social categories affect long-term mental health recovery.

² Despite the initial distress caused by a natural disaster, research suggests that the emotional consequences of a “natural” disaster typically last for a relatively short period of time (Drabek & Stephenson, 1971). Meanwhile, the signs of psychological distress linger for decades for those who survive technological disasters (Couch & Kroll-Smith 1985), in part because they are typically unexpected events and often take longer to remedy. Scholars tend to agree that Katrina is a technological disaster in that the damage was mostly caused by the failed levees rather than the storm itself.

My aim is to advance understandings of the relationship between sociodemographic characteristics and mental health during the disaster recovery process, and consider how different rates of mobility are associated with the likelihood of vulnerable populations experiencing mental health distress.

The Household Framework: Household Instability, Disasters and Mental Health

While the combination of economic disadvantage, racism, and gender differences are undoubtedly important to consider when examining post-disaster health outcomes, Edwards (1998) argues that the influence of disasters on individual well-being is best understood by examining the individual within the context of social systems like the family. Typically, family members provide emotional, instrumental, and other types of social support to members during a stressful event (Thoits 1995). Recent research has also found that family members can contribute to the strain of a stressful event rather than provide support to protect against it (Fingerman et al. 2004). Family members can therefore be a source of support, as well as a source of stress, both of which can be exacerbated following a disaster.

Households can experience several transitions and adjustments following a disaster, especially following an event like Katrina that displaced millions from their homes (Peek, Morrissey & Marlatt 2011). For example, disaster survivors—especially those of lower-income—are likely to live in bigger households during recovery as they often end up staying with family or friends, and/or doubling up with other survivors (Lowe, Rhodes & Scoglio 2012; Morrow 1997; Reid 2013; Weber & Peek 2012), creating cramped and potentially stressful living conditions. Generally, findings suggest that there is a cumulative disadvantage associated with experiencing multiple household

transitions and living in larger households (Cavanagh & Huston 2006; Wu & Thomson 2001); however, Langenkamp and Frisco (2008) acknowledge that much remains unknown regarding the long-term disadvantage of household transitions on mental health. As Reid and Rezcek (2011) acknowledge, few studies consider how familial relationships shape the stress process following a disaster, which leaves questions for future research to explore.

As household structure is complex and under-explored, there is a need to further examine how household instability may influence post-disaster mental health. This is especially important to consider as households can be unstable following a traumatic event and can experience multiple transitions, including the entering and leaving of family and friends during the course of recovery. Family relationships and structure can change over time, which might influence the amount of support provided or strain put upon household members. Rather than treat household structures as static, I explore the changing nature of household relationships post-disaster and how these transitions may mitigate or exacerbate health problems as they relate to the adult respondent. By examining an individual's household instability, I aim to generate insights into whether particular transitions (expansion and contraction) influence the mental health outcomes of adult respondents.

The Social Framework: The Effect of Perceived Social Support on Mental Health Recovery

Although various sociodemographic characteristics and household-level factors likely play an important role in understanding long-term post-disaster mental health, unequal access to social support may also influence various aspects of recovery. Social support can best be defined as a function—such as emotional, informational and

instrumental assistance (House & Kahn 1985)—performed by a primary or secondary group member for a particular individual (Thoits 2011). Over the last three decades, there is mounting evidence that social support is positively and causally related to mental health and buffers against the harmful mental health consequences of stress exposure (Thoits 2011; Murphy 1988; Kessler & McLeod 1985; Kessler, Price & Wortman 1985; Thoits 1995). While the relationship between social support and stress is clear, there is limited information on how social support is affected in the aftermath of a disaster and how these possible changes relate to mental health distress, especially when entire communities and neighborhoods are disrupted by the same event.

Following a disaster, residents often move several times to new places or return to neighborhoods without familiar faces, which can diminish social support. Networks and ties can become frayed during the recovery process, as households and communities become disrupted and survivors encounter perpetual migration. Since residents were extremely mobile in the years following Katrina, it is important to examine whether they possessed this critical component of recovery, and whether it was beneficial for their mental health. Similarly, questions remain regarding the strength of social ties when daily exchanges change or are diffused by disaster, and how these unfold over time. It is likely difficult to maintain pre-event levels and types of social support during recovery, which means that individuals may lack the protective support that informal ties can provide in a time of uncertainty and need. Similarly, it is possible that social support is more beneficial at particular periods of recovery: perhaps instrumental support is more beneficial during the immediate aftermath but emotional support is of greater importance at the later stages of recovery. Lastly, sociological research emphasizes that networks

offer social resources in times of need and that this capacity varies by the social position of those involved. As not all disaster survivors have access to the same levels and types of social support, it is important to consider how these differences affect post-disaster mental health outcomes during the recovery process.

Overview of the Dissertation

The first substantive chapter (Chapter 2) is titled, “Inequalities Over Time: Mobility and Intersecting Dimensions of Post-Katrina Mental Health Outcomes.” In this chapter, I consider multiple dimensions of how disasters affect mental health, and tie these aspects together to tell a coherent story of the long-term effects of disasters on mental health. This chapter includes growth curve models that examine how social characteristics and mobility rates relate to an adult respondent’s mental health in the five years following Hurricane Katrina. It builds on existing literature that focuses on individual-level predictors of mental health by examining if and how the relationship between social characteristics, mobility, and mental health changes over time. A main contribution of this chapter is to provide an analysis of longitudinal data that expands beyond past analyses that only focus on cross-sectional data. I use one main dependent variable to measure mental health, the Mental Health Composite Score (MCS), which is a subscale of the Medical Outcome Study Short Form-12 (SF12) scale. I use six main predictor variables including, race, income, gender, age, marital status, and children in the household, and also test various interaction effects as these characteristics relate to movement and location to influence mental health trajectories.

Chapter 3 sheds light on how individual mental health distress is linked to post-disaster household instability and mobility. Rather than treat household structure as static,

I explore the dynamic nature of post-disaster households and how instability might mitigate or exacerbate the negative mental health effects of disasters. In this chapter, I consider whether rates of stable households increase as time passes and residents begin to achieve a sense of normalcy. I also test the relationship between household instability and mental health, controlling for other sociodemographic factors, and determine whether there are different effects associated with experiencing a contracting or expanding household. A major contribution of this chapter is that it explores how the continuity of living arrangements relates to mental health following a disaster over time using a broad sample of highly effected Katrina survivors. Most importantly, I am able to distinguish not just whether household disruption negatively influences mental health but if the type of disruption (expanded or contracted) matters as well. Like Chapter 2, I use one main dependent variable to measure mental health, which is the Mental Health Composite Score (MCS). The main predictor variable for this chapter is household instability; however, I also examine additional housing related variables often linked to mental health, including house type, homeownership status, and mobility.

In Chapter 4, I examine the relationship between perceived social support and mental health for Waves 2, 3 and 4. Unlike previous chapters, I control for the respondents' mental health at baseline. Using five different measures of social support, this chapter aims to identify the support mechanisms that could be accessed by disaster victims, and determine how this perceived support affects mental health in the years following a disaster. I also explore whether social support increases across waves, as residents re-establish ties with friends and family or create different networks after moving to new neighborhoods. A goal of this analysis is to demonstrate whether certain

types of social support contribute to mental health, and how this relationship might change at various points of the recovery process, especially as it relates to mobility and displacement. Perhaps different types of social support are more influential at certain points of recovery than others. The key is to understand which groups have access to different types and amounts of social support, whether it varies with movement and time, and how this relates to health outcomes. Using MCS as the outcome variable, I test the relationship between five different types of social support, as well as three levels (low, medium and high) of social support while controlling for mobility, mental health at baseline, and sociodemographic characteristics.

The long-term effects of disaster on mental health are complex. Researchers frequently turn to sociodemographic predictors to understand who is at the greatest risk for mental health complications after a disaster. These studies also tend to survey disaster victims shortly after the event and do not survey them in the future so it remains unclear how trajectories of mental health recovery vary, especially for highly mobile, displaced residents. The G-CAFH data allows me to identify generalizable long-term mental health trajectories following disasters, identify groups most vulnerable to mental health distress, and explore issues related to mobility and mental health recovery. The goal of this research is to develop a comprehensive framework that explains mental health outcomes throughout the recovery process, and tie these to the mobility rates of respondents. Specifically, I would like to identify the stressors and support mechanisms that influence mental health recovery.

Although some may argue that the Katrina literature is thorough and overly saturated, the data used here provide new opportunities to make significant contributions

to our understandings of disaster, inequality, household instability, social support, and long-term mental health. As disasters begin to strike highly populated areas with greater frequency and strength, it is imperative to understand how different groups cope during times of social disruption; provide insight for how issues of mobility affect recovery; determine if household instability affects recovery post-disaster; and examine the use importance of social support. Understanding how affected individuals cope with the long-term effects of disasters contributes to our understandings of resilience, how to make recovery more efficient, as well as what is needed to provide better post-disaster mental health interventions.

Chapter 2: Inequalities Over Time: Mobility and the Intersecting Dimensions of Post-Katrina Mental Health Outcomes

1. Introduction

Hurricane Katrina struck the Gulf Coast nearly a decade ago leaving behind a path of devastation and destruction that remains unmatched in modern U.S. history. The size and strength of Katrina led to the largest displacement since the 1930s dust bowl migration with approximately 1.5 million people evacuating their homes and communities prior to its arrival (Weber & Peek 2012). The storm was unusual in that residents did not immediately return to their homes following evacuation and often found themselves displaced for months (Nigg, Barnshaw & Torres 2006). Such high levels of displacement consequently led to unprecedented post-disaster mobility and migration. In the case of Katrina, while some residents moved only once or twice following the storm, most moved three or four times (Weber & Peek 2012). Residents also migrated to states as far from the Gulf Coast as Colorado, Georgia, Missouri, South Carolina, and Texas (Weber & Peek 2012). Hugo (1996) argues that migration, regardless of whether it is permanent or temporary, has long been a response or survival strategy of those affected by disaster. However, post-disaster migration differs considerably from more general patterns of migration, as it is frequently forced upon disaster survivors and can be complicated by multiple moves (Morrow-Jones & Morrow-Jones 1991). The vulnerability of the Gulf Coast population and variation in relocation made tracking the movement in the years following Katrina and understanding its impact on recovery extremely complex. Whether post-Katrina migration was unexpectedly forced or perceived as a fresh start, the theme of mobility is apparent throughout every aspect of

recovery, which makes its examination critical to understanding the true consequences of the storm.

In addition to understanding general patterns of mobility following Katrina, it is important to consider how social inequality can shape post-disaster migration and mobility (Brunsma 2007; Oliver-Smith 2006). Katrina revealed that while a storm might strike a particular area and affect a large population, differences in socioeconomic status, social support, and geography could mean that survivors have profoundly different experiences of the same event. Preexisting inequalities relating to race, class, gender, and age might lead to different rates of forced migration and mobility, subsequently stalling the recovery process. In the case of Katrina, Weber and Peek (2012) found that mobility was not experienced equally as highly disadvantaged displaced residents relocated up to twelve times, with African American females reporting the highest relocation rates. Such findings demonstrate how vulnerable populations can experience increased post-disaster mobility, further exacerbating the effects of the storm and obstructing recovery.

In this chapter, I consider how mobility rates differ depending on various social characteristics, and how such relationships may reproduce and reinforce racial, class, gender, and age disparities during the recovery process. Recovery can be measured in several different ways, including housing stability, economic stability, re-established social roles and networks, access to civic and institutional resources, and good physical and mental health (Abramson et al. n.d.). The analyses presented in this chapter examine recovery through the lens of mental health distress in the four years following Katrina, and consider how different rates of mobility are associated with the likelihood of vulnerable populations experiencing mental health distress. Inequality can shape

exposure to “multiple biomedical, environmental, and psychosocial risk factors for health” following a disaster and delay recovery (Elo 2009: 554). Vulnerable populations tend to experience heightened stressors such as job loss, property damage, marital stress, displacement, and physical health conditions that directly relate to the disaster (Goldmann & Galea 2014). Such findings suggest that pre-existing inequalities endure in the face of extreme social disruption and demonstrate powerful links with various mental health outcomes. Some scholars argue that regulating these stressors and achieving successful mental health recovery is the single most important factor in overall recovery for displaced residents following Katrina (Tobin-Gurley, Peek & Loomis 2010). By examining the intricacies of inequality and mobility through an analysis of mental health distress, my aim is to advance understandings of the disaster recovery process.

To achieve this goal, I begin with a detailed description of post-Katrina mobility, including the characteristics of those who moved and how often. Determining whether certain groups moved more than others provides information on who might be most vulnerable to mental health distress and hence who faces the most serious challenges to recovery following a catastrophic event. Secondly, I consider the effect that mobility has on mental health over time to garner further insight into the post-disaster recovery process. Lastly, I examine whether mobility has more detrimental effects on mental health for vulnerable populations. To explore the relationship between mobility, social inequality, and mental health, I use the 2006-2009 *Gulf Coast Child and Family Health Study* (G-CAFH). Typically, there are problems associated with collecting data on disaster survivors, such as locating sampled respondents, completing surveys with disrupted residents, and maintaining contact over time. These difficulties have led to

limited knowledge of how social categories like race, class, gender and age affect mental health recovery, especially as it relates to mobility. To explore this question, I use random-effects and hybrid random-effects logistic regression models to examine whether mobility and social characteristics influence the likelihood that adults will experience mental health distress in the four years following Hurricane Katrina.

2. Background

2.1. Inequality and Post-Disaster Mental Health

Disaster researchers have only recently begun to deepen our knowledge of vulnerable populations such as women, minorities, and the poor, as all disaster victims were initially viewed as equal targets of the event (Fothergill et al. 1999). Researchers now recognize that race, ethnicity, class, age, and gender can influence disaster recovery, especially as these relate to mental health; however, important questions remain as to how and when such characteristics are particularly salient during the recovery process. Hicken et al. (2013) notes that those who experience social disadvantage are especially vulnerable to environmental hazards and disasters, which can lead to negative health effects. In the case of Hurricane Andrew, when controlling for class, Blacks (23 percent) and Latinos (38 percent) exhibited higher rates of PTSD than Whites (15 percent) over six months after the storm struck (Perilla et al. 2002). Such differences are often attributed to racism and prejudicial attitudes (Green et al. 1990; Fothergill et al. 1999), the disruption of important social networks (LaJoie, Sprang & McKinney 2010), and religious differences (Fothergill et al. 1999). In regards to gender, earlier studies argue that men and women experience similar psychological consequences from disasters while more recent research posits that women suffer far greater emotional and mental health

consequences than men, including stress, depression, PTSD, and anxiety (Fothergill 1996). Enarson and Morrow (1998) reason that women are especially vulnerable to disaster due to their role as caregivers during the recovery phase. By providing support to friends, family, and neighbors, women are burdened with the emotional work of helping others recover rather than focusing on their own recovery. Net of race and gender, a lack of resources can also hinder recovery, as an individual or family may experience difficulty paying rent or maintaining mortgage payments, paying for home repairs, or finding sufficient funds to pay for food and utilities. For these reasons, lower income persons can experience higher levels of emotional distress following a disaster (Lavelle & Feagin 2006). Numerous studies (Bolin 1993; Mileti, Sorenson & O'Brien 1992; Phillips 1993; Peacock, Morrow, & Gladwin 1997) have also found that the elderly are more likely to experience negative health consequences following a disaster and can take longer to recover due to fewer social and financial resources. Alternatively, Knight and colleagues (2010) argue that because older adults have had more experiences over their lifetimes they possess better coping abilities and are more resilient than younger people. Examining how likely seniors are to report mental health distress over time rather than shortly after a disaster will help clarify the discrepancies of these previous findings. Lastly, being single has been linked to a higher risk of mental stress following a disaster because of less social support than married or partnered individuals; however, because of their roles as caretakers being married can put women—not men—at greater risk for post-disaster psychopathology (Goldmann & Galea 2014).

While there may be independent effects of social statuses such as race, class, gender, and age on mental health, disadvantaged populations can also face cumulative

effects of environmental, material, psychological, and social stressors during the recovery process (Geronimus et al. 2006). Fothergill (1996) argues that when analyzing the inequalities revealed by disaster that a most complete analysis demands the use of a “feminist lens,” that examines the intersection of multiple social structures. There are several intersections of these factors to consider that can lead to greater risk of exposure to an environmental hazard, as well as higher risk of health problems post-disaster (Reid 2013). Pertaining to psychological reactions, Aptekar (1990) found that both social class and race contributed to how residents’ perceived the Loma Prieta Earthquake and Hurricane Hugo, especially concerning collective memory. Research on race and gender demonstrates that minority women are extremely vulnerable to disasters because of their relative lack of resources and power when compared to White women (Szalay et al. 1986). Minority women are also more likely to be single parents, which can contribute to the difficulties of dealing with the response, rescue, and recovery periods of a disaster (Pardee 2014). A contribution of this chapter will be to examine whether vulnerable populations experience higher rates of mental distress, as well as whether vulnerable populations report higher rates of mobility in the years following Katrina.

According to Goldmann and Galea (2014), findings from longitudinal studies suggest that mental health problems peak in the year following a disaster and then begin to improve. In the case of those who experience long-term mental health problems, ongoing stressors related to experiencing a disaster such as job loss, property damage, marital stress, physical health conditions, and displacement can prolong negative mental health conditions (Goldmann & Galea 2014). Although research suggests that respondents are most likely to exhibit mental health distress in the year following a

disaster and that this distress will decrease over time, there is little longitudinal evidence to support this assertion. There is also little longitudinal evidence regarding how intersecting social characteristics unfold over time. By using longitudinal data, I not only aim to contribute to understandings of how mental health improves in the years following a catastrophic event, but also consider how intersecting social characteristics influence mobility rates and mental health over time.

2.2. Forced Migration and Mobility

While some residents decide to move and make changes on their own following a major disaster, others likely have no other choice but to leave (Morrow-Jones & Morrow-Jones 1991). Once residents have been displaced or forced from their homes and communities following a disaster, they are faced with the decision as to whether or not to return (Asad 2014; Fussell, VanLandingham & Sastry 2010). This decision—or lack thereof—can be shaped by demographic and socioeconomic characteristics, which are factors that can constrain or enable residents in returning to their pre-disaster homes, neighborhoods, and towns. Using national-level data, Morrow-Jones and Morrow-Jones (1991) demonstrated that those unable to return home are more likely to be low-income, female-headed families, Blacks, and those with lower levels of formal education. In the case of Katrina, displaced Black residents lived in neighborhoods that experienced greater flooding and housing damage, and thus they returned to New Orleans at a slower rate than Whites (Fussell, VanLandingham & Sastry 2010). Institutional, labor market and social contexts can also influence the decision to return to disaster-affected towns and cities (Asad 2014). Among New Orleans communities, Elliot et al. (2009) found that more disadvantaged neighborhoods experienced lower return rates than neighborhoods

that were less disadvantaged before Katrina. In addition to forced migration, residents can be increasingly mobile following a disaster because of a lack of resources, employment issues or even the physical, mental, and emotional trauma of attempting to stay in the affected area (Peacock, Morrow & Gladwin 1997). People with higher economic resources are more likely to adjust to increased mobility, as they likely have more savings, insurance coverage, access to credit, and might be better able to navigate aid (Morrow-Jones & Morrow-Jones 1991). However, it remains unclear whether more highly resourced individuals are any less likely to move than those with fewer economic resources. Overall, these findings suggest that sociodemographic characteristics may have shaped the initial displacement and migration of residents, as well as their mobility frequency in the years following the storm.

Bringing together these findings on post-disaster migration and mobility, questions remain regarding the complexity of movement that preceded the return—or permanent migration—of displaced residents and whether social characteristics shaped mobility following Katrina. A goal of this chapter is to explore how post-Katrina mobility rates differed for vulnerable populations in the years following the storm. However, this chapter also begins to consider the effect that high rates of mobility can have on the disaster recovery process. Not only is moving multiple times possibly dependent upon social and financial resources but previous research suggests that high rates of mobility can increase stress levels (Morrow-Jones & Morrow-Jones 1991). Affected residents might suffer from higher levels of distress because of the unexpected and forced loss of their homes, the loss of ties with friends and family, or the need to find new employment in an unfamiliar area (Morrow-Jones & Morrow-Jones 1991). I argue

that post-Katrina mobility rates are intimately connected to issues of inequality and vulnerability, and have implications for the recovery process, specifically as reflected in self-reported mental health distress.

3. Research Objectives & Expectations

This chapter provides an analysis of longitudinal data that thereby expands on previous disaster studies that focus only on cross-sectional data. A main contribution of this chapter is to provide a descriptive understanding of mobility post-Katrina, including an explanation of who moved and how often, and to determine whether certain groups were more likely to move than others. Secondly, it builds on these descriptives by considering the effect that mobility has on mental health over time. The main dependent variable for mental health is measured using a portion of the Medical Outcome Study Short Form-12 (SF12) scale called the Mental Health Composite Score (MCS). I focus on several predictors of mental health—mobility, race, income, gender, age, marital status, and children in the home. I also examine interaction effects between mobility and particular vulnerable populations, including racial minorities, women, the elderly, the poor, and single, divorced, widowed or separated individuals. Based on previous research, I hypothesize:

H₁: Blacks, women, lower income, and younger respondents will exhibit higher levels of mobility than Whites, men, middle and upper income residents, and older respondents, respectively.

H₂: Frequency of mobility is inversely related to mental health.

H₃: Blacks, women, lower income, and the elderly will exhibit lower mean levels of mental health and will be more likely than Non-Blacks, men, middle and upper income residents, and younger respondents to report poor mental health.

H₄: Mobility has a more detrimental effect on mental health for vulnerable populations than for others.

4. Data & Methods

4.1 Sample & Data Collection

I use the *Gulf Coast Child and Family Health Study* (G-CAFH) to explore my research questions. G-CAFH is one of four existing longitudinal Katrina studies, and the only one to examine a random sample of families and children heavily affected by the storm. The study follows a cohort of 1,079 households to assess post-disaster recovery via indicators such as infrastructure rehabilitation and stability, community redevelopment and housing stability, economic recovery, social re-engagement, and personal resilience and recovery. Due to the child component of the survey, at baseline interviewers were instructed to ask to speak with the adult who was most knowledgeable about the household, which is the same respondent interviewed at each wave. The study focuses on identifying the health and social service needs among this displaced and highly affected population.

Abramson et al. (2008) used a stratified cluster sampling strategy to enroll subjects in the study in two phases: Louisiana in February 2006 (n=555) and Mississippi (n=524) in August 2006. Overall, they selected 26 sites as primary sampling units that included twelve FEMA group sites, ten commercial trailer sites, and four hotel sites. Using FEMA damage assessment maps and databases of the state's three coastal counties hardest hit by the hurricane, they randomly selected 150 of 650 census blocks that FEMA designated as having sustained moderate, extensive, or catastrophic damage. They sampled 4,284 households as secondary sampling units. Of those, 985 households were deemed ineligible because they were destroyed, vacant, abandoned, or under construction, leaving 3,299 eligible households. Among those, 1,587 households had an eligible adult

present to whom the study was presented; at the remaining 1,712 households, no contact was made despite repeated efforts. Among the 1,587 contacted households, 1,079 agreed to be enrolled in the longitudinal study, corresponding to a response rate of 32.6% (1079/3299) and a cooperation rate of 67.9% (1079/1587).³

The 1,079 households in Louisiana and Mississippi were followed for four rounds of data collection in the five years after Katrina (collected in 2006, 2007, 2008, 2009). For Louisiana respondents (n=555), all were still displaced at initial recruitment and were living either in group trailer parks or hotels. For respondents in Mississippi (n=524), they were either still displaced at initial recruitment, or were community-based respondents, some of whom had been displaced but had returned home, and some who only briefly evacuated their homes. At baseline, surveys were completed in person and lasted approximately one hour. The first follow-up round of interviews (Wave 2) was conducted in 2007, 20-23 months post-Katrina, and focused specifically on the physical and mental health effects and social and economic consequences resulting from exposure to the hurricane and subsequent displacement. A second follow-up survey (Wave 3), was conducted in 2008, 33-38 months post-Katrina and was completed with 777 interviews. A final follow-up survey (Wave 4) was completed in 2009 with 844 interviews. Over this period, G-CAFH retained 87.6% of the initial study cohort, including those who were still living and not incarcerated. This sampling strategy is representative of the approximately 60,000 residents who were displaced to congregate settings in Louisiana and Mississippi following Katrina, and representative of the 26,000 people who were living in the most damaged areas of the Mississippi Gulf Coast.

4.2 Dependent Variables

³ G-CAFH does not use weights to correct for sample selection or non-response.

4.2.1 *Mental Health*

The outcome measure *mental health* is derived from the mental health component of the short-form 12 (SF-12), version 2. The SF-12 is a multipurpose survey with 12 questions selected from the SF-36 Health Survey (Ware, Kosinski, & Keller 1996). The SF-12 was developed to provide a shorter alternative to the SF-36, which is criticized by health researchers as too long to administer (Ware, Kosinski, & Keller 1996). This subset of questions was combined, scored, and weighted to create two physical and mental health summary measures, denoted as the Physical and Mental Health Composite Scores (PCS-12 and MCS-12, respectively). These scales have been validated in both domestic and international populations, and are computed using the scores of twelve questions that range from 0 to 100 with zero indicating the lowest level of health and 100 the highest level of health (Ware, Kosinski, & Keller 1996). These scales have been normed to U.S. population standards with a mean score of 50.0 and a standard deviation of 10.0 (Ware, Kosinski, & Keller 1996). Questions from the SF-12 provide information on the mental and physical health of individual respondents, as well as their overall health-related-quality of life. The cutoff score of 42.0 for the MCS is often used to distinguish psychological distress (Ware, Kosinski, & Keller 1996). MCS has been dichotomized in these analyses to distinguish between those above (reference) or below the threshold for good mental health. Reliability is high for the SF-12 across all four waves with a Cronbach's Alpha of 0.85 at the baseline, 0.91 for Wave 2, 0.87 for Wave 3, and 0.82 for Wave 4. The outcome variable is normally distributed.

4.2 *Independent Variables*

4.3.1 *Mobility*

The main predictor variable *mobility* is measured continuously as the number of times the respondent moved between waves. I dummy coded the variable to distinguish between those who did not move (reference), those who moved 1-2, 3-5, or more than 5 times between waves. As the G-CAFH sample is a highly affected and subsequently highly mobile group, recoding movement as a dummy variable allows for comparisons of low, moderate, and high frequency movers with those who did not move at all.

4.3.2 Sociodemographic Variables

In addition to mobility, I consider variables that are known to influence mental health, including race, income, gender, age, marital status, and children in the household. Respondents self-identify their race or ethnicity at baseline, which was recoded as either “White,” “Black” or “Asian/Pacific Islander and Native American.” Due to frequency distributions, race is coded as a dichotomous variable: Black or Non-Black (reference). Household income is a time-variant variable that is measured categorically as earning less than \$10,000 annually (reference), between \$10-20,000, \$20-35,000, \$35-50,000 or greater than \$50,000 per year. Gender is measured at baseline and is coded as a dichotomous variable (1=male, 0=female). Age is a dummy variable categorized as 18-34 years old, 35-64 years old and older than 65. The younger age bracket (18-34) is the reference category, as younger adults usually have lower mental health score than older adults. I examine marital status at each wave and dichotomize it as (1 = married/cohabitating, 0 = single/separated/divorced/widowed). Lastly, I include whether or not the respondent has any children living in the household under the age of 18. This is measured as a time-variant dichotomous variable with no children in the household as the reference category.

4.4 Analytic Methods

The following analyses include random-effect logit models that report the log-odds of a respondent being below the threshold for poor mental health (<42.0). While random-effects and fixed-effects models are common approaches for analyzing longitudinal data, I use a variation of the random-effects model—a hybrid random effects model—to examine the effect of mobility on mental and physical health. Concerns over omitted variable bias make hybrid random effects models attractive for longitudinal analyses. The benefit of using a hybrid model is that it combines the advantages of both random and fixed effects (Allison 2009; Gasper et al. 2010).⁴ Considering random and fixed effects models separately helps explain the benefit of combining the advantages of each model. Using this approach often improves model fit and provides greater flexibility (Bollen & Brand 2010). It is important to note that time-varying regressors need to be decomposed and tested for heterogeneity bias. If there is no heterogeneity bias then the untransformed metric is more efficient. The random-effects logit model is expressed as follows:

$$\ln\left(\frac{\Pr(Y_{it} = 1)}{1 - \Pr(Y_{it} = 1)}\right) = \alpha + \beta X_{it} + \gamma W_i + \tau T_t + u_i$$

In this equation, Y_{it} is the binary response variable for the established threshold for poor mental health. The grand mean log-odds of mental health distress is represented by α , X_{it} are the time-varying (level-1) regressors (e.g. mobility, income, age, marital status,

⁴ Allison (2014) raises concerns regarding the use of the hybrid method with logistic regression. However, he concludes that the hybrid method for non-linear models is better than conventional random effects models. In addition, Goetgeluk and Vansteelandt (2008) show that any biased estimates for non-linear models are typically small.

children in the household) for individual i at time t , X_{it} are the time-stable (level-2) regressors (e.g. race, gender) for individual i , and τ represents the growth in log-odds between consecutive interviews. The error component includes the random effect for the intercept u_i .⁵

The last assumption of the random intercept model is problematic, as it does not control for unmeasured stable individual differences. However, the hybrid model decomposes time-varying independent variables from the random effects model into two parts, including between-person variation and within-person variation. The between-person variation is the mean of the variable for each individual across time or group mean. It can be written as follows:

$$\text{Between: } \bar{Y}_i = \alpha + \beta_B \bar{X}_i + u_i$$

The within-person component is the difference between each individual's group mean and his or her variable value at each time point:

$$\text{Within: } (Y_{it} - \bar{Y}_i) = \beta_W (X_{it} - \bar{X}_i)$$

The fully-specified hybrid model, including these decomposed variables that are used as predictors, can be noted as follows:

$$\ln \left(\frac{\Pr(Y_{it} = 1)}{1 - \Pr(Y_{it} = 1)} \right) = \alpha + \beta \tilde{X}_{it} + \gamma_1 \bar{X}_i + \gamma_2 W_i + \tau T_t + u_i$$

Using a hybrid approach provides coefficient estimates for both between-person effects and within-person effects for decomposed time-varying variables. Perhaps most importantly, the decomposition allows the within-individual estimates to be uncorrelated with the time-constant portion of the error term and makes it identical to the estimates

⁵ Level-1 residual (e_{it}) is unobserved because it is the residual of the latent response variable. It can be dropped from the model because it does not depend on X_{it} or W_i .

obtained in a fixed effect model. It is important to note, however, that this model does not control for the effects of change for unmeasured variables over time (Gasper et al. 2010).

4.4.1 Missing Data

As might be expected with a disrupted population, the sample size of each G-CAFH wave fluctuates following the baseline survey (n=1079). In subsequent waves, the sample decreases between 20 and 28 percent. In Wave 2, the sample size was 802. In Waves 3 and 4, the sample size was 777 and 844, respectively. Multiple imputation (MI) is an increasingly popular statistical technique for handling missing data, especially in medical and epidemiological research (White et al. 2011). MI uses the distribution of observed data to estimate values for the missing data by generating multiple datasets that create a set of parameter estimates (White et al. 2011). These estimates are then combined to create overall estimates, variances, and confidence intervals for an imputed dataset (White et al. 2011).

Rather than using complete case analysis or listwise deletion, I use the Stata 13 conditional multiple imputation procedure so as not to lose valid data points due to attrition across waves or non-responses to particular questions. I perform conditional MI using MI chained equations (MICE) in Stata and set the number of imputations to five. The key assumption that I make is that the data are missing at random (Allison 2002).

5. Results: Post-Disaster Mobility and Health Outcomes

5.1 Descriptives

Table 2.1 shows the unbalanced descriptives statistics for the sample by wave. At baseline, which was approximately one year after the storm, a majority of respondents

(57 percent) reported an MCS below 42.0, which indicates mental distress. This declines to nearly 48 percent about two years after the storm in Wave 2 and approximately 39 percent in Waves 3 and 4. A majority of respondents moved at least once between each of the first three waves while slightly less than 50 percent moved more than once in Wave 4. Respondents were highly mobile in the year immediately following Katrina as nearly 41 percent reported moving one to two times, 48 percent moving three to five times and 10 percent moving more than five times. Nearly 25 percent moved one to two times between baseline and two years after the storm, with almost 57 percent moving three to five times and 17 percent moving more than five times. An extremely small percentage of respondents reported that they had not moved at baseline, as well as between baseline and approximately two years after Katrina (1 and 2 percent, respectively). Many more respondents (35 percent) did not move between the time of Waves 2 and 3 (2-3 years after Katrina) and nearly no respondents moved more than five times (0.5 percent) during that period. However, a majority of respondents (58 percent) experienced one to two moves while 6 percent moved three to five times. Finally, between years three and four as reported at Wave 4, there is an increase in respondents that did not move. Nearly 37 percent moved one to two times, 10 percent moved three to five times and almost 3 percent moved more than five times. The highest rate of mobility (more than 5 moves) occurred between 2006 and 2007 (reported at Wave 2) when 17 percent of respondents indicated that they had moved five or more times. While interpreting these percentages, it is important to note that not all respondents were interviewed at each wave due to difficulty locating respondents. Mobility rates may be much higher, as those that interviewers were unable to locate and interview may be

moving with greater frequency than is shown here.

Insert Table 2.1 Here

Slightly more than half of the sample is Black (51 percent) while 49 percent identifies as either White, Asian, Pacific Islander or Native American. Income levels reflect the high poverty rates across affected areas of Louisiana and Mississippi with 31 percent of the sample earning a household income below \$10,000 per year and 34 percent earning between \$10-20,000 per year. These percentages remain steady over the course of the study with 35 percent, 30 percent and 29 percent earning a household income of less than \$10,000 annually. Similarly, 33 percent, 29 percent and 32 percent maintain household incomes between \$10-20,000 in each of the following years. As no more than 40 percent of the sample maintains a household income over \$20,000 at any wave there is evidence that a majority of respondents are constrained by their resources. Resource constraints can impede recovery making it an important variable to consider when examining mental health and other aspects of recovery.

A majority of respondents at baseline are women (59 percent), which might be expected as interviewers asked to speak with the person most knowledgeable about the household, and specifically about their children's health.⁶ The mean age of respondents at baseline was 46.4 with a standard deviation of 14.8. At baseline, 23 percent of respondents were between the ages of 18-34; 34 percent were between the ages of 35 and 49; 30 percent were between the ages of 50 and 65; and 12 percent were over the age of 65. As respondents move into different age categories, there are lower percentages of younger respondents (18-34) at each of the subsequent waves as expected. Younger

⁶ According to Abramson et al. (2008), interviewers sought an eligible adult respondent at each sampled household who was the "primary caregiver," someone who could knowledgeably report upon the health issues of all the individuals in the household.

respondents are also highly mobile even when not affected by disaster, which makes them a difficult population to keep enrolled in a cohort study. This could be why the raw number of young adults decreases ($n=129$) in Wave 3 and then increases ($n=142$) in Wave 4. At baseline, 34 percent of the sample is married or cohabitating with 66 percent reporting that they are single, widowed, divorced, or separated. The percent married or cohabitating increases to 43 percent in Wave 2, increases again to 45 percent in Wave 3 and remains about the same in Wave 4 (44 percent). The increase in marriage and cohabitation rates may be influenced by experiencing Katrina, as respondents may have moved in with their significant others to achieve greater emotional and financial resources in the face of a traumatic event. Lastly, approximately 40 percent of respondents have children in the home, defined as dependents below the age of 18. This percentage remains similar between Waves 1 and 3 but increases to 47 percent in Wave 4.

Table 2.2 reports the means and standard deviations for the number of moves by select independent variables. Respondents were highly mobile immediately following Katrina with an average number of 3.22 moves per household with a standard deviation of 2.29 in Wave 1. This mean number of moves increases slightly to 3.79 in Wave 2 but is lower in each of the next two waves. Despite this drop, respondents still experienced an average of approximately one move per year (0.97 and 1.04, respectively). These descriptive data also appear to demonstrate a relationship between mobility and poor mental health. Respondents with poor mental health (below 42.0) consistently report a higher number of moves than those with good mental health in each of the four years following Katrina with significant differences at Waves 1, 2 and 4. These respondents are also above the overall mobility mean at each wave. Income is strongly related to

number of moves, especially in the later years of recovery. Although mobility does not seem to vary much between income groups in Waves 1 and 2—approximately 0.40 difference among income groups in each wave between the highest and lowest mobility rates—by Waves 3 and 4 the lowest income bracket experiences the highest mobility rates (1.22 and 1.47 in Waves 3 and 4, respectively). This relationship, which will be further explored using logit models, suggests that while income does not greatly influence mobility rates immediately following the storm that financial resources play a larger role in the later stages of recovery. Lastly, there is a significant difference in average number of moves across age groups at each wave with younger respondents (18-34) reporting the highest rate of mobility at each time period. Younger people tend to be more mobile than older adults making this finding reflective of previous research. Interestingly, seniors (66 and older) averaged 2.69 moves in Wave 1 and 3.51 moves in Wave 2, which is surprising considering that they are not typically highly mobile. This is an important observation to further unpack as a high mobility rate might increase the likelihood that seniors experience poor mental health, especially since they are viewed as a vulnerable population following a disaster.

Insert Table 2.2 Here

Table 2.3 reports the unbalanced means and standard deviations for Mental Health Composite Scores (MCS) by mobility and sociodemographic characteristics. At baseline, there is a significant and somewhat linear relationship between frequency of mobility and mental health with respondents experiencing no moves having the highest MCS (43.7). The score is lower for those experiencing one to two moves (40.3) or three to five moves (40.5), and drops to 36.7 for those moving more than five times. By Wave 2, all

respondents see their mental health scores increase regardless of the number of moves they experience. Those with no moves increase to 46.3, those with one to two moves increase to 43.7, those with three to five moves increase to 42.2 while those with five or more moves increase to 40.0. By Wave 3, there are modest increases in mean MCS for all except those who moved three to five times. The mean MCS remains about the same for all mobility groups in Wave 4 except for those that moved more than five times who experience a relatively large drop in average mental health to 35.1. Across each wave those who moved more than five times have the lowest mean MCS indicating that there is a relationship between high mobility and mental health. Additionally, at Wave 4 those who moved more than five times have the lowest MCS score (36.7) across all categories of sociodemographic characteristics examined in Table 2.3.

Insert Table 2.3 Here

At baseline, Blacks, and Whites, Asian/Pacific Islander and Native American report similar mean mental health scores (approximately 40), and racial differences in mental health remain small throughout the four years of the study. At baseline, all income groups report similar mean MCS scores, ranging from 39.8 to 40.9. However, MCS improvement between the groups is not equal as those earning below \$10,000 annually see their mean MCS remain the same by Wave 4 (39.8) while those earning over \$50,000 annually report a substantial improvement in mental health to a score of 51.2. These significant differences across Waves 2, 3 and 4 suggest that recovery does not occur equally across all income groups when measured by mean MCS, despite typically reporting similar scores at baseline. As a large portion of respondents earned under \$10,000 at each wave of G-CAFH, it is important to consider the possible effect that

income and lack of financial resources may have on mental health recovery.

Women report significantly lower mean MCS at baseline (39.2) compared to men (41.5); however, each group increased by approximately 4 points by Wave 4 with women having a final mean mental health score that is only 1.7 lower than men, and not statistically different. It is interesting to consider that seniors report the highest mental health score at each wave (44.5, 45.5, 48.2 and 49.2, respectively), as they are typically considered a population vulnerable to disaster. Those who were married or cohabitating reported higher mental health scores at each wave (40.6, 43.7, 45.6 and 46.2, respectively) than those who were either single, widowed, divorced or separated (39.7, 41.2, 44.8 and 43.9, respectively), which suggests that being partnered may provide a protective buffer to post-disaster distress. Finally, those with children in the household report lower mental health scores at baseline (38.8) compared to those without children (41.0), but this difference largely disappears by Wave 4. The significant differences in mental health between parents and non-parents in the early years of the study suggest that those with children may have more stressors in the immediate years following Katrina than those without dependent children. Overall, this table suggests that time may be a powerful predictor of post-disaster mental distress, as nearly all groups report at least some increase in mean MCS when comparing initial mental health reports to those four years after the storm.

5.2 Non-Normal Error Models

The results for models predicting the odds of experiencing mental distress (below 42.0) are presented in Table 2.4.⁷ Models 1 and 2 are random-effects logit models while

⁷ In order to calculate the odds ratio (transformed in a percentage for ease of interpretation), the following formula was used: $100(e^x - 1)$ where x equaled the coefficient.

Model 3 is a hybrid random-effects logit model. Although not shown, time alone has a significant effect on the likelihood of scoring below 42.0 on the MCS. The odds of scoring below 42.0 on the MCS decline by 31 percent per year after the baseline interview. Model 1 includes only dummy variables that measure the effect that number of moves has on the likelihood of being in poor mental health. This model shows that there is no significant difference in the likelihood of having an MCS score below 42.0 for those who moved 1-2 or 3-5 times on average compared to those who did not move. However, the odds of being mentally distressed (on average across all waves) are 75 percent higher ($p < .01$) for those who moved more than five times than for those who did not move. Time remains a significant predictor as the odds of experiencing poor mental health decrease by 27 percent after baseline. The intraclass correlation coefficient is 0.41, which means that 41 percent of the variance in the propensity to experience mental health distress can be attributed to individuals. This coefficient reflects the propensity for individuals to score below 42.0 on the MCS, rather than manifest mental distress.

Insert Table 2.4 Here

Model 2 adds all of the sociodemographic variables, including race, income, gender, age, marital status and children in the household. This model produces similar results to Model 1 regarding the effect of mobility on the odds of experiencing mental health distress. Again, there is no significant difference in the odds of having an MCS score below 42.0 for those who moved 1-2 times or 3-5 times compared to those who did not move. Similarly, the odds of scoring below 42.0 on the MCS is 54 percent higher for those who moved more than five times compared to those who did not. Although the odds of experiencing mental health distress decrease in Model 2, the effect of high

mobility remains significant while considering aspects of vulnerability such as race, gender, and income that can influence the effect of mobility. The effect of income is highly significant and reflects a similar pattern found in the means reported in Table 2.2. Compared to households earning less than \$10,000 annually, the odds of experiencing mental distress decreases by 30 percent, 48 percent, 57 percent, and 66 percent, for those earning between \$10-20,000, \$20-35,000, \$35-50,000, and, over \$50,000 annually, respectively. Overall, these findings suggest a very powerful relationship between income and mental health distress that has the potential to negatively influence the recovery process.

There is a significant relationship between gender and mental health distress with men nearly 27 percent less likely to report poor mental health than women. Although there is no significant difference in mental health between individuals who are 35-49 year olds or 50-65 year olds and younger adults (18-34 year olds), seniors (66 years and older) have significantly lower odds of being distressed than the youngest adults. The odds of mental health distress are 43 percent less for seniors compared to young adults. This is especially interesting since seniors are typically considered a vulnerable population following a disaster. While likely vulnerable to the event, perhaps seniors are more resilient than other age groups as it relates to mental health recovery. There is a significant difference in mental health between adults with children and without, as those with children are 27 percent more likely to experience mental health distress suggesting that taking care of children after a disaster can be an additional stressor during recovery. Lastly, the odds of mental health distress are 25 percent lower for married or cohabitating respondents than those who are not partnered. Similar to Model 1, time remains a

significant predictor as the odds of experiencing poor mental health decrease by 27 percent after baseline. The intraclass correlation coefficient for Model 2 is 0.38, which is lower than Model 1. Thirty-eight percent of the variance in the propensity to experience mental health distress can be attributed to individuals. Interaction effects that examined high mobility rates (greater than five moves) with various sociodemographic characteristics (low income, Black, female, elderly, and single/divorced/separated/widowed) are not significant. Thus, while levels of distress vary by race, income, gender, age, and marital status, that the effects of mobility on mental health are experienced similarly by all groups. Although these interaction effects are not significant this may be a reflection of the sample rather than the true relationship between mobility and overlapping social characteristics after a disaster. G-CAFH is a highly mobile and affected sample, which means that there may not be enough range in vulnerability to distinguish different interactions. This lack of variation could cause the differential impact of mobility to not be significant. Such remaining questions create possibilities for exploration in future studies.

Model 3 is a hybrid random-effects logit model predicting the odds of experiencing mental health distress. Decomposing time-varying covariates into between-person and within-person components is a strategy used to address selection effects (Gasper et al. 2010). If no heterogeneity bias is evident through a means test then untransformed metrics were used, as they are considered to be more efficient. Model 3 provides a key test as to whether the relationship between mobility and mental health can be attributed to preexisting differences among respondents. The decomposed “between” coefficients give the between-person differences in mental health for mobility. The

decomposed “within” coefficients provide the change in mental health that follows a change in the decomposed variable. Decomposing time-varying characteristics in this way provides a means for determining whether the effects of variables that can change over time is coming from differences between respondents from the start or from dynamic influences on mental health over time (within person effects).

Many of the findings from Model 2 are similar to Model 3, however decomposing the time-varying dummy variables for number of moves reveal an important understanding of where the effect of mobility on the odds of experiencing mental health distress come from. Unlike the untransformed measure in Model 2, the between-person coefficient for each measure of mobility is large and significant, and the within person coefficients are all non-significant. This shows that people who have moved more often have higher odds of experiencing mental health distress than those who did not move at all. However, this relationship is because of differences between individuals who moved varying number of times and *not* representative of a causal effect of moving on diminished mental health. Although researchers typically link aspects of secondary exposure like displacement and mobility to mental health distress, these results suggest that those who move more frequently have poorer mental health at the outset.

The results for income show that between-person influences are significant for higher income categories but not for those earning \$10-20,000. Similarly, within influences are significant for \$10-20,000 but not for other income categories. By transforming this variable it is easier to see that the between-person coefficient is greater and significant for these higher income categories. This means that a major part of the effect of income on mental health that is seen in Model 2 is coming from differences

between people (i.e., those that have higher incomes compared to those who earn under \$10,000 annually). However, importantly, there is also an effect of changes in post-Katrina income on changes in mental health. Those whose incomes decreased to \$10-20,000 in the years after the storm saw nearly 24 percent decrease in their mental health. This finding suggests that there is something significant about falling below the poverty line during post-disaster recovery, which can negatively impact mental health. Other time varying variables (age, marital status, and children in the household) are not decomposed, as the means tests were not significant, which suggests that the untransformed measure is more efficient. Of these time-varying variables that were not transformed, many of the significant findings from Model 2 disappear in Model 3, including the effect of age, marriage/cohabitation and children. Alternatively, race is now a significant predictor of the odds of experiencing mental health distress, which is 27 percent lower for Black compared to Whites, Asian/Pacific Islanders and Native Americans, everything else being equal. Lastly, time remains a significant predictor of mental health as the odds of experiencing distress decrease by 31 percent.

6. Discussion

The main contribution of this chapter was to provide a descriptive understanding of mobility post-Katrina, including the characteristics of movers and how often they moved. Overall, affected Katrina residents were highly mobile in the years following the storm. Perhaps surprisingly, residents experienced higher rates of mobility between Waves 1 and 2 (up to 23 months post-Katrina) than a year after the storm when recorded at baseline. While residents reported far fewer moves at Waves 3 and 4 they still average approximately one move per year. To contextualize how this remains a high rate of

mobility, Americans on average move once every five years (Fields & Kominski 2010). Averaging approximately one move per year suggests that Katrina residents are still dealing with the repercussions of the storm and are continuing to settle or put roots down in new homes, neighborhoods, or cities. These findings provide support for the argument that post-Katrina migration was different from previous disaster migration. Katrina residents often found themselves experiencing *perpetual migration* where they moved several times even after they had migrated to another town or city. I posit that this combination of forced migration with high mobility could have lasting implications for mental health and overall recovery.⁸

Determining which groups were more mobile than others provides information on who might be most vulnerable following a catastrophic event, as well as who faces the most serious challenges during the recovery process. As expected, similar to Weber and Peek's (2012) argument, mobility was not experienced equally, especially in the later years of recovery, as highly disadvantaged residents reported the highest relocation rates. Those with poor mental health and lower income residents exhibited the highest mean mobility rates with nearly 4 moves at Wave 2. These groups continued to experience some of the highest mobility rates across all groups at each wave. Identifying the poor and mentally distressed as those who are vulnerable to high mobility following a disaster, especially during the recovery process, will assist policymakers in creating targeted, long-term programs that provide individuals with the support necessary to achieve better rates of mental health recovery.

A second aim of this chapter was to explore how post-Katrina residential mobility

⁸ G-CAFH contains point data for each respondent over the course of the study. A future analysis should examine distance moved between waves to determine whether those who moved long distances experienced mental health distress similar to those who experienced high mobility.

influences mental health while controlling for various social characteristics. Although previous research had yet to unpack the long-term effects of mobility and inequality on health outcomes, these findings shed light on this relationship. I expected that the effects of mobility would lessen once variables measuring different social characteristics were included. However, net of sociodemographic characteristics, high mobility (> 5 moves) is associated with significantly greater odds of experiencing poor mental health. The hybrid model further unpacks this relationship and suggests that those who move are more likely to report mental health distress rather than high mobility increasing the likelihood of experiencing distress. This is an important directional relationship to identify as it is typically argued that high exposure, including high mobility, can have a detrimental effect on mental health. Instead, these findings suggest that those who move frequently are more likely to initially have poor mental health. Those with poor mental health are more likely to live in poverty, have low levels of social support, and less likely to live in stable housing, which may influence post-disaster recovery, including mobility rates.

In addition to the relationship between mental distress and mobility, there were two surprising findings in the logit analyses. I expected that there would be significant age differences in the likelihood of experiencing poor mental health. Numerous studies (Bolin 1993; Mileti, Sorenson & O'Brien 1992; Phillips 1993; Peacock, Morrow, & Gladwin 1997) have found that the elderly are more likely to experience negative health consequences following a disaster and can take longer to recover. The elderly are typically considered some of the most vulnerable following a disaster so it was unexpected to find that they reported the highest mean mental health scores at each wave.

Additionally, seniors (66 and older) were highly mobile following Katrina with nearly 3 moves between the storm and baseline, and 3.5 moves between baseline and Wave 2. Seniors are some of the least mobile individuals, which make their high mean mobility rates following Katrina unexpected. Although one might expect that seniors would be more likely to experience poor mental health than younger adults because of high mobility rates and being labeled a vulnerable population, Model 2 suggests that seniors were quite resilient in the years after the storm. Despite exhibiting higher rates of mobility and greater odds of poor mental health in the first two years following Katrina, it is possible that they were able to recover at a faster rate than younger adults. Although this significant relationship disappears for seniors in Model 3, descriptive analyses suggest that seniors should be considered a vulnerable population during and immediately following a disaster but appear to be one of the most resilient groups in the aftermath of Katrina, as it relates to mental health.

Perhaps the most powerful finding was that of the relationship between poor mental health and income. Despite income groups reporting similar scores at baseline, mental health recovery does not appear to be equal across all income groups. While higher resourced individuals report mean MCS scores nearly 12 points higher at Wave 4 than at baseline, those earning under \$10,000 annually do not report a change in mean MCS from the 39.8 reported at baseline. There is also evidence that income is strongly related to number of moves, especially in the later years of recovery. Previous research is not definitive as to whether higher resourced individuals are any less likely to move than those with fewer economic resources. The findings presented here suggest that while higher income residents are just as likely to move as lower income residents at the

beginning stages of recovery, as time passes they are, on average, less likely to move.

These findings demonstrate that it is important to consider the possible effect that lack of financial resources has on both mental health and mobility over time. While income does not appear to greatly influence mental health or mobility rates immediately following the storm it is possible that financial resources play a larger role in the later stages of recovery. Such findings demonstrate that pre-existing inequalities endure in the face of extreme social disruption and demonstrate powerful links with various mental health outcomes.

Lastly, as reflected in the differences between income groups, the findings presented here suggest that time is a powerful predictor of post-disaster mobility rates and mental distress. Literature on the mental health consequences of disasters has demonstrated that the psychological effects of disasters can persist for years (Norris et al. 2002). In fact, prior studies show that mental health problems can persist for more than two years after a disaster, with relocated residents twice as likely to experience symptoms of mental health distress (Yzermans et al. 2005). Overall, these findings support previous research; however, they also demonstrate that recovery is a slow, and often unequal, process. Further, disasters often work to sustain and endure inequalities that existed prior to the event. There is certainly a complexity to mental health outcomes following a disaster, in which aspects of race, income, gender and mobility further exacerbate inequalities and perhaps even cause downward social mobility. However, the relationship between different vulnerabilities and mental health distress must continue to be examined in future research. In terms of policy, these results suggest that highly mobile residents and lower income individuals are at the highest risk for experiencing

mental distress. Although such explanations should be further explored in future research before any conclusions can be reached, inequalities that existed prior to Katrina appear to point to which vulnerable groups are in greatest need of targeted programming and assistance following a disaster.

Table 2.1		Unbalanced Descriptives of G-CAFH Cohort: 2006-2009			
(N, % unless noted)		Wave 1	Wave 2	Wave 3	Wave 4
<i>Dependent Variable</i>					
MCS (0-100) mean/SD		40.1 (11.0)	42.3 (13.1)	45.2 (13.2)	44.9 (12.9)
	<i>Below 42.0</i>	600 (56.7)	383 (47.9)	300 (38.7)	324 (38.5)
	<i>Above 42.0</i>	457 (43.3)	416 (52.1)	475 (61.3)	518 (61.5)
<i>Independent Variables</i>					
Number of Moves					
	<i>No moves</i>	14 (1.3)	12 (1.5)	271 (35.3)	429 (50.8)
	<i>Moved 1-2 times</i>	436 (40.5)	199 (24.8)	448 (58.3)	309 (36.6)
	<i>Moved 3-5 times</i>	518 (48.2)	455 (56.7)	45 (5.9)	84 (10.0)
	<i>Moved >5 times</i>	107 (10.0)	136 (17.0)	4 (0.5)	22 (2.6)
Race					
	<i>Black</i>	514 (50.5)			
	<i>Other</i>	504 (49.5)			
Income					
	<i>< 10K</i>	316 (31.1)	274 (34.8)	224 (29.8)	241 (29.2)
	<i>10-20k</i>	347 (34.0)	258 (32.8)	214 (28.5)	265 (32.1)
	<i>20-35k</i>	183 (17.9)	126 (16.0)	157 (20.9)	149 (18.0)
	<i>35-50k</i>	95 (9.3)	71 (9.0)	88 (11.7)	87 (10.5)
	<i>> 50k</i>	79 (7.8)	58 (7.4)	68 (9.1)	84 (10.2)
Gender					
	<i>Male</i>	440 (40.7)			
	<i>Female</i>	642 (59.3)			
Age					
	<i>18-34</i>	251 (23.4)	154 (19.2)	129 (16.7)	142 (16.8)
	<i>35-49</i>	365 (34.1)	272 (34.0)	266 (34.4)	272 (32.2)
	<i>50-65</i>	324 (30.2)	271 (33.8)	271 (35.0)	305 (36.2)
	<i>66+</i>	132 (12.3)	104 (13.0)	108 (13.9)	125 (14.8)
Marital Status					
	<i>Married/Cohabiting</i>	358 (33.9)	341 (42.5)	344 (44.5)	372 (44.2)
	<i>Not Married</i>	699 (66.1)	462 (57.5)	429 (55.5)	470 (55.8)
Children in the Household					
	<i>Children</i>	428 (39.6)	323 (40.2)	303 (39.0)	398 (47.2)
	<i>No Children</i>	653 (60.4)	480 (59.8)	474 (61.0)	446 (52.8)
Total N		1079	802	777	844

Table 2.2		Unbalanced Means and Standard Deviations for Mobility by Select Sociodemographic Characteristics for the G-CAFH Cohort: 2006-2009			
		Wave 1	Wave 2	Wave 3	Wave 4
Number of Moves		3.22 (2.29)	3.79 (2.00)	0.97 (1.25)	1.04 (1.73)
Independent Variables					
MCS (0-100)					
mean/SD					
	<i>Below 42.0</i>	3.44 (2.56)***	3.93 (2.09)*	1.03 (1.11)	1.28 (1.76)***
	<i>Above 42.0</i>	2.92 (1.87)	3.66 (1.90)	0.92 (1.34)	0.89 (1.69)
Race					
	<i>Black</i>	3.06 (1.58)	3.64 (1.87)*	1.02 (1.41)	1.07 (1.55)
	<i>Other</i>	3.32 (2.79)	3.92 (2.06)	0.91 (1.09)	1.01 (1.94)
Income					
	<i>< 10K</i>	3.15 (1.80)	3.96 (2.17)*	1.22 (1.71)***	1.47 (2.34)***
	<i>10-20k</i>	3.23 (2.77)	3.72 (1.98)	1.04 (1.21)	1.11 (1.53)
	<i>20-35k</i>	3.10 (2.02)	3.35 (1.68)	0.81 (0.82)	0.89 (1.38)
	<i>35-50k</i>	3.22 (1.75)	3.94 (1.96)	0.69 (0.82)	0.44 (1.02)
	<i>> 50k</i>	3.46 (3.09)	3.98 (1.93)	0.68 (0.84)	0.51 (0.81)
Gender					
	<i>Male</i>	3.15 (2.61)	3.65 (2.07)	0.96 (1.33)	1.23 (2.13)**
	<i>Female</i>	3.27 (2.05)	3.88 (1.95)	0.98 (1.13)	0.92 (1.40)
Age					
	<i>18-34</i>	3.48 (2.97)*	4.14 (2.05)*	1.36 (2.11)***	1.86 (1.85)***
	<i>35-49</i>	3.21 (2.41)	3.66 (1.90)	0.96 (0.96)	1.00 (1.54)
	<i>50-65</i>	3.24 (1.77)	3.82 (2.08)	0.87 (1.08)	0.91 (1.90)
	<i>66+</i>	2.69 (1.45)	3.51 (1.96)	0.76 (0.73)	0.52 (1.10)
Marital Status					
	<i>Married/Cohabiting</i>	3.14 (1.82)	3.76 (1.86)	0.89 (1.45)	0.89 (1.46)*
	<i>Other</i>	3.26 (2.51)	3.82 (2.11)	1.03 (1.07)	1.14 (1.89)
Children in Household					
	<i>Children</i>	3.31 (2.80)	3.79 (1.97)	1.03 (1.54)	1.15 (1.57)
	<i>No Children</i>	3.16 (1.89)	3.80 (2.03)	0.93 (1.04)	0.94 (1.85)
Total N		1079	802	777	844

* p ≤ 0.05 ** p ≤ 0.01 *** p ≤ 0.001

**Unbalanced Means and Standard Deviations for Mental Health
Composite Score (MCS) by Mobility and Sociodemographic
Table 2.3 Characteristics for the G-CAFH Cohort: 2006-2009**

	Wave 1	Wave 2	Wave 3	Wave 4
MCS (0-100)	40.1 (11.0)	42.3 (13.1)	45.2 (13.2)	44.9 (12.9)
Independent Variables				
Number of Moves				
<i>No moves</i>	43.7 (13.8)*	46.3 (9.9)*	47.0 (12.8)*	46.5 (12.6)***
<i>Moved 1-2 times</i>	40.3 (10.7)	43.7 (12.9)	44.4 (13.4)	44.2 (12.5)
<i>Moved 3-5 times</i>	40.5 (11.2)	42.2 (12.9)	42.1 (12.8)	41.6 (13.7)
<i>Moved >5 times</i>	37.1 (9.48)	40.0 (13.7)	41.0 (14.7)	35.1 (14.9)
Race				
<i>Black</i>	40.2 (11.0)	42.7 (12.7)	46.1 (12.5)	44.8 (12.2)
<i>Other</i>	39.9 (10.9)	41.9 (13.4)	44.6 (13.7)	45.0 (13.5)
Income				
< 10K	39.8 (11.0)	39.6 (13.5)***	41.4 (14.2)***	39.8 (14.1)***
10-20k	40.3 (10.3)	42.0 (12.3)	44.1 (13.2)	45.3 (11.5)
20-35k	39.8 (10.9)	44.1 (12.4)	47.7 (12.2)	47.1 (11.7)
35-50k	40.9 (11.9)	45.6 (12.8)	49.4 (11.5)	47.1 (13.6)
> 50k	39.5 (11.9)	47.8 (11.7)	48.6 (10.6)	51.2 (9.3)
Gender				
<i>Male</i>	41.5 (11.1)***	43.8 (12.8)**	45.7 (12.7)	45.9 (13.2)
<i>Female</i>	39.2 (10.7)	41.3 (13.1)	44.8 (13.5)	44.2 (12.7)
Age				
18-34	38.3 (10.3)***	42.4 (12.3)*	45.2 (14.4)*	44.5 (14.6)***
35-49	39.2 (11.1)	41.0 (13.3)	43.5 (13.0)	43.4 (11.9)
50-65	40.7 (11.1)	42.2 (13.4)	45.5 (13.0)	44.7 (13.2)
66+	44.5 (9.6)	45.5 (12.3)	48.2 (12.1)	49.2 (11.4)
Marital Status				
<i>Married/Cohabit.</i>	40.6 (11.2)	43.7 (13.1)**	45.6 (13.6)	46.2 (12.6)**
<i>Other</i>	39.7 (10.7)	41.2 (12.9)	44.8 (12.9)	43.9 (13.0)
Children in Household				
<i>Children</i>	38.8 (10.8)***	41.1 (12.6)*	45.2 (12.9)	44.1 (13.2)
<i>No Children</i>	41.0 (10.9)	43.1 (13.3)	45.1 (13.4)	45.6 (12.6)
Total N	1079	802	777	844

* p <= 0.05 ** p <= 0.01 *** p <= 0.001

Table 2.4 Random-Effects and Hybrid Random-Effects Logit Models Testing the Association between Mental Health and Mobility for the G-CAFH Cohort: 2006-2009 (N=1079)

			Model 1			Model 2			Model 3		
			Coefficient	95% CI	P	Coefficient	95% CI	P	Coefficient	95% CI	P
Independent Variables											
Number of Moves											
No moves (ref.)											
Moved 1-2 times			0.13	(-0.11, 0.37)	0.283	0.07	(-0.18, 0.31)	0.591			
Moved 3-5 times			0.27	(-0.04, 0.58)	0.089	0.16	(-0.15, 0.47)	0.302			
Moved >5 times			0.56	(0.15, 0.97)	0.008	0.43	(0.02, 0.84)	0.039			
Number of Moves (Between)											
No moves (ref.)											
Moved 1-2 times									1.27	(0.57, 1.98)	0.000
Moved 3-5 times									1.60	(0.72, 2.48)	0.000
Moved >5 times									2.79	(1.75, 3.82)	0.000
Number of Moves (Within)											
No moves (ref.)											
Moved 1-2 times									-0.10	(-0.38, 0.16)	0.451
Moved 3-5 times									-0.02	(-0.37, 0.32)	0.898
Moved >5 times									0.07	(-0.39, 0.53)	0.759
Race											
Black						-0.31	(-0.62, 0.01)	0.055	-0.31	(-0.61, -0.01)	0.049
Other (ref.)											
Income											
< 10K (ref.)											
10-20k						-0.36	(-0.60, -0.13)	0.003			
20-35k						-0.65	(-0.95, -0.34)	0.000			
35-50k						-0.86	(-1.29, -0.43)	0.000			
> 50k						-1.08	(-1.51, -0.64)	0.000			
Income (Between)											
< 10K (ref.)											
10-20k									-0.43	(-0.95, -0.09)	0.103
20-35k									-0.92	(-1.56, -0.28)	0.006
35-50k									-1.07	(-1.76, -0.39)	0.002
> 50k									-1.29	(-1.92, -0.66)	0.000

Income (Within)			
	< 10K (ref.)		
	10-20k		
	20-35k		
	35-50k		
	> 50k		
Gender			
	Male	-0.31	(-0.57, -0.04)
	Female (ref.)	0.023	-0.33
Age			
	18-34 (ref.)		
	35-49	0.16	(-0.16, 0.47)
	50-65	0.15	(-0.20, 0.49)
	66+	-0.57	(-1.03, -0.11)
Marital Status			
	Married/Cohabiting	-0.29	(-0.55, -0.04)
	Other (ref.)	0.027	-0.22
Children in the Household			
	Children	0.24	(0.01, 0.48)
	No Children (ref.)	0.048	0.22
Time	-0.32	(-0.40, -0.23)	0.000
Sigma_u	1.51	(1.34, 1.70)	1.42
ICC	0.41	(0.35, 0.47)	0.38
Model Significance (P)		0.000	0.000

* p <= 0.05 ** p <= 0.01 *** p <= 0.001

Chapter 3: Household Instability After Katrina: An Analysis of Adult Mental Health Patterns

1. Introduction

Hurricane Katrina was a catastrophic disaster, causing approximately 1.5 million people to evacuate their homes and communities prior to the storm's arrival (Weber & Peek 2012). Once the storm passed, nearly 150,000 businesses and over 300,000 homes across the Gulf Coast were left badly damaged or destroyed (Rodriguez et al. 2006; Weber & Peek 2012). This widespread destruction resulted in the largest displacement in U.S. history, separating families and causing residents to migrate to all fifty states (Nigg, Barnshaw & Torres 2006; Rendall 2011; Weber & Peek 2012). While disasters typically displace residents for a period of days or weeks, Katrina was unusual in that residents often spent months displaced from their homes and were unable to seek shelter with nearby friends or family who were likely suffering from similar difficulties. Insufficient and inadequate shelter meant that displaced residents often had to separate from family members or double up with others in order to find temporary housing (Rendall 2011). In the weeks, months, and years following Katrina, affected residents were often confronted with extreme confusion and uncertainty regarding their housing, which manifested into difficulties reconfiguring and settling their own families. Uncertainty and disruption such as this is often a stressor that can have long-lasting mental health consequences.

The consequences of disaster-induced displacement and mobility, including lack of permanent and stable housing, have been widely recognized (Erikson 1976; Norris et al. 2002; Galea et al. 2007; Levine, Esnard & Sapat 2007; LaJoie, Sprang & McKinney 2010). However, there are other, less noticed, aspects of stress related to housing damage, displacement and mobility. One overlooked consequence is that household living

arrangements become disrupted. Although previous studies have explored the changes in how the relationships and roles within a household link to mental health, few have considered how familial and household relationships shape mental health recovery following a disaster (Reid & Rezcek 2011). Generally, highly disruptive disasters like Katrina cause households to experience multiple transitions, including the entering and leaving of family and friends during the course of recovery. Fothergill and Peek (2015) describe several poignant accounts of household separations, including a mother and sixteen year old boy who were forced to separate because of age and gender restrictions in a shelter. This separation came nearly three years after Katrina, following countless moves to different shelters, hotels and apartments throughout Louisiana, New York, and California—an example of how perpetual migration can stall recovery.

Household instability following a disaster could be caused by home damage or destruction, economic constraints, lack of adequate living space, or difficulties within the family (Glick & Van Hook 2011). Such disruption can put a strain on resources, break up extensive kin networks, and upset informal support systems that individuals rely on in a time of disaster recovery (Glick & Van Hook 2011). Additionally, household instability may lead to inconsistent or different forms of physical and emotional support. While previous research acknowledges the substantial instability that many households experience following a disaster, few studies examine whether household instability influences mental health, and if so, exactly how different types of household transitions, including the addition or subtraction of family and friends, may negatively affect mental health recovery.

The analyses presented in this chapter provide a nuanced view of household instability by considering the sociodemographic differences between households that expand, contract or remain stable in the years following Katrina. Understanding these patterns will illustrate some of the difficulties faced by families over the course of recovery. To further examine these general patterns, I analyze how the addition or subtraction of household members over time can affect an adult respondent's mental health while holding sociodemographic characteristics constant. Rather than treat household structure as static, I explore the dynamic nature of post-disaster households and how instability might mitigate or exacerbate mental health recovery. Similar to Rendall (2011), I argue that household instability should be treated as a social vulnerability characteristic, which can increase mental health distress. Thus, it is possible that household instability should be considered a consequence of displacement following a disaster, one that could be associated with declining mental health.

To explore the relationship between household instability and mental health, I use the 2006-2009 *Gulf Coast Child and Family Health Study* (G-CAFH). Using household instability categories developed by Hays et al. (1995), I examine whether households were stable, contracted or expanded in the four years following Katrina. These distinctions capture whether the household remained intact (stable), split into separate living situations (contracted), or took in others, possibly including family, friends or acquaintances (expanded). Using nuanced household instability categories—rather than simply examining whether the household is stable or unstable—provides further insight into whether different types of transitions can affect the primary care giver's mental health over time. These categories capture the unique experience of Katrina survivors

who often separated from family members or doubled up with others after the storm affecting resources, social networks, and informal support systems (Rendall 2011). To explore these relationships, I use random effects and hybrid random effects growth curve models to examine whether different types of household instability influences adult mental health recovery following Hurricane Katrina.

2. Background

2.1. Post-Katrina Displacement and Household Transitions

The lack of permanent and stable housing following a disaster has received considerable attention with research showing the unstably housed as more likely to report mental health distress, have a poorer sense of community, and lack adequate social support (Abramson et al. n.d.). Although housing stability is important to consider, post-disaster mental health outcomes are best understood by examining the individual within the context of social systems like the family or household (Edwards 1998). This is largely because family relationships are dynamic and can change over time, especially following a traumatic event like a disaster, which influences the amount of support or strain placed on members during the recovery process. Following a disaster, households can experience several transitions and adjustments, especially when an event is powerful enough to displace millions from their homes (Peek et al. 2011).

In the period following Katrina, displaced residents moved several times and often between different house types, including trailers, hotels, shelters, apartments, public housing, and single family homes (Weber & Peek 2012). This kind of uncertainty, frequently linked to displacement and mobility, can disrupt and break ties with family, friends, and sources of community support (McLanahan & Sandefur 2009; Cooper et al. 2009). After Katrina hit, Gulf Coast families found themselves broken up and scattered

with great frequency (Haney, Elliot, & Fussel 2007; Rendall 2011). Household members can be a source of support or stress during recovery. The loss of household members following a disaster, especially if unwanted, could remove protective buffers against stress. Similarly, the addition of others to a household could be a source of stress because of strained resources or limited space.

Within the first year following the storm, approximately two-thirds of pre-Katrina households consisting of two or more individuals decreased by at least one person (Rendall 2011). Similarly, in extended family households half of all adult children were no longer living with their pre-Katrina household a year following the storm. It is important to note that such transitions can be temporary as they may be the result from the need for home repairs or improvements to neighborhood infrastructure (Rendall 2011), high rates of mobility or unstable housing (Abramson et al. n.d.). Alternatively, they may be permanent transitions caused by divorce or frayed relationships. Regardless of length, such disruption can take its toll emotionally on members of the household as they attempt to recover from a traumatic event.

2.2. Household Instability and Mental Health

Household members typically provide emotional and instrumental social support to one another, which can benefit mental health by buffering against stressful events (Cooper et al. 2009; Wright et al. 1998; Thoits 1995). Overall, social support—like that often provided by household members—is inversely related to psychological disorder, physical morbidity, and mortality (Aneshensel 1992). It is possible that disrupting these supportive social ties through unanticipated household transitions could be harmful to mental health, especially when coping with the emotional uncertainty associated with recovering from a catastrophic disaster. Alternatively, recent research has found that the

household can contribute to the strain of a stressful event rather than provide support to protect against it (Fingerman, Hays & Birditt 2004). A stressful event has the potential to affect the entire family, which can lead to conflict or breakdown of relationships (Walsh 1996). Losing resources, a household's daily routine, and a sense of control were all associated with psychological distress following Hurricane Hugo (Freeddy et al. 1992). Such consequences could be further exacerbated when compounded with household transitions. These findings suggest that questions remain regarding whether households act as stressors or provide social support following a disaster.

There are two main forms of household instability examined here—the subtraction of members (i.e. contracted) or the addition of friends or family (i.e. expanded). Research on the association between health and household instability is not definitive (Burgard, Seefeldt & Zelner 2012). Family extension may have contradictory effects, as on the one hand, it can lead to economic and emotional resource sharing during a time of stress or economic constraint (Ahrentzen 2003). Such arrangements can be beneficial to household members as they receive social support, including basic social needs such as approval, belonging, identity and security (Cobb 1976; Thoits 1982). On the other hand, extended-household living arrangements are not always beneficial, as they can also be a source of stress, especially for the primary caregivers. This could be due to additional household members placing strains on space, which can produce crowded living and sleeping arrangements. It can also strain resources if additional members do not have steady incomes or savings to draw upon to contribute to expenses.

Similarly, some studies suggest that “doubling up” with others has a negative effect on mental health (Burgard, Seefeldt & Zelner 2012; Evans et al. 1989; Gove,

Hughes, & Galle 1979; Lepore, Evans, & Schneider 1992). Disaster survivors—especially those of lower-income—are likely to live in bigger households during recovery as they often end up staying with family or friends, and/or doubling up with other survivors (Lowe, Rhodes & Scoglio 2012; Morrow 1997; Reid 2013; Weber and Peek 2012), creating cramped and potentially stressful living conditions. Some findings suggests that it is not crowding or resource strain that contributes to mental distress but isolation, as being alone causes individuals to “dwell on their internal struggles” (Burgard, Seefeldt & Zelner 2012: 2216). Those living alone also tend to suffer the most because they lack social contact and do not have access to the same support networks as those who live with others (Klinenberg 2002). Similarly, losing household members could mean that there is less social support, fewer financial resources, and even help with daily household chores and management, including childcare, cooking, and cleaning. For example, Hurricane Katrina has been associated with increased divorce rates and the scattering of families (i.e. contracted household), which could decrease financial resources, disrupt routines, and lessen emotional support. It is also possible that households expanded by taking in senior relatives or other dependents that might strain resources. In each of these situations, the addition or subtraction of household members might further disrupt mental health recovery by delaying a sense of normalcy.

For these reasons, examining household transitions can further understandings of how changes in household living arrangements following a disaster can impede mental health recovery. As instability in the context of disasters is often an unanticipated consequence, experiencing such an undesirable event can have serious implications for mental health (Cooper 2009). The addition or subtraction of individuals from a

household could mean that socioeconomic, social, and health resources become altered, at least for a period of time. The question is whether these types of changes are equally, more, or less detrimental to mental health. Although there are theoretical reasons to expect that mental health declines when faced with a household transition, it is unclear whether expansion or contraction has a more pronounced negative effect on mental health than living in a stable household. The analysis presented in this chapter aims to determine which type of transition has a more powerful influence on mental health recovery.

2.3. Household Instability & Recovery

Much remains unknown regarding the long-term disadvantage of household transitions on mental health (Langenkamp & Frisco 2008). While unstable housing has been used as a measure of recovery following disasters there has been little focus on household transitions and the ability to achieve household stability, despite displaced Katrina residents noting that “reconstituting the family” was of most importance to them following the storm (Fussell 2012: 157). There is also little understanding regarding how long the living arrangements made immediately following a disaster tend to last (Glick & Van Hook 2011). Previous research suggests that households can be unstable following a disaster, however, the extent of household stability and how this changes over time is unclear, as are its effects on mental health. Beyond Rendall’s (2011) cross-sectional research on the breakup of New Orleans households following Katrina there has been little work on household instability following the initial evacuation, which means household patterns such as these remain unexplored. A major contribution of this chapter is that it explores how the continuity of living arrangements relates to mental health following a disaster over the course of recovery using a broad sample of highly affected Katrina survivors. Most importantly, I am able to distinguish not just whether household

disruption negatively influences mental health but if the type of disruption (expanded or contracted) matters as well.

3. Research Objectives & Expectations

In this chapter, I use random effects and hybrid random effects growth curve modeling to examine whether changes in household structure over time influence the mental health of residents. These data contain respondents who were highly affected by Hurricane Katrina, including those who were displaced. The baseline interview was conducted within the first year after Katrina, with the second, third, and fourth waves completed annually around the anniversary of the storm. On the basis of previous findings from literature on disaster, mental health, and household instability, I test three research hypotheses:

H₁: Household stability increases in each of the four years following Hurricane Katrina.

H₂: Living in a household that contracted has a significant negative effect on the mental health of the adult respondent.

H₃: Living in a household that expanded has a significant negative effect on the mental health of the adult respondent.

Because this dataset focuses on highly affected residents, it is possible that their households are extremely unstable in the years following Hurricane Katrina. As highly mobile and displaced residents are likely to experience household instability it is possible that household instability negatively influences mental health, which would suggest that it be treated as an additional and consequential form of disruption following a disaster. As time passes and residents begin to achieve a sense of normalcy, then rates of stable households should increase. A key contribution of this chapter is to assess whether one or both hypotheses regarding contracted and expanded households are supported. If both

are supported, exploring the distinction provides the opportunity to evaluate the relative magnitudes of the effect that each type of transition has on mental health. This understanding is important because it allows me to determine whether generally living in a stable or unstable household affects mental health or whether it is the type of transition that matters. Overall, this chapter tests the relationship between household instability and mental health, controlling for other sociodemographic factors, and determines whether there are different effects associated with experiencing a contracting or expanding household.

4. Data & Methods

4.1 Sample & Data Collection

I use the *Gulf Coast Child and Family Health Study* (G-CAFH) to explore my research questions. G-CAFH is one of four existing longitudinal Katrina studies, and the only one to examine a random sample of families and children heavily affected by the storm. The study follows a cohort of 1,079 households in order to assess post-disaster recovery via indicators such as infrastructure rehabilitation and stability, community redevelopment and housing stability, economic recovery, social re-engagement, and personal resilience and recovery. Due to the child component of the survey, at baseline interviewers were instructed to ask to speak with the adult who was most knowledgeable about the household, which is the same respondent interviewed at each wave. The study focuses on identifying health and social service needs among this displaced and heavily impacted population.

Abramson et al. (2008) used a stratified cluster sampling strategy to enroll subjects in the study in two phases: Louisiana in February 2006 (n=555) and Mississippi

(n=524) in August 2006. Overall, they selected 26 sites as primary sampling units that included twelve FEMA group sites, ten commercial trailer sites, and four hotel sites. Using FEMA damage assessment maps and databases of the state's three coastal counties hardest hit by the hurricane, they randomly selected 150 of 650 census blocks that FEMA designated as having sustained moderate, extensive, or catastrophic damage. They sampled 4,284 households as secondary sampling units. Of those, 985 households were deemed ineligible because they were destroyed, vacant, abandoned, or under construction, leaving 3,299 eligible households. Among those, 1,587 households had an eligible adult present to whom the study was presented; at the remaining 1,712 households, no contact was made despite repeated efforts. Among the 1,587 contacted households, 1,079 agreed to be enrolled in the longitudinal study, corresponding to a response rate of 32.6% (1079/3299) and a cooperation rate of 67.9% (1079/1587).⁹

The 1,079 households in Louisiana and Mississippi were followed for four rounds of data collection in the five years after Katrina (collected in 2006, 2007, 2008, 2009). For Louisiana respondents (n=555), all were still displaced at initial recruitment and were living either in group trailer parks or hotels. For respondents in Mississippi (n=524), they were either still displaced at initial recruitment, or were community-based respondents, some of whom had been displaced but had returned home, and some who only briefly evacuated their homes. At baseline, surveys were completed in person and lasted approximately one hour. The first follow-up round of interviews (Wave 2) was conducted in 2007, 20-23 months post-Katrina, and focused specifically on the physical and mental health effects, and social and economic consequences resulting from exposure to the hurricane and subsequent displacement. A second follow-up survey (Wave 3), was

⁹ G-CAFH does not use weights to correct for sample selection or non-response.

conducted in 2008, 33-38 months post-Katrina and was completed with 777 interviews. A final follow-up survey (Wave 4) was completed in 2009 with 844 interviews. Over this period, G-CAFH retained 87.6% of the initial study cohort, including those who were still living and not incarcerated. This sampling strategy is representative of the approximately 60,000 residents who were displaced to congregate settings in Louisiana and Mississippi following Katrina, and representative of the 26,000 people who were living in the most damaged areas of the Mississippi Gulf Coast.

4.2 Dependent Variable

The outcome measure *mental health* is derived from the mental health component of the short-form 12 (SF-12), version 2. The SF-12 is a multipurpose survey with 12 questions selected from the SF-36 Health Survey (Ware, Kosinski, & Keller 1996). The SF-12 was developed to provide a shorter alternative to the SF-36, which is criticized by health researchers as too long to administer (Ware, Kosinski, & Keller 1996). This subset of questions was combined, scored, and weighted to create two physical and mental health summary measures, denoted as the Physical and Mental Health Composite Scores (PCS-12 and MCS-12, respectively). These scales have been validated in both domestic and international populations, and are computed using the scores of twelve questions that range from 0 to 100 with zero indicating the lowest level of health and 100 the highest level of health (Ware, Kosinski, & Keller 1996). These scales have been normed to U.S. population standards with a mean score of 50.0 and a standard deviation of 10.0 (Ware, Kosinski, & Keller 1996). Questions from the SF-12 provide information on the mental and physical health of individual respondents, as well as their overall health-related-quality of life. The cutoff score of 42.0 for the MCS is often used to

distinguish psychological distress (Ware, Kosinski, & Keller 1996). Reliability is high for the SF-12 across all four waves with a Cronbach's Alpha of 0.85 at the baseline, 0.91 for Wave 2, 0.87 for Wave 3, and 0.82 for Wave 4. The outcome variable is normally distributed.

4.3 Independent Variables

4.3.1 Household Stability

I examine five individual-level variables as predictors of respondents' mental health following Katrina. The main independent variable is *household instability*, which is a measure based on previous research regarding household stability (Hays et al. 1995). Change in household stability is measured between each follow-up period using three categories: stable (no change in household composition), expanded (one or more persons joined the household) or contracted (one or more persons left the household). To create *household instability* dummy variables, I used a variable that asks how many people were living in a respondent's household at the time of the interview. Because G-CAFH also contains a question that asks how many people were living in the respondent's household in the week prior to Katrina, I determined whether the respondent's household was stable, contracted or expanded between immediately before Katrina struck and the time of the Wave 1 survey. For the Wave 2 measure of household stability, the variable captures a respondent's answer to how many people were living in the household is the same as Wave 1 (stable), less than Wave 1 (contracted) or greater than Wave 1 (expanded). I then repeated this process for Waves 3 and 4 comparing each to the immediately prior survey.

4.3.2 Controls

I also consider variables that are associated with housing stability and mental

health, including mobility, pre-Katrina homeownership status, post-Katrina housing type, and marital status. Mobility, which is measured continuously, captures the number of moves respondents experienced between interviews. Homeownership status at the time of Katrina is operationalized as a dichotomous variable (1 = owned home, 0 = rented home), and is treated as a time-invariant variable. Housing type is measured as a dichotomous time-variant variable (1 = other, 0 = trailer). I use this dichotomous operationalization because the sample strategy yielded a cohort that was displaced to congregate settings in trailer parks in Louisiana and Mississippi immediately following the storm. In this sense, living in a trailer is a form of temporary post-disaster housing while other housing types, such as apartments or single-family homes, represent greater housing stability. I examine *marital status* at each wave and treat it as time-variant, which is dichotomized as (1 = married/cohabitating, 0 = single/separated/divorced/widowed).

I also control for several theoretically relevant variables that are known to influence mental health. Respondents were asked to identify their race or ethnicity at baseline, which is recoded as either “Black” or “Other,” (reference category) including White, Asian/Pacific Islander and Native American. Household income is collected in five categories - less than \$10,000 annually, between \$10-20,000, \$20-35,000, \$35-50,000 or greater than \$50,000 per year. It is recoded to distinguish households living in poverty (less than \$20,000 annually) from those with annual incomes above \$20,000 annually (reference category). Gender is a dichotomous variable (1=male, 0=female). Finally, age is a dummy variable categorized as 18-34 years old, 35-64 years old and older than 65. The younger age bracket (18-34) is the reference category, as younger

adults typically have lower mental health score than older adults.

4.4 Analytic Methods

This chapter uses random-effects multilevel growth curve models. While random-effects and fixed-effects models are common approaches for analyzing longitudinal data, I use a variation of the random-intercept model—a hybrid random effects model—to examine the effect of household instability on mental health. Concerns over omitted variable bias make hybrid random effects models attractive for longitudinal analyses. The benefit of using a hybrid model is that it combines the advantages of both random and fixed effects (Allison 2005; Gasper et al. 2010). Considering random and fixed effects models separately helps explain the benefit of combining the advantages of each model. Using this approach often improves model fit and provides greater flexibility (Bollen & Brand 2010). It is important to note that time-varying regressors need to be decomposed and tested for heterogeneity bias. If there is no heterogeneity bias then the untransformed metric is more efficient. The random-intercept model is expressed as follows:

$$Y_{it} = \alpha + \beta X_{it} + \gamma W_i + \tau T_t + u_i + e_{it}$$

In this equation, Y_{it} is the response variable, mental health, at time t . The intercept is represented by α , X_{it} are the time-varying (level-1) regressors (e.g. household stability, mobility, house type, marital status, income, age) for individual i at time t , W_i are the time-stable (level-2) regressors (e.g. gender, race, pre-Katrina homeownership status) for individual i , and T represents the time-stable individual differences. The error components include the random effect for the intercept u_i and the random effect for the slope of the time-varying regressors e_{it} . The error components are assumed to be

uncorrelated with the predictors.

In longitudinal multilevel models, the last assumption of the random intercept model is problematic because it does not control for unmeasured stable individual differences. However, the hybrid model decomposes time-varying independent variables from the random effects model into two parts, including between-person variation and within-person variation. The between-person variation is the mean of the variable for each individual across time or group mean. It can be written as follows:

$$\text{Between: } \bar{Y}_i = \alpha + \beta_B \bar{X}_i + u_i + \bar{e}_i$$

The within-person component is the difference between each individual's group mean and his or her variable value at each time point:

$$\text{Within: } (Y_{it} - \bar{Y}_i) = \beta_W (X_{it} - \bar{X}_i) + (e_{it} - \bar{e}_i)$$

The fully-specified hybrid model, including these decomposed variables that are used as predictors, can be noted as follows:

$$Y_{it} = \alpha + \beta \tilde{X}_{it} + \gamma_1 \bar{X}_i + \gamma_2 W_i + \tau T_t + u_i + e_{it}$$

Using a hybrid approach provides coefficient estimates for both between-person effects and within-person effects for decomposed time-varying variables. Perhaps most importantly, the decomposition allows the within-individual estimates to be uncorrelated with the time-constant portion of the error term and makes it identical to the estimates obtained in a fixed effect model. It is important to note, however, that this model does not control for the effects of change for unmeasured variables over time (Gasper et al. 2010).

4.4.1 Missing Data

As might be expected with a disrupted population, the sample size of each G-

CAFH wave fluctuates following the baseline survey (n=1079). In subsequent waves, the sample decreases between 20 and 28 percent. In Wave 2, the sample size was 802. In Waves 3 and 4, the sample size was 777 and 844, respectively. Multiple imputation (MI) is increasingly considered the best statistical technique for handling missing data, especially in medical and epidemiological research (White et al. 2011). MI uses the distribution of observed data to estimate values for the missing data by generating multiple datasets that create a set of parameter estimates (White et al. 2011). These estimates are then combined to create overall estimates, variances, and confidence intervals for an imputed dataset (White et al. 2011).

Rather than using complete case analysis or listwise deletion, I use the Stata 13 conditional multiple imputation procedure so as not to lose valid data points due to attrition across waves or non-responses to particular questions. I performed conditional MI using MI chained equations (MICE) in Stata and set the number of imputations to five. The key assumption that I make is that the data are missing at random (Allison 2002).

5. Results: Post-Disaster Household Instability

5.1 Descriptives

Figure 3.1 displays the unbalanced mean MCS across waves. These results show clear improvements in mental health over the four years after Katrina. Respondents have a mean MCS score of 40.1 at baseline, which is below the cutoff of 42.0 that indicates psychological distress. Further, a majority of respondents (56.7 percent) reported an MCS below 42.0 at baseline (not shown). The mean MCS score increases over the next two waves—42.3 and 45.2, respectively—however, it drops slightly in Wave 4 to 44.9. Despite this overall mean increase from the baseline where well over half were distressed,

four years after Katrina nearly 40 percent of respondents report an MCS score of 42.0 or below (not shown).

Insert Figure 3.1 Here

Figure 3.2 illustrates household instability for the G-CAFH cohort at each time point. Approximately 56 percent of households did not experience an increase or decrease in number of people in the household shortly after Katrina when compared to right before the storm. This number drops to about 50 percent in both Waves 2 and 3 but increases to nearly 60 percent in Wave 4. Slightly less than one third (30 percent) of households contracted by at least one person within the first year after the storm, and 40 percent lost household members between Waves 1 and 2. The percentage of contracted households drops dramatically between Waves 2 and 3 and Waves 3 and 4 to just 10 percent and 15 percent, respectively. Finally, approximately 14 percent of households added at least one person shortly after Hurricane Katrina. This percentage drops to 9 percent in Wave 2 but increases to 40 percent in Wave 3 and approximately 25 percent in Wave 4. This type of variation suggests that households were quite unstable in the years following Hurricane Katrina. Specifically, it is likely that households were scattered in the early years but then were trying to reassemble in the three to four years after the storm.

Insert Figure 3.2 Here

Table 3.1 reports unbalanced descriptive statistics for mental health and all independent variables except for household stability (reported in Figure 3.2).

Respondents were highly mobile in the first two years after Katrina with an average number of 3.22 moves per household with a standard deviation of 2.29 in Wave 1. While

this average is lower in each of the next three waves, respondents still experienced an average of approximately one move per year (3.79, 0.97 and 1.04, respectively). A majority of respondents were not homeowners prior to Katrina (57 percent). As this was a highly affected and frequently displaced population, nearly 90 percent of respondents were living in trailers at the baseline interview. This percentage drops substantially across the subsequent waves to 64 percent, 22 percent and finally 12 percent in Wave 4, indicating increasing structural housing stability. At baseline, 34 percent are married or cohabitating with 66 percent reporting that they were single, widowed, divorced, or separated. The percent married or cohabitating increases to 42 percent in Wave 2, increases to 45 percent in Wave 3 and increases again to 44 percent in Wave 4. Table 3.1 demonstrates that the marital rates of respondents increase across waves, which is particularly interesting to note when analyzing post-disaster household stability because these findings suggest that the expansion of households is possibly tied to the increase in marriage rates. This increase in marriage rates could simply be a result of time passing, as respondents age and decide to marry. However, it is also possible that increased marriage rates reflect greater stabilization and recovery in areas of relationships and housing. Alternatively, this increase may suggest a need for greater emotional and economic security during recovery, including a means of increasing support and pooling of resources. Although it is not possible to know exactly why marriage rates increased, these possibilities each suggest a sense of recovery being achieved in the years following Katrina.

Insert Table 3.1 Here

Slightly more than half of the sample is black (50.5) while 49.5 percent identifies

as either white, Asian, Pacific Islander or Native American. Pre-Katrina income reflects the median income across affected areas of Louisiana and Mississippi with 27 percent of the sample earning a household income below \$10,000 per year (not shown). As New Orleans had high levels of poverty prior to Katrina, it is not surprising that over 60 percent of respondents lived in households with annual incomes below \$20,000. By Wave 2, the percent living in poverty increased to 68 percent but was lower in the next two waves at 58 percent and 61 percent, respectively. A majority of respondents at baseline were women (59 percent), which might be expected as interviewers asked to speak with the person most knowledgeable about the household, and specifically about their children's health.¹⁰ The mean age of respondents at baseline was 46.4 with a standard deviation of 14.8 (not shown). At baseline, 23 percent of respondents were between the ages 18-34; 63 percent were between the ages of 35 and 64; and 14 percent were over the age of 65.

Table 3.2 reports the unbalanced means and standard deviations for Mental Health Composite Scores (MCS) by mobility and select housing variables. At baseline, respondents in stable (40.7), contracted (40.1) and expanded (41.3) households report similar mean MCS, which are all below the cutoff of 42 that indicates mental distress. By Wave 2, those living in households that expanded see their MCS decrease to 39.0 while respondents living in stable (42.5) and contracted (42.7) households increase. By Wave 3, mean MCS for those in stable households increase to 46.1 while contracted (44.1) and expanded (44.5) households experience more modest increases. Finally, at Wave 4 MCS remains about the same for stable (46.0) and contracted (44.3) households

¹⁰ G-CAFH interviewers sought an eligible adult respondent at each sampled household who was the "primary caregiver," someone who could knowledgeably report upon the health issues of all the individuals in the household.

but drops for expanded households (43.7). The most interesting trend that deserves greater scrutiny is that while there are not significant differences in MCS between stable, contracted and expanded households at each time period, those living in stable households report MCS scores nearly 6 points higher at Wave 4 than at baseline. In contrast, those living in contracted or expanded households at Wave 4 report a smaller increase in MCS (4.2 and 2.4, respectively).

Insert Table 3.2 Here

Those who owned their homes at the time of Katrina report significantly higher mental health scores at each wave, and also see their mental health increase more overtime from 42.0 to 46.7 compared to 39.9 to 43.6 for those who did not own their homes. For those living in a trailer at baseline, their mean MCS is 39.2 while those who lived in a different house type reported significantly higher scores (43.3). By Wave 4 both had increased by several points to 43.7 for those living in trailers, and to 45.1 for those living in houses, apartments, or other forms of housing; however, the overall mental health score increased more for those living in trailers (4.5 points) compared to those not living in a trailer (1.8 points). Similarly, those who were married or cohabitating reported higher mental health scores at each wave (40.6, 43.7, 45.4 and 46.2, respectively) than those who were either single, widowed, divorced or separated (39.8, 41.2, 45.0 and 43.9, respectively).

At baseline, Blacks (40.2), and Whites, Asian/Pacific Islander and Native American (39.9) report similar mean mental health scores. This small difference between racial groups at baseline is similar in each of the following years. At baseline those living in poverty (39.9) also report similar MCS scores to those that do not live in poverty

(40.3). However, adults in poverty showed much smaller improvements in mental health over the five years than those in non-impooverished households with differences of 2.9 between Waves 1 and 4 for those in poverty to a difference of 7.9 for the other adults. This is consistent with findings in Chapter 2. Women report significantly lower mean MCS at baseline (39.9) compared to men (42.1); however, each group increased by approximately 4 points by Wave 4 with women having a final mean mental health score of 44.2 and men having one of 46.2. Overall, these differences suggest that recovery does not appear to be equal across all groups—especially by income—when measured by mean MCS, despite many reporting similar scores at baseline.

5.2 Random-Effects Growth Curve Model

The results for models predicting mental health are presented in Table 3.3. Models 1-4 are random effects growth curve models while Model 5 is a hybrid random-effects growth curve model. Examining the effect of only time on mental health reveals that the mental health score increases significantly by 1.68 on average for all individuals across time with a grand mean of 40.5 (not shown). Model 1 includes only dummy variables that measure the effect of the main independent variable household instability, specifically contracted or expanded households compared to those that were stable. This model shows the expected negative and significant relationship between respondents living in households that expanded and mental health. Across all time periods, those who lived in a larger household than prior to Katrina reported lower MCS scores (-1.07) than those living in stable households. However, there is not a significant difference in mental health between respondents living in households that lost members and those in stable

households. Time remains a significant predictor of mental health with respondents experiencing a 1.75 point average increase in MCS across all time periods.

Insert Table 3.3 Here

As respondents were highly mobile and such mobility should be closely connected with household instability, I add mobility to Model 2. After controlling for geographic mobility, adults in households that expanded still have significantly lower mental health (by -1.06 points) than those in a stable household. Mobility is significant as each additional move is associated with a 0.23 reduction in the mental health score. Time is a significant predictor of mental health as across all time periods and individuals as respondents experience a 1.55 average increase in MCS. Model 3 includes household instability and mobility, as well as pre-Katrina home tenure and whether or not the respondent lived in a trailer. The effects of living in a household that expanded compared to stable ($b=-1.17$) and experiencing a move ($b=-0.24$) are similar to those demonstrated in Model 2. However, the coefficients for pre-Katrina home tenure and house type are significant and much larger than for housing instability. Being a homeowner prior to Hurricane Katrina increases a respondent's mental health by 1.75 across all time periods while living in any form of housing except a trailer increases a respondent's mental health score by 2.78 on average. Time is again significant ($b=0.78$) although the effect is lower than reported in Models 1 and 2 indicating that a large portion of the over-time change in mental health is because of prior homeownership status and the type of housing people lived in after the storm.

Model 4 adds all of the controls, including marital status, race, income, gender, and age. Similar to Models 1 through 3, living in a household that expanded has a

significant negative effect on the mental health of the respondent ($b=-1.16$). Mobility, as well as pre-Katrina homeownership, are no longer significant once controlling for various demographic variables. Living in another house type (apartment, single family home, etc.) compared to living in a trailer post-Katrina has a significant positive mental health effect ($b=2.60$). Nearly all control variables exhibit significant effects on the mental health of respondents over time. The time-invariant controls for race and gender, as well as the time-variant controls of income, age, and marital status have the expected effects. Those who are married experience a significant positive effect on their mental health ($b=1.40$) compared to those who are single, divorced, separated, or widowed. Blacks have 1.16 point higher average mental health scores across time than other racial groups while men have are 1.36 point higher scores on average than women. Those living in poverty are 2.29 lower on the MCS than those living in household earning over \$20,000 annually. Seniors report significantly higher mental health scores than younger respondents ($b=2.84$) while there is no significant difference between 35-64 year olds compared to 18-34 year olds. While many of these controls are significant, living in a household that expanded continues to have a significant effect on mental health even when controlling for variables that are linked with differences between expanded and stable post-disaster households. The intraclass correlation coefficient for Model 4 suggests that approximately 35 percent of the variance for mental health is between subjects while 65 percent is within subjects.

5.3 Hybrid Random-Effects Growth Curve Model

Model 5 is a hybrid random effects growth curve model predicting mental health. Decomposing each time-varying covariate into between-person and within-person

components is a strategy used to address selection effects (Gasper et al. 2010). If no heterogeneity bias is evident through a means test then untransformed metrics were used, as they are considered to be more efficient measures. This model provides a key test by considering whether the relationship between household stability and mental health can be attributed to preexisting differences among respondents. The decomposed “between” coefficients give the between-person differences in mental health for mobility, house type, and poverty averaged across all time periods. The decomposed “within” coefficients provide the change in mental health that follows a change in the decomposed variable (i.e. moving from trailer to another house type). Decomposing time-varying variables in this way provides a means for determining whether the significance for certain variables is coming from between or within person effects.

Many of the findings from Model 5 are similar to those from Model 4, although it is easier to determine exactly where the effect is coming from. Because it was not decomposed, living in a household that expanded still captures the effects of living in a household that expanded compared to stable. In this model, it remains negative and significant ($b=-1.10$) on average across all time points. There is a considerable difference in the effect of mobility when compared to Model 4 and the between-person Model 5. Unlike the untransformed measure in Model 4, the between-person coefficient for mobility is negative and significant ($b=-1.39$), which suggests an association between moving and mental health across people in the sample. However, the within-person coefficient is small and not significant. This indicates that the overall mobility effect shown in prior models is due to the fact that the individuals in the sample who moved more frequently initially have significantly lower mental health. Alternatively, when

individuals move additional times, this does not influence their self-reported mental health, which is a finding consistent with Chapter 2. In contrast, the transformed measure for not living in a trailer reveals that the relationship between house type and mental health can be found at the within-person level over time. Thus, people who move from a trailer to a more stable form of housing experienced a 2.4 point increase in their mental health score on average due to this housing transition.

Living in poverty provides an interesting finding, as both between and within-person decomposed variables are significant. However, by transforming this variable it is easier to see that the association of poverty with mental health distress is notably larger across people ($b = -4.60$) than within people ($b = -1.40$). This means that the majority of the effect of poverty on mental health stems from the fact that those that live in poverty have poorer mental health than those who are not impoverished. Becoming poor has an additional, but less sizable, effect in diminishing one's mental health in the years following Katrina. Other time varying variables (household stability, age and marital status) were not decomposed, as the means tests were not significant, which suggests that the untransformed measure is more efficient because there is no statistically significant difference between the between and within effects. Of these time-varying variables that were not transformed, the only significant finding is that seniors ($b = 2.40$) have better mental health compared to younger adults, which is similar to Model 4. Black respondents and males experience better mental health scores on average (1.13 and 1.39, respectively). However, the respondents who were married or cohabitating at any point over the time period did not exhibit significantly higher mental health scores, as they did in Model 4.

6. Discussion

A primary aim of this chapter was to determine whether households were unstable following Hurricane Katrina, and if so, whether household stability would increase in each of the four years after the storm. This hypothesis is partially supported as the overall percentage of stable households increased between 2006 and 2009 from 56 percent to 60 percent. However, the percentage of stable households actually decreased in Waves 2 and 3 before increasing in Wave 4. In terms of unstable households, in the first two years following Katrina, between 30 and 40 percent of households contracted by at least one person. This is likely during a time when household members were at risk of separating due to inadequate housing, mobility or economic strain. It is also possible that contracted households are a temporary aspect of disaster recovery because of home repairs when one person remains in the home to monitor improvements and the remaining members temporarily reside in hotels, shelters or with friends or relatives. As the percentage of contracted households declined in years three and four, it is not surprising that this is when between 26 and 40 percent of households expanded. At this point in the recovery process, households were able to add members—possibly the same members as before the storm—in part because of greater housing stability. Understanding such patterns is a benefit of longitudinal data, which provides information on what post-disaster households experience during the recovery process. Overall, these descriptive results suggest that respondents experienced household transitions and instability in the four years following Katrina and that it took several years until they were able to “reconstitute the family.”

The second and third hypotheses of this chapter tested whether living in a

contracted or expanded household would have a significant negative effect on the mental health of the adult respondent. Although there is not support for the third hypothesis, there is support for the second, as there is a significant negative effect of living in a household that expanded. This is somewhat surprising as previous findings (Rendall 2011) suggest that many families were separated due to Katrina, which was an emotionally draining experience for affected residents. Although previous studies have found that the economic and emotional resource sharing that can occur within expanded households might be beneficial to household members, these findings suggest that expanded households contribute to the stress and strain of recovering from a disaster. Expanded households may be a source of stress for primary caregivers, especially if the additional members do not have steady incomes to contribute to expenses and become a strain on resources. These households might also put a strain on living spaces and sleeping arrangements, which are not only stressful living conditions but serve as a constant reminder of Katrina. Lastly, these results provide further support that household instability should not simply be measured as stable versus unstable but that it must take into account more nuanced measures of household instability. Without examining categories in such a way, it is possible that researchers will overlook the different effects that particular types of household transitions have on mental health.

An important finding from these analyses is that both mobility and house type have significant effects on mental health. These effects are larger in magnitude than for household expansion, which suggests that mobility and house type must be taken into account along with the expansion or contraction of households in order to gain a detailed understanding of how post-disaster household instability affects mental health. As I

argued in Chapter 2, post-Katrina migration seems to have been unique in comparison to previous disaster migration events. The effects of *perpetual migration*—defined as when a survivor moves several times even after they migrated to another town or city—may also trigger household instability. Most importantly, the effect of mobility on mental health is due to between person differences, which mean that those with poor mental health move more frequently. These findings suggest that mobility—and perhaps perpetual migration—could become a means of identifying an extremely vulnerable post-disaster population. Since individuals who moved more frequently have significantly lower mental health policymakers should offer mental health services in conjunction with post-disaster housing assistance programs.

These results also demonstrate the powerful negative mental health effects that living in a trailer can have on disaster survivors. Previous research has argued that living in FEMA trailers is a stressful experience that can delay the emotional recovery of displaced residents and have long-term recovery effects (Bolin 1982). At baseline, nearly 90 percent of the G-CAFH sample lived in trailers. Those who were able to move out of the trailers (all but 12 percent of the sample by Wave 4) had significantly better mental health than those who remained in the trailers over the course of the study. Such findings support previous research and suggest the importance of ensuring that displaced residents find permanent and stable housing soon after the storm rather than linger in recovery housing. Generally, these results further demonstrate that household instability, along with house type, have lasting, independent implications for mental health recovery.

Overall, this chapter takes an important first step in examining the effects of household instability on mental health following a disaster. These findings demonstrate

that the relationship between household instability and mental health following a disaster is complex. A consequence of home damage and displacement, especially if it is to distant cities and states, is that household living arrangements become disrupted. Households can be unstable following a traumatic event and can experience multiple transitions, including the entering and leaving of family and friends during the course of recovery. Although a large percentage of households were unstable in the years following the storm, high rates of contracting and expanding households are connected to other issues of housing and recovery such as mobility, house type, income, and marital status. Therefore, explaining the effect of household instability on mental health cannot simply be done by examining whether the respondent experienced a contracted or expanded household. Similarly, focusing only on how mobility, house type, and income negatively affect mental health is also insufficient, as living in an expanded household following a disaster has an independent and significant negative effect on mental health. Finding a way to provide more resources and support for households that take in others following a disaster or need to double-up should be a priority for policy makers, public health officials, and researchers.

7. Limitations and Future Research

A current limitation of this chapter is that it does not consider different relationship types and household compositions in conjunction with household instability. The next step is to explore whether households with particular kinds of relationships and compositions (i.e. parent/child; adult/non-relative, etc.) have higher rates of instability and similar patterns of mental health outcomes for the primary care giver. Adding dependents to a household, including minor children or elderly relatives, might be an

emotional and financial burden that negatively affects a respondent's mental health. Similarly, the loss of an adult who typically contributes financially to the household might also be a stressor, as economic resources would decrease. Overall household composition is also important to consider, as general patterns of household structure suggest that a household consisting of parents, adult children, and/or grandchildren is associated with a lower probability of transition than households containing multigenerational kin, distant kin, or friends, which is typically temporary and short-lived (Glick & Van Hook 2011; Fertig & Reingold 2008). Determining whether these general patterns hold or if the effects are exacerbated during disaster recovery could be the next step in this analysis.

Figure 3.1 Unbalanced Mean MCS by Wave, G-CAFH: 2006-2009

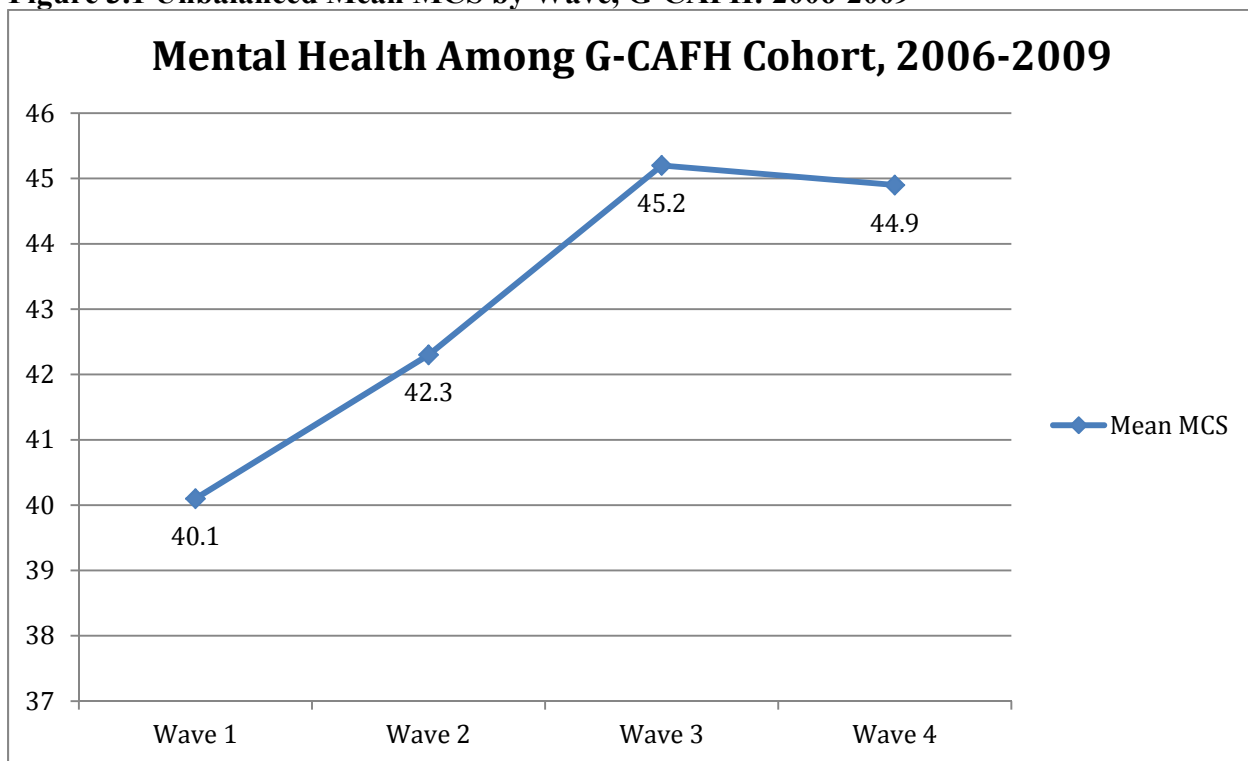


Figure 3.2 Unbalanced Household Stability Among G-CAFH Cohort, 2006-2009

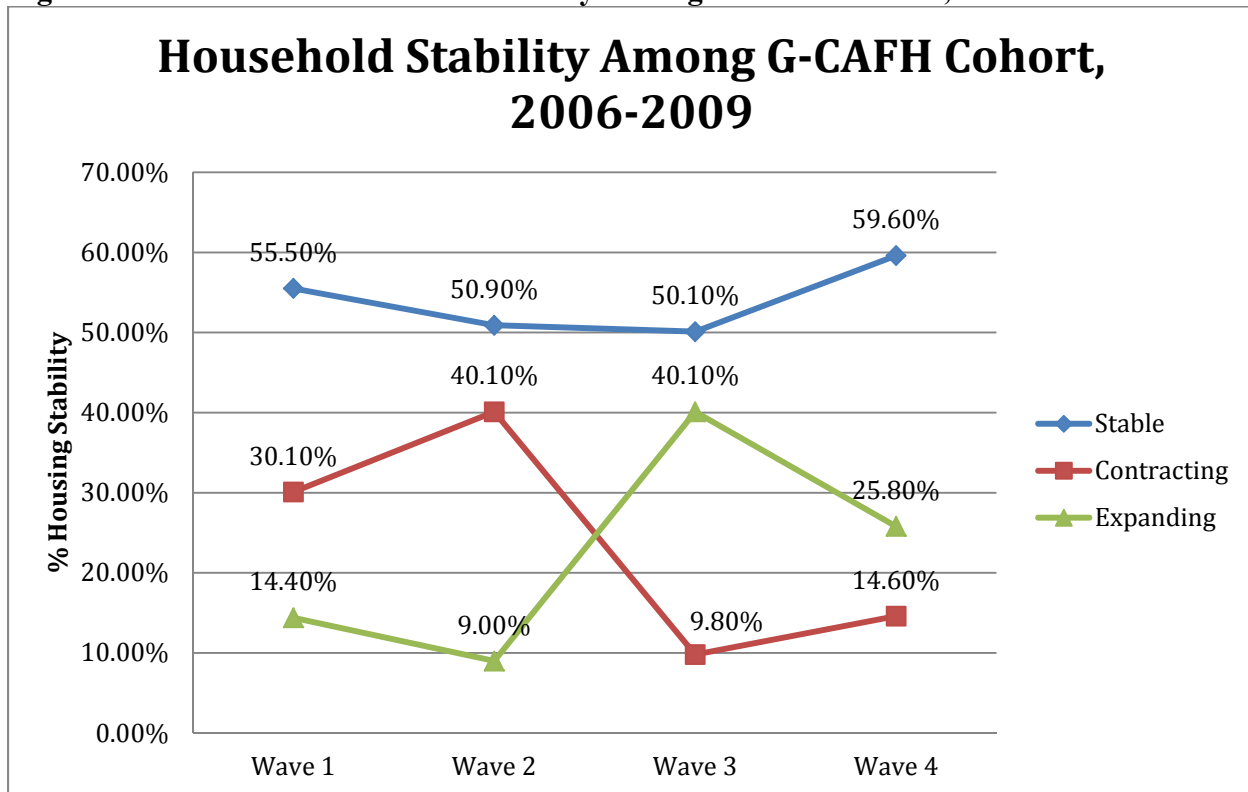


Table 3.1 Descriptive Statistics of the G-CAFH Cohort for Mental Health Composite Score (MCS) and Select Independent Variables (mean/SD, unless noted)				
	Wave 1	Wave 2	Wave 3	Wave 4
<i>Dependent Variable</i>				
MCS (0-100) mean/SD	40.1 (11.0)	42.3 (13.1)	45.2 (13.2)	44.9 (12.9)
<i>Independent Variables</i>				
Mobility (number of moves)	3.22 (2.29)	3.79 (2.00)	0.97 (1.25)	1.04 (1.73)
Pre-Katrina Home Tenure				
<i>Owner</i>	0.43			
<i>Other</i>	0.57			
House Type				
<i>Trailer</i>	0.89	0.64	0.22	0.12
<i>Other</i>	0.11	0.36	0.78	0.88
Marital Status				
<i>Married/Cohabiting</i>	0.34	0.42	0.45	0.44
<i>Not Married/Cohabiting</i>	0.66	0.58	0.55	0.56
Race				
<i>Black</i>	0.50			
<i>Other</i>	0.50			
Annual Household Income				
<i>Poverty (<20k)</i>	0.64	0.68	0.58	0.61
<i>Not Poverty (>20k)</i>	0.36	0.32	0.42	0.39
Gender				
<i>Male</i>	0.41			
<i>Female</i>	0.59			
Age (years)				
<i>18-34</i>	0.23	0.14	0.12	0.13
<i>35-64</i>	0.63	0.49	0.48	0.52
<i>65+</i>	0.14	0.36	0.40	0.35
Total N	1079	802	777	844

Unbalanced Means and Standard Deviations for Mental Health Composite Table 3.2 Score (MCS) by Mobility and Select Housing Variables				
	Wave 1	Wave 2	Wave 3	Wave 4
MCS (0-100)	40.1 (10.9)	42.3 (13.1)	45.2 (13.2)	44.9 (12.9)
Independent Variables				
Household Stability				
<i>Stable</i>	40.7 (10.8)	42.5 (12.8)	46.1 (13.1)	46.0 (12.3)
<i>Contracted</i>	40.1 (11.3)	42.7 (13.3)	44.1 (12.9)	44.3 (13.4)
<i>Expanded</i>	41.3 (9.8)	39.0 (13.1)	44.5 (13.5)	43.7 (12.8)
Pre-Katrina Home Tenure				
<i>Owner</i>	42.0 (11.3)**	43.7 (13.0)**	46.4 (12.7)*	46.7 (12.2)**
<i>Other</i>	39.9 (10.4)	41.2 (13.1)	44.3 (13.6)	43.6 (13.1)
House Type				
<i>Trailer</i>	39.2 (11.0)**	40.9 (12.9)***	42.7 (13.5)**	43.7 (13.6)
<i>Other</i>	43.3 (11.0)	44.5 (13.0)	46.2 (12.9)	45.1 (12.8)
Marital Status				
<i>Married/Cohabiting</i>	40.6 (11.2)	43.7 (13.1)**	45.4 (13.7)	46.2 (12.6)**
<i>Not Married/Cohabiting</i>	39.8 (10.7)	41.2 (12.9)	45.0 (13.0)	43.9 (13.0)
Race				
<i>Black</i>	40.2 (10.8)	42.7 (12.7)	46.1 (12.5)	44.8 (12.2)
<i>Other</i>	39.9 (10.9)	41.9 (13.4)	44.5 (13.7)	45.0 (13.5)
Annual Household Income				
<i>Poverty (<20k)</i>	39.9 (10.6)	40.7 (13.0)***	42.7 (13.7)***	42.7 (13.1)***
<i>Not Poverty (>20k)</i>	40.3 (11.3)	45.4 (12.3)	48.4 (11.6)	48.2 (11.8)
Gender				
<i>Male</i>	42.1 (11.1)**	43.8 (12.6)**	46.0 (12.6)	46.2 (13.3)*
<i>Female</i>	39.9 (10.6)	41.3 (13.2)	44.8 (13.6)	44.2 (12.4)
Age (years)				
<i>18-34</i>	38.3 (10.3)***	42.4 (12.3)*	45.2 (14.4)**	44.5 (14.6)***
<i>35-64</i>	39.9 (11.2)	41.6 (13.3)	44.4 (13.1)	44.0 (12.6)
<i>65+</i>	43.9 (9.9)	45.1 (12.4)	48.5 (11.8)	49.1 (11.4)
Total N	1079	802	777	844

Table 3.3 Random-Effects and Hybrid Random-Effects Growth Curve Models Testing the Association between Household Instability and Mental Health for the G-CAFH Cohort: 2006-2009 (N = 1079)

	Model 1	Model 2	Model 3	Model 4	Model 5
	Household Instability Only	Household Instability & Mobility	Household Instability, Mobility & Housing Variables	Household Instability, Mobility & Controls	Hybrid Random Effects Growth Curve
Independent Variables					
Household Stability					
<i>Contracted</i>	-0.10 (0.45)	-0.03 (0.45)	-0.02 (0.44)	-0.12 (0.44)	-0.05 (0.43)
<i>Expanded</i>	-1.07 (0.53)*	-1.06 (0.53)*	-1.17 (0.53)*	-1.16 (0.54)*	-1.10 (0.54)*
<i>Stable (ref.)</i>					
Mobility		-0.23 (0.11)*	-0.24 (0.10)*	-0.20 (0.10)	
Mobility (Between)					-1.39 (0.27)***
Mobility (Within)					-0.05 (0.11)
Pre-Katrina Home Tenure					
<i>Owner</i>			1.75 (0.64)**	0.76 (0.68)	0.13 (0.68)
<i>Renter (ref.)</i>					
Post-Katrina House Type					
<i>Trailer (ref.)</i>					
<i>Other</i>			2.78 (0.49)***	2.60 (0.50)***	
Trailer (Between)					1.54 (1.21)
Trailer (Within)					2.54 (0.55)***
Marital Status					
<i>Married/Cohabiting</i>				1.40 (0.59)*	1.13 (0.61)
<i>Not Married (ref.)</i>					
Race					
<i>Black</i>				1.16 (0.57)*	1.13 (0.58)*
<i>Other (ref.)</i>					

Annual Household Income*Poverty (<20k)*

-2.29 (0.51)***

*Other (ref.)***Poverty (Between)**

-4.60 (0.84)***

Poverty (Within)

-1.40 (0.61)*

Gender*Male*

1.36 (0.57)*

1.39 (0.56)**

*Female (ref.)***Age***18-34 years old (ref.)**35-64 years old*

-0.36 (0.71)

0.77 (0.69)

65 and older

2.84 (0.98)**

2.40 (0.97)**

Time

1.75 (0.18)***

1.55 (0.19)***

0.78 (0.23)***

0.76 (0.23)***

0.94 (0.23)***

Sigma_u

7.67 (0.25)

7.61 (0.25)

7.51 (0.25)

7.24 (0.26)

7.07 (0.24)

Sigma_e

9.90 (0.15)

9.91 (0.15)

9.87 (0.15)

9.86 (0.15)

9.85 (0.15)

ICC

0.38 (0.02)

0.37 (0.02)

0.37 (0.02)

0.35 (0.02)

0.34 (0.02)

Constant

40.63 (0.42)***

41.44 (0.55)***

43.30 (0.75)***

42.89 (1.17)***

46.99 (1.35)***

Standard errors are shown in parentheses. Two-tailed tests.

* p <= 0.05, ** p <= 0.01, *** p <= 0.001

Chapter 4: Ties that Rebuild? Examining the Link between Social Support, Mobility and Mental Health during the Recovery Process

1. Introduction

Findings in Chapters 2 and 3 demonstrate that sociodemographic characteristics, household instability, and frequent mobility play an important role in understanding mental health recovery following Hurricane Katrina. While these findings establish that individual and household-level factors influence mental health recovery, unequal access to social support can also affect whether residents are able to regain equilibrium in their lives following a traumatic event (Bonanno et al. 2010; Thoits 2011; Norris & Kaniasty 1996). In fact, there is increasing evidence that a particular type of social support—*perceived* rather than *received* support—serves as a core component in disaster recovery, and buffers against the effects of trauma and post-disaster distress (Bonanno et al. 2010; Thoits 2011). While the benefits of received support (e.g. the actual support provided) on mental health recovery are inclusive, perceived support (e.g. the subjective experience of being supported) has been consistently and positively associated with improved mental health following a disaster (Bonanno et al. 2010; Barrera 1986). Yet, less is known regarding the effect of perceived support on mental health recovery when high levels of mobility and displacement disrupt entire neighborhoods and communities. Similarly, it is unclear whether such disruptions to perceived social support diminish its protective buffer against stress over the course of recovery.

Social support is typically very stable (Sarason et al. 1992; Sarason et al. 1994). However, stressful events can alter social support by disrupting networks and changing the quality and quantity of social relations. While there is some evidence that social support, especially amongst family members, can improve following disasters, a majority

of evidence suggests that disasters disrupt social ties and social support (Bonanno et al. 2010). Some argue that social support—in particular, perceived support—is especially vulnerable to environmental changes and can deteriorate in a disaster’s aftermath (Bonanno et al. 2010; Kaniasty & Norris 1993). Additionally, the need for support may exceed available support as others attempt to recover simultaneously (Norris & Kaniasty 1996). Such deterioration may explain why the typically protective properties found in perceived support often do not operate during disaster recovery (Bonanno et al. 2010; Cook & Bickman 1990). Findings in Chapter 2 illustrate that residents, especially those with poor mental health or limited financial resources, were extremely mobile in the years following Katrina, which raises questions regarding whether these vulnerable groups possessed this arguably critical component of mental health recovery.

This chapter aims to identify the perceived support mechanisms that could be accessed by disaster victims, and determine how this support affects mental health in the years following a disaster. A goal is to determine whether certain types of social support contribute to improved post-disaster mental health, and how changes in perceived social support relate to mental health recovery. It is possible that certain types of perceived support are more important during recovery than others. The key is to determine which groups have access to certain types and amounts of social support, whether it varies over time and by mobility rates, and its effect on mental health recovery. As previous findings suggest that the respondents from G-CAFH were highly mobile in the years following the storm, understanding whether affected residents’ lack, maintain or gain perceived support could unpack the relationship between social support and mental health recovery. To explore these questions, I use the last three waves (2007-2009) of the *Gulf Coast Child*

and Family Health Study (G-CAFH) while controlling for mental health and sociodemographic characteristics at baseline. I use random effects and hybrid random effects non-continuous growth curve models to examine whether different types and levels of perceived support influence adult mental health over the course of recovery following Hurricane Katrina.

2. Background

2.1. Social Support and Stress

Over the last three decades, there is mounting evidence that social support is positively and causally related to mental health, and that it buffers against the harmful mental health consequences of stress exposure (Thoits 2011; Murphy 1988; Kessler & McLeod 1985; Kessler, Price & Wortman 1985; Thoits 1995). Social support can best be defined as a function—such as emotional, informational and instrumental assistance (House et al. 1985)—performed by a primary or secondary group member for a particular individual (Thoits 2011). Such social support can embed individuals within a social system that provides a sense of attachment to a social group or dyad (Norris & Kaniasty 1996; Hobfoll & Stokes 1988). Social ties such as these can provide countless benefits, including economic resources, emotional support, and family well-being (Thoits 2011; Portes 1998). Researchers argue that there are two major aspects of social support: received social support and perceived social support (Barrera 1986; Norris & Kaniasty 1996). Received social support is best understood as “naturally occurring helping behaviors that are being provided” while perceived support is a “belief that such helping behaviors would be provided when needed” (Norris & Kaniasty 1996: 498). Thoits (2011) argues that it is the *perceived* everyday support provided by primary (i.e., informal

groups such as family members, relatives, and friends) and secondary groups (i.e., formal groups such as voluntary or religious organizations)—rather than *received* support—that accounts for the positive effect of social support on mental health. Somewhat surprisingly, Norris and Kaniasty (1996) note that there is not a substantiated link between received and perceived support, meaning that simply because one perceives to have social support does not mean that he or she can actually access this support.

Disasters can best be described as uncontrollable, disruptive events. Controllable events require different types of social support for recovery compared to uncontrollable or unexpected events (Cutrona & Russell 1990). While controllable events necessitate instrumental, informational, and esteem support to encourage problem solving, uncontrollable events require emotional support, including comforting and knowing that one is loved (Thoits 2011; Cutrona & Russell 1990). Emotional support typically refers to “love and caring, esteem and value, encouragement, and sympathy” (Thoits 2011:146) while instrumental support includes supplying behavioral or material assistance with problems (Thoits 2011). However, Katrina was arguably both a controllable and uncontrollable event, which makes it important to examine whether a particular type of perceived support acts as a greater buffer to mental distress. In this analysis, I examine individual measures for emotional and instrumental support, which comprise the most pressing forms of perceived support following a disaster.

While the relationship between social support and stress is clear, there is limited knowledge regarding how the effect of perceived social support on mental health changes in the aftermath of a catastrophic disaster, especially when a large number of people are disrupted by the same event. Similarly, questions remain regarding how deviations from

daily exchanges following a disaster can alter or diffuse perceived support, and how this unfolds over time. It is likely difficult to maintain social relations during recovery, which means that individuals lack the protective support that informal ties can provide in a time of uncertainty and need. Similarly, it is possible that certain types of social support are more beneficial to mental health over the course of recovery than others.

2.2. Social Support, Mobility and Mental Health Recovery

Research on exchanges of social support posits that physical proximity and residential stability are crucial to maintaining high levels of support (Magdol & Bessel 2003). Recent findings suggest that length of residence, as well as proximity to others, are beneficial for social exchanges that can maintain and develop social ties (Magdol & Bessel 2003). However, there is contradictory evidence regarding the relationship between residential mobility and social support, as most research on residential mobility focuses on its predictors rather than its consequences (Magdol & Bessel 2003). Highly mobile individuals are thought to have social deficits (Kasarda & Janowitz 1974; Sampson 1988) and more unstable social ties, which limits available social support during stressful circumstances (DeAngelis 1995). Other research posits there is little difference between the informal social relations of voluntary and involuntary movers or stayers (Butler, McAllister & Kaiser 1973). If there is physical distance between actors yet they are able to maintain contact through telephone, mail or email, these relationships may remain psychologically important yet less functional (Magdol & Bessel 2003). One study even suggests that mobility can enhance social resources, including the ability to make new friends and become more social (Jones 1973) while other research argues that moving does little to damage existing ties (Viry 2012; Butler, McAllister & Kaiser 1973).

Mobility can be examined in myriad ways, including distance of move, duration of move and location of move. However, due to the perpetual migration experienced by most of the residence in G-CAFH, I examine mobility as the number of moves experienced by an individual between waves. High residential mobility can be a proxy for duration of move, which can result in social support deficiencies (Magdol & Bessel 2003). I argue that those who were able to maintain high levels of social support should be able to limit the harmful consequences of mobility on mental health found in Chapters 2 and 3.

Although there are certainly negative aspects to social support (Thoits 2011), including that relationships can be a source of strain rather than support, the purpose of this analysis is to examine the benefits that perceived social support could have for highly affected residents during their recovery. Networks and ties can become frayed during the recovery process, as households and communities become disrupted and survivors encounter perpetual migration. This chapter considers what happens to mental health when social support is disrupted by a disaster by bringing together theories on social support, stress, mobility, and disaster. I expect that social support will increase across waves—both when examining different levels and types of social support—once residents re-establish ties with friends and family or create different networks after moving to new neighborhoods.

I also consider whether those recovering from a disaster need different kinds of support than what people need in their everyday lives. The support that individuals receive in their everyday lives largely goes unnoticed because it occurs as part of a routine (Kessler et al. 1992). However, once individuals experience a traumatic event like a disaster they must consider whether they know friends, family or acquaintances

that could help with recovery. Housing needs are at the forefront of disaster recovery, especially after Katrina. Navigating temporary housing or the ability to find permanent and stable housing can be a stressful experience, one that can be mediated by support from others. Additionally, with financial resources likely stretched following a disaster, having someone who can lend several hundred dollars in the event of a medical emergency may lessen stress. Regardless of which type of social support exhibits the greatest benefit for mental health, there is reason to expect that those with high levels of social support will report better rates of mental health, which would suggest that social support acts as a buffer during the recovery process.

3. Research Objectives & Expectations

According to Bonanno et al. (2010), methodologically sound data that can investigate the relationship between social support and mental health over the course of recovery is scarce. However, G-CAFH data provide an opportunity to examine this relationship both by type and level of social support. These data contain respondents who were highly affected by Hurricane Katrina, including those who were displaced and experience high rates of mobility. The baseline interview was conducted within the first year after Katrina, with the second, third, and fourth waves completed annually around the anniversary of the storm. In this chapter, I use random effects and hybrid random effects non-continuous growth curve modeling to examine five types of social support, as well as three levels of social support (low, medium, high), measured at Waves 2, 3 and 4 to explore the relationship between these variables and mental health recovery. Perhaps most importantly, I control for mental health at baseline in order to address findings from Chapters 2 and 3 that suggest that those with poor prior mental health tend to have poorer

mental health following a disaster. On the basis of previous findings from literature on social support, stress, and mobility, I test three research hypotheses:

H₁: Social support increases over time as affected residents regain a sense of normalcy and (re)establish ties with friends and family.

H₂: Instrumental forms of social support (i.e. knowing someone who could lend several hundred dollars for a medical emergency/known someone who could help locate housing) will have a greater positive effect on mental health compared to emotional forms of social support (i.e. anyone you could count on for everyday favors/anyone to take care of you if confined to bed for several weeks/anyone to talk to if having family troubles).

H₃: Those with high or medium levels of social support will exhibit significantly better mental health than those with little or no social support.

Findings in Chapters 2 and 3 demonstrate that G-CAFH residents were highly mobile and households were extremely unstable in the years following Katrina. This type of disruption can negatively affect social ties, which may limit the type and amount of social support available over the course of recovery. While previous research suggests that different types of social support can affect mental health, I argue that it is not only the type but also the amount of social support that can buffer against the stressors of disaster. As social support is critical to post-disaster recovery, those with high or medium social support should exhibit significantly better mental health than those with little or no support. Similarly, those who are able to develop social support over the course of the recovery should report improvements to mental health. As these data contain respondents who were highly affected and mobile, it is possible that respondents had low levels of social support at the beginning of the study but were able to increase social support over time, as they reestablish or develop new social ties.

A main contribution of this chapter is to provide a descriptive understanding of perceived social support post-Katrina, including who believed they had access and

whether there were significant differences between groups. Secondly, I consider the effect that different types and levels of social support can have on mental health recovery while controlling for mobility, and mental health and sociodemographic characteristics at baseline. Similar to previous chapters, the main dependent variable for mental health is measured using a portion of the Medical Outcome Study Short Form-12 (SF12) scale called the MCS-12. I use five measures of social support and control for several theoretically relevant variables including, mental health at baseline, race, income, gender, age, and whether or not the respondent lives alone. Overall, this chapter tests the relationship between social support and mental health, and determines whether different types and levels of social support improve mental health recovery.

4. Data & Methods

I use the *Gulf Coast Child and Family Health Study* (G-CAFH) to explore my research questions. G-CAFH is one of four existing longitudinal Katrina studies, and the only one to examine a random sample of families and children heavily affected by the storm. The study follows a cohort of 1,079 individuals in order to assess post-disaster recovery via indicators such as infrastructure rehabilitation and stability, community redevelopment and housing stability, economic recovery, social re-engagement, and personal resilience and recovery. Due to the child component of the survey, at baseline interviewers were instructed to ask to speak with the adult who was most knowledgeable about the household, which is the same respondent interviewed at each wave. G-CAFH focuses on identifying the health and social service needs among this highly affected and displaced population.

Abramson et al. (2008) used a stratified cluster sampling strategy to enroll subjects in the study in two phases: Louisiana in February 2006 (n=555) and Mississippi (n=524) in August 2006. Overall, they selected 26 sites as primary sampling units that included twelve FEMA group sites, ten commercial trailer sites, and four hotel sites. Using FEMA damage assessment maps and databases of the state's three coastal counties hardest hit by the hurricane, they randomly selected 150 of 650 census blocks that FEMA designated as having sustained moderate, extensive, or catastrophic damage. They sampled 4,284 households as secondary sampling units. Of those, 985 households were deemed ineligible because they were destroyed, vacant, abandoned, or under construction, leaving 3,299 eligible households. Among those, 1,587 households had an eligible adult present to whom the study was presented; at the remaining 1,712 households, no contact was made despite repeated efforts. Among the 1,587 contacted households, 1,079 agreed to be enrolled in the longitudinal study, corresponding to a response rate of 32.6% (1079/3299) and a cooperation rate of 67.9% (1079/1587).¹¹

The 1,079 households in Louisiana and Mississippi were followed for four rounds of data collection in the five years after Katrina (collected in 2006, 2007, 2008, 2009). For Louisiana respondents (n=555), all were still displaced at initial recruitment and were living either in group trailer parks or hotels. For respondents in Mississippi (n=524), they were either still displaced at initial recruitment, or were community-based respondents, some of whom had been displaced but had returned home, and some who only briefly evacuated their homes. At baseline, surveys were completed in person and lasted approximately one hour. The first follow-up round of interviews (Wave 2) was conducted in 2007, 20-23 months post-Katrina, and focused specifically on the physical

¹¹ G-CAFH does not use weights to correct for sample selection or non-response.

and mental health effects, and social and economic consequences resulting from exposure to the hurricane and subsequent displacement. A second follow-up survey (Wave 3), was conducted in 2008, 33-38 months post-Katrina and was completed with 777 interviews. A final follow-up survey (Wave 4) was completed in 2009 with 844 interviews. Over this period, G-CAFH retained 87.6% of the initial study cohort, including those who were still living and not incarcerated. This sampling strategy is representative of the approximately 60,000 residents who were displaced to congregate settings in Louisiana and Mississippi following Katrina, and representative of the 26,000 people who were living in the most damaged areas of the Mississippi Gulf Coast.

4.2 Dependent Variable

The outcome measure *mental health* is derived from the mental health component of the short-form 12 (SF-12), version 2. The SF-12 is a multipurpose survey with 12 questions selected from the SF-36 Health Survey (Ware, Kosinski, & Keller 1996). The SF-12 was developed to provide a shorter alternative to the SF-36, which has been criticized by health researchers as too long to administer (Ware, Kosinski, & Keller 1996). This subset of questions was combined, scored, and weighted to create two physical and mental health summary measures, denoted as the Physical and Mental Health Composite Scores (PCS-12 and MCS-12, respectively). These scales have been validated in both domestic and international populations, and are computed using the scores of twelve questions that range from 0 to 100 with zero indicating the lowest level of health and 100 the highest level of health (Ware, Kosinski, & Keller 1996). These scales have also been normed to U.S. population standards with a mean score of 50.0 and a standard deviation of 10.0 (Ware, Kosinski, & Keller 1996). Questions from the SF-12 provide information

on the mental and physical health of individual respondents, as well as their overall health-related-quality of life. The cutoff score of 42.0 is often used to distinguish psychological distress for the MCS-12 (Ware, Kosinski, & Keller 1996). Reliability is high for the SF-12 across all four waves with a Cronbach's Alpha of 0.85 at the baseline, 0.91 for wave 2, 0.87 for wave 3, and 0.82 for wave 4. The outcome variable is normally distributed.

4.3. Independent Variables

4.3.1 Social Support

G-CAFH includes five different measures of social support based on previous research by Litwak and colleagues (1989). These five measures include: 1) *Is there anyone you could count on for everyday favors like getting a ride, borrowing a little money, or errands?* 2) *Is there anyone you could count on to take care of you if you were confined to bed for several weeks?* 3) *Is there anyone you know who you could count on to lend you several hundred dollars for a medical emergency?* 4) *Is there anyone you could talk to if you were having troubles with family relationships?* 5) *Is there anyone who could help you locate housing if you had to move?* Each of these questions are able to ascertain the informal support systems that are often critical for disaster recovery, including everyday needs, health difficulties, monetary issues, relationship troubles and housing difficulties. Each question is coded as a dichotomous variable (1=yes, 0=no). In the first group of models presented in Table 4.3, I examine the effect of each type of social support on mental health. Doing so provides information on whether emotional or instrumental forms of social support are more conducive to post-disaster mental health recovery. In the second group of models (Table 4.4), I consider whether the amount of

social support also influences mental health. I recoded these individual forms of social support into dummy variables indicating high support (4-5), medium support (2-3) and low support (0-1) as the reference.

4.3.2 Controls

I also consider variables that are associated with social support and mental health recovery, including mobility, mental health at baseline, race, gender, income, age, and whether or not the respondent lives alone. Mobility, which is measured continuously, captures the number of moves respondents experienced between interviews.

Respondents were asked to identify their race or ethnicity at baseline, which is recoded as either “Black” or “Other,” (reference category) including White, Asian/Pacific Islander and Native American. Household income is collected in five categories - less than \$10,000 annually, between \$10-20,000, \$20-35,000, \$35-50,000 or greater than \$50,000 per year. It is recoded to distinguish households living in poverty (less than \$20,000 annually) from those with annual incomes above \$20,000 annually (reference category). Gender is a dichotomous variable (1=male, 0=female) while age is a continuous variable that ranges from 18-89. Finally, I created a variable that captures whether or not a respondent lives alone (1=lives alone 0=lives with others). This dichotomous variable was created by taking the number of people in the household at each wave and recoding it as “Lives Alone” if the respondent indicated there was one person in the household (him or herself) and “Lives with others” if the respondent indicated there was more than one person in the household (reference).

4.4 Analytic Methods

This chapter uses random-effects multilevel non-continuous growth curve models.

I use an alternative specification of the growth curve model that measures growth non-continuously by using dummy coding for time. Time is modeled in this way after likelihood ratio tests that balance model fit and model complexity (i.e., Akaike information criterion and Bayesian information criterion) indicated that this was the best-fitting model. While random-effects and fixed-effects models are common approaches for analyzing longitudinal data, I use a variation of the random-intercept model—a hybrid random effects model—to examine the effect of social support on mental health.

Concerns over omitted variable bias make hybrid random effects models attractive for longitudinal analyses. The benefit of using a hybrid model is that it combines the advantages of both random and fixed effects (Allison 2005; Gasper et al. 2010).

Considering random and fixed effects models separately helps explain the benefit of combining the advantages of each model. Using this approach often improves model fit and provides greater flexibility (Bollen & Brand 2010). It is important to note that time-varying regressors need to be decomposed and tested for heterogeneity bias. If there is no heterogeneity bias, the untransformed metric is more efficient. The non-continuous growth curve model is expressed as follows:

$$Y_{it} = \alpha + \sum_{t=2}^T \tau_t 1(Time_t) + u_i + e_{it}$$

In this model, 1 is an indicator function that dummy codes $Time_t$. The error components include the random effect for the intercept u_i and the random effect for the slope of the time-varying regressors e_{it} . The error components are assumed to be uncorrelated with the predictors. In longitudinal multilevel models, the last assumption of the random intercept model is problematic because it does not control for unmeasured stable

individual differences. However, the hybrid model decomposes time-varying independent variables from the random effects model into two parts, including between-person variation and within-person variation. The between-person variation is the mean of the variable for each individual across time or group mean. The within-person component is the difference between each individual's group mean and his or her variable value at each time point. Using a hybrid approach provides coefficient estimates for both between-person effects and within-person effects for decomposed time-varying variables. Perhaps most importantly, the decomposition allows the within-individual estimates to be uncorrelated with the time-constant portion of the error term and makes it identical to the estimates obtained in a fixed effect model. It is important to note, however, that this model does not control for the effects of change for unmeasured variables over time (Gasper et al. 2010).

5. Results

5.1 Descriptives

Table 4.1 shows the unbalanced descriptive analyses for respondents that completed surveys at Waves 2, 3 and 4 (n=844). At baseline, a majority of these respondents (57 percent) reported an MCS below 42.0, which indicates mental distress. This declines to nearly 48 percent about two years after the storm in Wave 2 and 39 percent three years post-Katrina in Waves 3 and 4. The mean MCS is below or at the cutoff at baseline (40.1) and Wave 2 (42.3) but increases to approximately 45 in the last two waves. Table 4.1 also reports the percentage of respondents who answered affirmatively that they had a particular type of social support at Waves 2, 3 and 4. The percentage of those who answered positively varies for each individual item of social

support. Nearly 60 percent reported that they had someone they could count on for everyday favors at Wave 2, which increased to 73 percent in Wave 3 and 74 percent in Wave 4, respectively. A large majority of respondents (78 percent) had someone they could count on to take care of them if they were confined to bed for several weeks in Wave 2. This decreased slightly to 76 percent in Wave 3 and nearly 73 percent in Wave 4, and was the only measure of social support to decrease over the course of G-CAFH. A far lower percentage of respondents had someone they could count on to lend them several hundred dollars for a medical emergency. Nearly 44 percent indicated they had this type of support in Wave 2, which increased approximately 46 percent in Waves 3 and 4. This type of social support is likely a proxy for income, as previous chapters have shown that G-CAFH is a highly impoverished sample. A far greater percentage (74.0) of respondents in Wave 2 had someone they could talk to if they were having family troubles, which increased to 76 and nearly 81 percent in Waves 3 and 4, respectively. Lastly, less than half (approximately 42 percent) of respondents knew someone that could help them locate housing, which jumped to 53 percent and nearly 59 percent in Waves 3 and 4. As housing is often a critical part of post-disaster recovery, this particular lack of social support might have negative implications for mental health.

Insert Table 4.1 Here

In addition to considering how individual types of support changed in the years following Katrina, I also consider how different levels of social support (high, medium and low) increase or decrease during recovery. While only a third of respondents (33 percent) have high social support two years after Katrina, this increases to 41 and nearly 53 percent in the following waves. A relatively similar percentage of respondents

reported medium social support across the three waves (28.4, 28.0 and 32.0, respectively). As a result of the increase in those with medium or high social support, there is a decrease in those with low social support across each wave (38.2 percent; 30.8 percent; and 15.2 percent, respectively). This decrease is likely a reflection of recovery, as respondents become increasingly settled in their neighborhoods and communities, and reestablish ties with friends and family or create new ones. Reflecting findings in Chapter 2, this subset of G-CAFH respondents were highly mobile in the years immediately following Katrina, as they averaged nearly four moves at Wave 2. However, this drops to around one move on average per year in Waves 3 and 4, respectively.

Slightly more than half of the sample is Black (51 percent) while 49 percent identifies as White, Asian, Pacific Islander or Native American. Similar to descriptive statistics shown for the overall sample in Chapter 2, over 67 percent of respondents in this analysis reported that they lived in poverty at Wave 2. This dropped to approximately 59 percent in Wave 3 but increased again to over 61 percent at Wave 4. As economic constraints can influence the need for social support, poverty is an important variable to consider when examining mental health outcomes and overall recovery. A majority of respondents at baseline are women (nearly 61 percent), which might be expected as interviewers asked to speak with the person most knowledgeable about the household, and specifically about their children's health.¹² The mean age of this sample at baseline was 46.4 with a standard deviation of 14.8. Lastly, the percentage of those who live alone remains relatively steady over the years with approximately 28 percent living alone at Wave 2, 27 percent at Wave 3 and a slight decrease to 23 percent

¹² According to Abramson et al. (2008), interviewers sought an eligible adult respondent at each sampled household who was the "primary caregiver," someone who could knowledgeably report upon the health issues of all the individuals in the household.

at Wave 4.

Table 4.2 reports the unbalanced means and standard deviations for Mental Health Composite Scores (MCS) by type and level of social support, as well as select independent variables. Those who report having someone to count on for everyday favors have significantly higher mental health scores (44.4) compared to those who do not (39.7) at Wave 2. This difference is consistent and remains statistically significant at Wave 3 (46.5 compared to 41.2) and Wave 4 (46.2 compared to 40.9) and suggests that those without this kind of social support exhibit mental health distress. Those who have someone they can count on to take care of them if confined to bed for several weeks have similar mean MCS to those who have someone they can count on for everyday favors (44.4, 46.7 and 46.3 at each respective wave). However, those without this type of support have significantly lower social support at each wave, and are below the cutoff of 42.0 that indicates mental health distress (37.7, 40.4, and 39.8 at each respective wave). Those who have someone they can count on to lend them several hundred dollars for a medical emergency have some of the highest mean mental health scores. Compared to those without this type of support at Wave 2 (39.7), those with someone who could lend them money for a medical emergency have a mean MCS of 45.9. This score increases to nearly 48 in each of the next two waves, and is significantly different from those without this type of social support (42.9 and 42.3, respectively). By Wave 4, those with someone they can count on to lend them money for a medical emergency have the highest mean MCS of any individual type of social support. This finding may be reflective of the relationship found in Chapter 2 between income and mental health, which found that lower income respondents are significantly more likely to report poor mental health.

Respondents who have someone they could talk to if they were having family troubles report mean mental health scores of 44.7 at Wave 2, which increases to 46.9 in Wave 3 but then drops slightly to 46.0 at Wave 4. However, similar to other types of social support, those without someone they could talk to about family troubles in Wave 2 fall far below the cutoff that indicates mental distress (42.0) with a mean MCS of 36.3. This increases over the next two waves (39.2 and 40.1, respectively) but remains below the cutoff. Lastly, those who have someone that can help them locate housing consistently have the highest mean MCS of all forms of social support with 46.4 at Wave 2, 48.4 at Wave 3, and 47.0 at Wave 4. This is significantly different from those without someone who could help locate housing, and supports the argument that locating housing is a critical aspect of mental health recovery. The most interesting trend that deserves greater scrutiny is that at each wave there is a statistically significant difference between those who have a particular form of social support and those that do not, and suggests that further analyses should be performed. Overall, each form of social support represents a significantly higher mean MCS at each wave, and generally similar mental health scores. Those without a particular form of social support almost always fall below the cutoff of 42.0 at each wave with the exception being those without someone who could lend them money for a medical emergency at Waves 3 and 4.

Insert Table 4.2 Here

Similar to the differences in mean MCS when examining individual forms of social support, there is a statistically significant difference in mental health between those with high, medium and low levels of social support. Those with high social support are nearly six points higher (47.1) than those with medium social support (41.4) and almost

12 points higher than those with low social support (35.8) at Wave 2. Those with high levels of social support improve to a mean MCS of 49.0 at Wave 3 but drop slightly to 47.8 at Wave 4. Perhaps most importantly, those with medium social support hover around the cutoff for mental health distress at each wave (42.3 in Wave 3 and 42.7 in Wave 4) while those with low social support have mean mental health scores that indicate mental health distress (39.3 and 39.4) at each wave. This bivariate analysis suggests a strong relationship between levels of social support and mental health recovery.

At Wave 2, Blacks (42.9), and Whites, Asian/Pacific Islander and Native American (42.0) report similar mean mental health scores. This small difference between racial groups at Wave 2 nearly disappears by Wave 4 with Blacks reporting a mean MCS of 44.9 and other racial groups reporting a score of 44.8. At Wave 2 those living in poverty (40.9) also report significantly lower MCS scores compared to those with greater financial resources (45.5). Over the course of the study, adults in poverty showed much smaller improvements in mean mental health scores (1.8 increase) than those living in non-impooverished households (2.7 increase), which is consistent with findings in Chapter 2. Women report significantly lower mean MCS at baseline (39.9) compared to men (42.1) (not shown); however, each group increased by approximately 4 points by Wave 4 with women having a final mean mental health score of 44.2 and men having a mean of 45.9. Lastly, there is no significant difference in mean MCS when comparing those who live alone to those who live with others. In fact, those who live alone had lower mean MCS at Wave 2 (41.9) compared to those who live with others (42.7). But by Waves 3 and 4, those who live alone report higher mean MCS scores (45.9 and 46.0, respectively) compared to those who do not (44.7 and 44.6, respectively). Overall, there are significant

differences in mean MCS when examining those who had social support compared to those who did not while other sociodemographic variables—with the exception of poverty—do not appear to be as predictive of mental health across waves for this subsample of G-CAFH.

5.2 Random-Effects Non-Continuous Growth Curve Models Examining Types of Social Support

The results for models predicting mental health with individual social support items are presented in Table 4.3. Models 1 and 2 are random effects non-continuous growth curve models while Model 3 is a hybrid random-effects non-continuous growth curve model. Examining the effect of time on mental health reveals that mental health is significantly higher by 2.48 in Wave 3 compared to Wave 2, and significantly higher by 2.50 in Wave 4 (not shown). Model 1 includes dummy variables for the five main independent variables that measure different types of social support while also controlling for mental health at baseline. This model demonstrates the expected positive and significant relationship on mental health for four of the five different forms of social support. Those who had someone they could count on to take care of them if confined to bed for several weeks ($b=3.25$) and those who had someone they could talk to regarding family troubles ($b=3.23$) reported similar benefits to mental health. Those who had someone that could help them locate housing ($b=2.13$) and those who had someone who could lend them several hundred dollars for a medical emergency ($b=1.83$) also experienced similar and significant benefits to mental health. However, there is not a significant difference in mental health between respondents who had someone they could count on for everyday favors and those who did not.

It is notable that these particular forms of social support can be grouped into similar mental health effects. The first grouping (e.g. help if confined to bed and help to talk about family troubles) reflects how emotional support can be beneficial during recovery. The second grouping (e.g. help with housing and monetary help with medical expenses), which can be classified as instrumental support, has a positive effect on mental health although the effect is not as large as the benefit provided by perceived emotional support. Lastly, time remains a significant predictor of mental health with respondents experiencing a 2.23-point improvement in mental health at Wave 3 compared to Wave 2 and 1.58 improvement in Wave 4 compared to Wave 2. The intraclass correlation coefficient for Model 1 suggests that approximately 34 percent of the variance for mental health is between subjects while 66 percent is within subjects.

Insert Table 4.3 Here

Similar to Chapters 2 and 3, I add mobility and controls in Model 2. However, unlike previous findings, there is no significant relationship between mobility and mental health after accounting for the effect of social support. This suggests that the effect of mobility on mental health is mediated by social support, and that the effect of mobility on mental health seems to operate through its link with social support. These findings also suggest that emotional forms of social support have a greater positive influence on mental health than formal, instrumental types of social support. While mobility is not significant in Model 2, several sociodemographic variables have an effect on mental health. Mental health at baseline controls for preexisting differences in mental health, and can be interpreted as a one point higher score in MCS at baseline is significantly associated with 0.39 unit increase in mental health score across time. Blacks have a 1.66 higher mean

MCS on average compared to other racial groups. There is a similar poverty penalty as found in previous chapters with those living in poverty demonstrating significantly lower MCS ($b=-3.65$) than those earning more than \$20,000 per year. Similar to Model 1, time is significant at Wave 3 ($b=1.53$); however, there is not a significant effect on mental health at Wave 4. The intraclass correlation coefficient for Model 2 suggests that approximately 30 percent of the variance for mental health is between subjects while 70 percent is within subjects.

5.3 Hybrid Random-Effects Non-Continuous Growth Curve Model Examining Types of Social Support

Model 3 in Table 4.3 is a hybrid random effects non-continuous growth curve model predicting mental health. Decomposing each time-varying covariate into between-person and within-person components is a strategy used to address selection effects (Gasper et al. 2010). This model provides a key test as to whether the relationship between social support and mental health can be attributed to preexisting differences among respondents. The decomposed “between” coefficients give the between-person differences in mental health for each type of social support and poverty averaged across all time periods. The decomposed “within” coefficients provide the change in mental health that follows a change in the decomposed variable (i.e. not having a particular kind of social support to having it). Decomposing time-varying variables in this way provides a means for determining whether the significance for certain variables is coming from between or within person effects.

Many of the findings from Model 3 are similar to those from Model 2, although this model demonstrates exactly where the effect of social support on mental health is coming from between or within person effects. The only type of social support that is

significant at the between-person level is whether a respondent knew someone who could help them locate housing ($b=3.57$), which suggests an association—albeit non-causal—between help finding housing and mental health. Alternatively, the within-person coefficient is small and not significant. This indicates that the overall effect that having someone to help locate housing in Models 1 and 2 is because individuals in the sample who have this kind of social support have significantly better mental health from the start. As such, gaining this type of social support is not causally related to improving mental health. In contrast, other types of social support are only significant at the within-person level over time. Those who had someone they could count on to take care of them if confined to bed for several weeks report a mental health score nearly 3.6 points higher than those without this kind of support at the within-person level. This suggests that those who were able to attain this type of social support experienced increases to their mental health. Likewise, those who had someone they could talk to if they were having family troubles are nearly three points higher on average at the within-person level. These findings suggest that people who do not have this type of social support but eventually gain it over the course of recovery experienced an improvement to their mental health.

Similar to the findings on poverty and mental health in Chapter 3, both between and within-person decomposed variables for living in poverty are significant. Also reflecting findings in Chapter 3, between-person effect is larger ($b= -5.45$) compared to within-person effect ($b= -1.77$), which suggests that most of the effect of poverty on mental health is because of those living in poverty exhibiting poorer mental health than those who are not impoverished. Becoming poor over the course of recovery has an

additional, but less sizable, effect in diminishing one's mental health. Similar to Model 2, time is significant at Wave 3 compared to Wave 2 (1.90), however, it is not significant at Wave 4.

5.4 Random-Effects Non-Continuous Growth Curve Model Examining Levels of Social Support

Table 4.4 displays random-effects non-continuous growth curve models examining mental health for those with high and medium levels of social support compared to low. While the models in Table 4.3 support the hypothesis that different forms of social support can have differential effects on mental health, I also hypothesize that the amount of perceived social support is critical during disaster recovery. Model 1 reports the effect of high and medium levels of social support compared to low while controlling for mental health at baseline. Those with high social support have MCS scores that are over eight points higher than those with low social support. Those with medium levels of social support also possess significantly better mental health ($b=3.64$) than those with little or no social support. In this model, the dummy variables for time are significant at both Wave 3 ($b=2.00$) and Wave 4 ($b=1.69$). Model 2 considers levels of social support while controlling for mental health at baseline, mobility and sociodemographic characteristics. Although the effect size is somewhat smaller, those with high ($b=7.89$) and medium social support ($b=3.43$) continue to possess significantly higher MCS scores compared to those with low social support. Similar to findings in Table 3, one point higher score in MCS at baseline is significantly associated with 0.39 unit increase in mental health score across time. Blacks have significantly better mental health ($b=1.74$) than Whites, Asian/Pacific Islanders and Native Americans. Consistent with findings in Table 4.3, as well as previous chapters, living in poverty has a

significantly negative effect on overall mental health. Those who are impoverished score 3.43 points lower on the MCS compared to those who live in households earning over \$20,000. In Model 2, while the effect of time remains significant for Wave 3 ($b=1.31$) the significance for time at Wave 4 disappears. The intraclass correlation coefficient for Model 2 suggests that approximately 31 percent of the variance for mental health is between subjects while 69 percent is within subjects. Both of these models support the argument that it is not only the type of social support that can influence mental health but also the amount of perceived support.

5.5 Hybrid Random-Effects Growth Curve Model Examining Levels of Social Support

Although Models 1 and 2 support the third hypothesis of this chapter, these models do not demonstrate whether the effect of the level of social support on mental health is at the between or within-person level. In order to determine where the effect is coming from, Model 3 in Table 4.4 reports results from a hybrid random effects non-continuous growth curve model predicting mental health. Both between and within-person decomposed variables for high social support are significant. Although both substantial, the between-person effect is larger ($b=9.27$) compared to within-person effect ($b=6.76$). These findings suggest that the effect of high social support on mental health is because those who have high social support exhibit better mental health than those who do not have high social support. Although gaining high levels of social support over the course of recovery has an additional positive effect on mental health it is less sizable but remains large. As the between-person coefficient is small and not significant for medium social support, the overall effect that medium social support has in Models 1 and 2 is because individuals in the sample who went from low to medium social support

experienced an increase in their mental health. As respondents developed more social support over the course of recovery it had an independent and significant effect on improving their mental health. Although not decomposed, mental health at baseline ($b=0.36$), race ($b=1.78$) and living in poverty ($b=-3.23$) have similar and significant effects as they did in Model 2. Also similar to Model 2, time is significant at Wave 3 compared to Wave 2 (1.90), however, it is not significant at Wave 4.

6. Discussion

The goals of this chapter were three-fold. Primarily, I aimed to determine whether highly affected residents reported an increase in perceived social support in the years following Katrina. Using findings from previous research, I expected that as residents regained a sense of stability in their everyday lives and became more settled in their neighborhoods that they would develop or reestablish social ties that would provide them with support. This hypothesis is almost entirely supported as respondents reported an increase in all types of social support except one—having someone they could count if confined to bed for several weeks—between Waves 2 and 4. Although the percentage of those reporting that they had this type of social support declined by six percentage points between 2007 and 2009, nearly 73 percent of respondents reported having someone they could count on for help if confined to bed at Wave 4. It is possible that decrease is related to high rates of mobility, and that as respondents moved and developed new social relationships that they had not established close enough ties to have someone they could count on for this type of support. Despite this drop across waves, a majority of respondents still reported that they possessed this type of social support. Respondents maintained high levels of another type of emotional support, including knowing someone

they could count on if they were having family troubles and having someone they could count on for everyday favors. Alternatively, far fewer respondents reported having instrumental forms of social support, including having someone they could count on to lend them several hundred dollars for a medical emergency and knowing someone that could help them locate housing. This lack of instrumental support could hinder recovery, as respondents might have difficulty navigating complex bureaucratic systems to find housing or obtain other post-disaster needs. However, these findings could also reflect the particular difficulties experienced by the G-CAFH cohort, as nearly all respondents were displaced or highly affected, and approximately 60 percent lived below the poverty line. Thus, it is likely that those who respondents might look to for help when facing a housing crisis were simultaneously experiencing their own difficulties locating housing. Similarly, as a large portion of G-CAFH respondents were poor—and likely also dealing with the financial hardship of recovering from a disaster—theories of network homophily suggest that it is likely that they did not know anyone with funds they could borrow (McPherson, Smith-Lovin & Cook 2001). As a large portion of respondents did not report having either type of instrumental support over the course of recovery, this is a gap that policymakers could address when creating post-disaster recovery programs.

As there was an increase in nearly all forms of social support, it follows that there was also an increase in those with high and medium levels of social supports. As time passed, respondents found themselves with greater levels of social support—by Wave 4 more than 50 percent of respondents reported possessing four or five different types of social support. While nearly 40 percent of respondents reported little or no social support nearly two years after the storm, this dropped dramatically to only 15 percent four years

after Katrina. Highly affected Katrina residents were likely busy in the time immediately following the storm in getting settled and establishing or reestablishing new network ties. Additionally, if residents anticipated eventually returning to New Orleans it is possible that they were hesitant to invest in creating new social ties. The substantial drop in those reporting little or no social support by Wave 4 could signify that approximately three or four years after the storm affected residents were able to take dramatic steps in their recovery, especially as it related to regaining social support. Future studies should attempt to collect data on pre-disaster levels of social support in order to further examine this proposed trajectory of recovery. While collecting data prior to a disaster is ideal—although usually coincidental rather than planned—asking respondents retrospectively about their social support could provide a comparison between pre- and post-disaster types and levels of social support.

The second aim of this chapter was to examine whether particular types of support mechanisms had a greater positive impact on mental health than others over the course of recovery. I proposed that instrumental forms of social support such as knowing someone who could lend several hundred dollars for a medical emergency and knowing someone who could help locate housing would have the greatest positive effect on mental health, as lack of monetary funds and housing instability are often the most stressful aspects of disaster recovery. However, this hypothesis was not supported, as the models predicted nearly the exact opposite. It is not instrumental support but emotional support that provides the greatest positive influence on mental health over the course of recovery. Specifically, respondents saw the greatest improvements to their mental health at the within-level for emotional forms of social support. These findings suggest that those who

were able to gain this kind of emotional support over the course of recovery experienced significant benefits to their mental health. It is important to note that gaining this kind of social support may be indicative of greater recovery, as people with emotional support may be more likely to have re-established or developed social ties as their lives became increasingly settled. Alternatively, knowing someone who could help locate housing is only significant at the between-person level, which suggests that individuals who have this kind of instrumental support possess significantly better mental health. Although not a perfect substitute, the results provided by the decomposed model suggests that interventions can be made to improve mental health by creating programs that provide forms of emotional support to disaster survivors, such as counseling for family issues, during the recovery period.

Lastly, I tested whether those with high or medium levels of social support exhibited significantly better mental health scores than those with little or no social support. These findings support previous theories of perceived social support and mental health, as those with high social support report significantly greater mental health on average across time than those with little or no support. Interestingly, when this variable is decomposed it is significant at both the between and within levels. There is a more sizable effect at the between-person level, which suggests that those who have high social support exhibit better mental health than those who do not have high social support. However, gaining a high level of social support over the course of recovery has an additional—and substantial—positive effect on mental health; however, it is less sizable than at the between level. While not as large as high social support, those with moderate support also experience a significantly positive impact on their mental health. Similarly,

those with moderate social support receive similar positive benefits to their mental health on average over time although this is only significant at the within-person level. This suggests a causal relationship in that gaining a moderate level of social support—presumably of particular types given the results in Table 4.3—over the course of recovery has a positive influence on mental health. These findings reinforce suggestions made in the previous paragraph, in which helping disaster survivors get settled can perhaps accelerate the process of reestablishing and developing social ties, which can benefit mental health.

Despite social support being a powerful predictor of mental health, poverty remains an enduring harm to mental health for this subset of the G-CAFH sample. Similar to findings in Chapter 2 on poverty and mental health, and Chapter 3, which compared various income categories with mental health outcomes, living in poverty continues to have an independent negative effect on mental health even when considering perceived social support. Such findings demonstrate that pre-existing socioeconomic inequalities endure in the face of disaster, and cannot necessarily be buffered by social support. There were also important non-findings, including for mobility, which was not significant in any of the models. Although high rates of mobility were found to be detrimental to mental health in previous chapters, in these analyses possessing social support acts as a mediator of the effect of mobility on mental health. These findings support the notion that perceived support serves as a core component in disaster recovery, and buffers against the effects of post-disaster distress, specifically as it relates to mobility. It also suggests that it is not the physical act of moving that is associated with poor mental health but that moving disrupts important social ties that protect against the

stressors of disasters. If residents are able to maintain social support throughout their multiple moves then they do not appear to suffer from the harmful effects typically associated with high rates of mobility. Similarly, while time was a significant predictor of mental health in Wave 3, it is not significant in Wave 4. This suggests that improvements to mental health are not necessarily linear during recovery when considering the effects of social support. For this reason, there may be important points during the trajectory of recovery in which affected residents could benefit from recovery programs that provide emotional support in the form of mental health assistance or counseling services.

Overall, social support is a powerful predictor of mental health in the years following Katrina. However, it is difficult to encourage or force disaster survivors to develop social support. This is especially true when a disaster as disruptive as Katrina creates displacement and perpetual migration that causes a combination of high mobility rates and forced migration. However, policymakers could create programs and services that substitute or supplement traditional forms of social support. For example, rather than relying on family or friends, local and federal policymakers could create programs that assist displaced residents with family support or marital counseling. This kind of program could be especially helpful during disasters when affected residents realize their networks have become frayed and that their social support systems are consumed with facing their own recovery needs. Perhaps most importantly, these analyses provide evidence that those without social support should be considered a vulnerable population following a disaster. While sociodemographic characteristics such as age, gender, race, and income can be used to identify at-risk groups, those without perceived social support

appear to be at a significant disadvantage during recovery as it relates to mental health.

Targeting affected residents with recovery programs that inform them of the availability of instrumental or emotional support could benefit the mental health recovery of those with little or no perceived social support.

7. Limitations

Questions remain as to exactly *how* social ties or social support actually sustain or improve health and well-being (Thoits 2011). While this chapter was able to determine whether or not respondents perceive that they possess social support, it does not address how or who provides social support or whether they used it. Understanding whether social support during disasters largely comes from primary or secondary groups, as well as how respondents rely on this support for recovery can help identify areas where disaster assistance programs can attempt to meet these needs. Lastly, it would be helpful to have a more refined measure of mobility, including distance of moves since frequent local movers should be able to maintain their local social ties while long-distance movers may be disadvantaged because they need to create new relationships. The assumption is that frequent movers have newer social ties. However, future studies should attempt to collect more detailed information on the duration and type of ties individuals use during recovery. Being able to capture this distinction may shed further light on the relationship between social support, mobility, and mental health recovery.

Table 4.1 Descriptives Statistics of the G-CAFH Cohort: 2007-2009 (N=844)
(N, % unless noted)

	Wave 1	Wave 2	Wave 3	Wave 4
Dependent Variable				
MCS (0-100) mean/SD	40.2 (11.0)	42.5 (13.0)	45.1 (13.2)	44.9 (12.9)
<i>Below 42.0</i>	469 (56.7)	323 (47.8)	278 (39.2)	324 (38.5)
<i>Above 42.0</i>	358 (43.3)	353 (52.2)	431 (60.8)	518 (61.5)
Independent Variables				
Social Support (Individual Items)				
<i>Everyday favors</i>		404 (59.7)	518 (73.2)	626 (74.4)
<i>Take care of you if confined to bed for several weeks</i>		657 (78.2)	530 (76.0)	489 (72.8)
<i>Lend you several hundred dollars for medical emergency</i>		293 (43.8)	321 (46.1)	388 (46.5)
<i>Talk to if you were having family troubles</i>		502 (74.0)	536 (76.1)	679 (80.8)
<i>Help you locate housing</i>		275 (41.6)	356 (53.1)	490 (58.8)
Social Support (Levels)				
<i>High (4-5)</i>		282 (33.4)	348 (41.2)	446 (52.8)
<i>Medium (2-3)</i>		240 (28.4)	236 (28.0)	270 (32.0)
<i>Low (0-1)</i>		322 (38.2)	260 (30.8)	128 (15.2)
Mobility mean/SD		3.81 (2.03)	0.96 (1.26)	1.04 (1.73)
Race				
<i>Black</i>	420 (51.5)			
<i>Other</i>	396 (48.5)			
Income				
<i>Poverty (<20k)</i>	503 (63.3)	448 (67.3)	404 (58.6)	506 (61.3)
<i>Not in poverty (>20k)</i>	292 (36.7)	218 (32.7)	285 (41.4)	320 (38.7)
Gender				
<i>Male</i>	330 (39.1)			
<i>Female</i>	514 (60.9)			
Age (18-100) mean/SD	46.6 (14.8)	47.9 (14.2)	48.9 (14.2)	49.5 (14.3)
Live Alone				
<i>Lives Alone</i>		192 (28.3)	190 (26.8)	191 (22.6)
<i>Lives with Others</i>		486 (71.7)	520 (73.2)	653 (77.4)
Total N	844	802	777	844

Table 4.2		Unbalanced means and standard deviations for MCS by type and level of social support and select independent variables		
		Wave 2	Wave 3	Wave 4
<i>Independent Variables</i>				
Types of Social Support				
Everyday favors?				
	<i>Yes</i>	44.4 (12.1)***	46.5 (12.6)***	46.2 (12.6)***
	<i>No</i>	39.7 (13.9)	41.2 (14.1)	40.9 (12.9)
Take care of you if confined to bed for several weeks?				
	<i>Yes</i>	44.4 (12.7)***	46.7 (12.5)***	46.3 (12.3)***
	<i>No</i>	37.7 (12.6)	40.4 (13.6)	39.8 (13.9)
Lend you several hundred dollars for medical emergency?				
	<i>Yes</i>	45.9 (12.2)***	47.6 (12.3)***	47.7 (12.0)***
	<i>No</i>	39.7 (13.0)	42.9 (13.7)	42.3 (13.2)
Talk to if having family troubles?				
	<i>Yes</i>	44.7 (12.4)***	46.9 (12.3)***	46.0 (12.8)***
	<i>No</i>	36.3 (12.8)	39.2 (14.4)	40.1 (12.3)
Help you locate housing?				
	<i>Yes</i>	46.4 (11.9)***	48.4 (11.6)***	47.0 (12.3)***
	<i>No</i>	39.5 (13.1)	41.1 (14.0)	41.8 (13.2)
Levels of Social Support				
	<i>High (4-5)</i>	47.1 (11.6)***	49.0 (11.1)***	47.8 (12.0)***
	<i>Medium (2-3)</i>	41.4 (12.7)	42.3 (13.6)	42.7 (12.7)
	<i>Low (0-1)</i>	35.8 (12.9)	39.3 (14.3)	39.4 (13.9)
Race				
	<i>Black</i>	42.9 (12.9)	46.0 (12.4)*	44.9 (12.2)
	<i>Other</i>	42.0 (13.1)	44.1 (13.8)	44.8 (13.6)
Income				
	<i>Poverty (<20k)</i>	40.9 (13.1)**	42.7 (13.8)***	42.7 (13.1)***
	<i>Not in poverty (>20k)</i>	45.5 (12.2)	48.3 (11.5)	48.2 (11.8)
Gender				
	<i>Male</i>	43.6 (12.8)*	45.7 (12.6)	45.9 (13.2)
	<i>Female</i>	41.8 (13.2)	44.7 (13.5)	44.2 (12.7)
Live Alone				
	<i>Lives Alone</i>	41.9 (13.4)	45.9 (12.2)	46.0 (12.4)
	<i>Lives with Others</i>	42.7 (12.9)	44.7 (13.5)	44.6 (13.0)
Total N		802	777	844
*** p <= 0.001, ** p <= 0.01, * p <= 0.05				

**Random-Effects and Hybrid Random-Effects Non-Continuous
Growth Curve Models Testing the Association between Individual
Types of Social Support and Mental Health for the G-CAFH
Cohort: 2007-2009 (N = 795)**

Table 4.3

	Model 1	Model 2	Model 3
Independent Variables			
Social Support (Individual Items)			
<i>Everyday favors</i>	0.56 (0.62)	0.76 (0.64)	
<i>Take care of you if confined to bed for several weeks</i>	3.25 (0.65)***	3.38 (0.68)***	
<i>Lend you several hundred dollars for medical emergency</i>	1.83 (0.58)**	1.49 (0.60)**	
<i>Talk to if you were having family troubles</i>	3.23 (0.66)***	3.02 (0.68)***	
<i>Help you locate housing</i>	2.13 (0.57)***	1.75 (0.59)**	
Social Support (Between - Individual Items)			
<i>Everyday favors</i>			1.69 (1.26)
<i>Take care of you if confined to bed for several weeks</i>			2.43 (1.26)
<i>Lend you several hundred dollars for medical emergency</i>			1.59 (1.13)
<i>Talk to if you were having family troubles</i>			2.32 (1.32)
<i>Help you locate housing</i>			3.57 (1.11)***
Social Support (Within - Individual Items)			
<i>Everyday favors</i>			0.33 (0.74)
<i>Take care of you if confined to bed for several weeks</i>			3.57 (0.81)***
<i>Lend you several hundred dollars for medical emergency</i>			0.82 (0.73)
<i>Talk to if you were having family troubles</i>			2.95 (0.79)***
<i>Help you locate housing</i>			0.82 (0.69)
Mental Health at Baseline	0.39 (0.03)***	0.36 (0.03)***	0.36 (0.03)***
Mobility		-0.19 (0.15)	-0.16 (0.15)
Race			
<i>Black</i>		1.66 (0.64)**	1.76 (0.66)**
<i>Other (ref.)</i>			
Income			

	<i>Poverty (<20k)</i>	-3.65 (0.59)***	
	<i>Not in poverty (>20k)(ref.)</i>		
Income (Between)			
	<i>Poverty (<20k)</i>		-5.45 (0.87)***
	<i>Not in poverty (>20k)(ref.)</i>		
Income (Within)			
	<i>Poverty (<20k)</i>		-1.77 (0.80)***
	<i>Not in poverty (>20k)(ref.)</i>		
Gender			
	<i>Male</i>	0.78 (0.67)	0.49 (0.67)
	<i>Female (ref.)</i>		
Age			
		0.04 (0.02)	0.03 (0.02)
Live Alone			
	<i>Lives Alone</i>	0.89 (0.73)	0.96 (0.74)
	<i>Lives with Others (ref.)</i>		
Time Dummy Year 3	2.23 (0.56)***	1.53 (0.70)*	1.90 (0.70)**
Time Dummy Year 4	1.58 (0.53)**	0.77 (0.68)	1.21 (0.68)
Sigma_u	6.84 (0.32)	6.31 (0.34)	6.26 (0.33)
Sigma_e	9.49 (0.19)	9.54 (0.20)	9.50 (0.20)
ICC	0.34 (0.03)	0.30 (0.03)	0.30 (0.03)
Constant	19.93 (1.37)***	21.20 (1.92)***	22.01 (2.15)***

Standard errors are shown in parentheses. Two-tailed tests.

*** p ≤ 0.001, ** p ≤ 0.01, * p ≤ 0.05

Random-Effects and Hybrid Random-Effects Non-Continuous Growth Curve Models
Testing the Association between Levels of Social Support and Mental Health for the G-CAFH
Cohort: 2007-2009 (N = 795)

Table 4.4	Model 1	Model 2	Model 3
<i>Independent Variables</i>			
Social Support (Levels)			
<i>High (4-5)</i>	8.41 (0.70)***	7.89 (0.72)***	
<i>Medium (2-3)</i>	3.64 (0.69)***	3.43 (0.71)***	
<i>Low (0-1) (ref.)</i>			
Social Support (Between - Levels)			
<i>High (4-5)</i>			9.27 (1.12)***
<i>Medium (2-3)</i>			2.51 (1.36)
<i>Low (0-1) (ref.)</i>			
Social Support (Within - Levels)			
<i>High (4-5)</i>			6.76 (0.89)***
<i>Medium (2-3)</i>			3.40 (0.81)***
<i>Low (0-1) (ref.)</i>			
Mental Health at Baseline	0.39 (0.03)***	0.37 (0.03)***	0.36 (0.03)***
Mobility		-0.18 (0.14)	-0.16 (0.14)
Race			
<i>Black</i>		1.74 (0.63)**	1.78 (0.63)**
<i>Other (ref.)</i>			
Income			
<i>Poverty (<20k)</i>		-3.43 (0.57)***	-3.23 (0.57)***
<i>Not in poverty (>20k)(ref.)</i>			
Gender			
<i>Male</i>		0.86 (0.66)	0.87 (0.66)
<i>Female (ref.)</i>			

Age		0.04 (0.02)	0.04 (0.02)
Live Alone			
	<i>Lives Alone</i>	0.35 (0.70)	0.29 (0.70)
	<i>Lives with Others (ref.)</i>		
Time Dummy Year 3	2.00 (0.53)***	1.31 (0.67)*	1.45 (0.68)*
Time Dummy Year 4	1.69 (0.51)***	0.91 (0.66)	1.14 (0.68)
Sigma_u	6.87 (0.31)	6.36 (0.33)	6.35 (0.33)
Sigma_e	9.51 (0.18)	9.56 (0.19)	9.54 (0.19)
ICC	0.34 (0.02)	0.31 (0.03)	0.31 (0.03)
Constant	21.74 (1.32)***	22.85 (1.86)***	22.25 (1.97)***

Standard errors are shown in parentheses. Two-tailed tests.

*** p ≤ 0.001, ** p ≤ 0.01, * p ≤ 0.05

Chapter 5: Conclusion

Trajectories of Post-Disaster Mental Health Recovery

Summary

In this dissertation, I used a multidimensional perspective to understand trajectories of mental health recovery following a catastrophic disaster. Research on disasters and recovery suggest that different mechanisms drive mental health recovery for different segments of the population (Fussell 2015). Identifying these mechanisms can illustrate why mental health recovery is often an unequal, drawn-out process for disaster survivors (Fussell 2015). Disaster researchers often wonder why some survivors achieve mental health equilibrium within several months to a year following an event while others suffer from mental health distress for multiple years (Bonanno et al. 2010). Contextual factors, like sociodemographic characteristics, household instability, and social support provide a background to understanding these different trajectories of mental health recovery. Perhaps most importantly, including mobility variation in analyses of mental health recovery strengthens our understandings of how these contextual factors operate following a disaster. For this reason, I established sociodemographic, household, and social explanatory frameworks for mental health recovery to better understand the effect of post-disaster mobility on mental health. This approach can help explain the wide-ranging variability in mental health distress following a disaster, including why some demonstrate mental health resiliency while others experience stalled recovery or chronic mental health distress.

In Chapter 2, I examined post-Katrina mobility, including the characteristics of movers and how often they moved. Determining which groups were more mobile than

others provides information on who might be most vulnerable following a catastrophic event, as well as who faces the most serious challenges during the recovery process. Even three years after the storm, respondents were averaging approximately one move per year, which suggests that they were dealing with the repercussions of the storm long after it struck the Gulf Coast. Although previous research had yet to unpack the long-term effects of mobility and inequality on mental health outcomes, these findings show that net of sociodemographic characteristics, high mobility was associated with significantly greater odds of experiencing poor mental health. However, those who moved were more likely to report mental health distress rather than high mobility being causally linked to the likelihood of experiencing distress. This is an important directional relationship to identify as it is typically argued that high exposure, including high mobility, can have a detrimental effect on mental health. Instead, these findings suggest that those who move frequently following a disaster are more likely to have poor mental health. Those with poor mental health are typically more likely to live in poverty, have low levels of social support, and be less likely to live in stable housing, which may influence post-disaster recovery, including mobility rates. Identifying the mentally distressed as those who are vulnerable to high mobility following a disaster, will assist policymakers in creating targeted, long-term programs that provide individuals with the support necessary to achieve better rates of recovery.

There is also evidence that income is strongly related to mobility frequency, especially in the later years of recovery. Previous research is not definitive as to whether higher resourced individuals are any less likely to move than those with fewer economic resources. Findings in Chapter 2 suggest that while higher income residents are just as

likely to move as lower income residents at the beginning stages of recovery, as time passes they are, on average, less likely to move. Similarly, despite income groups reporting similar scores at baseline, mental health recovery is not equal across all income groups. Those earning more than \$50,000 annually report nearly 12-point improvements to their mental health by 2009 while those earning less than \$10,000 annually do not report any increases to their mental health. The mean mental health score of 39.8 for those living in poverty also falls below the cutoff of 42.0 that indicates mental health distress. These findings demonstrate that it is important to consider how a lack of financial resources can stall recovery and create cascading consequences after a disaster. Overall, these findings establish that pre-existing inequalities endure in the face of extreme social disruption and demonstrate powerful links with mental health that set vulnerable groups on different trajectories of recovery.

In Chapter 3, I examined whether households were unstable following Hurricane Katrina, and if so, whether household stability would increase in each of the four years after the storm. Overall, descriptive analyses suggest that respondents experienced household transitions in the five years following Katrina, and that it took several years until they were able to “reconstitute the family.” I also examined whether living in a contracted or expanded household would have a significant negative effect on the mental health of the adult respondent. Somewhat surprisingly, there was a significant negative effect on mental health for living in an expanded household but not when living in a contracted household. Although previous studies have found that the economic and emotional resource sharing that often occurs within expanded households might be beneficial to household members, these findings suggest that expanded households

contribute to the stress and strain of recovering from a disaster. Expanded households may be a source of stress for primary caregivers, especially if the additional members do not have steady incomes to contribute to expenses and drain financial resources. These households might also compromise living spaces and sleeping arrangements, which are not only stressful living conditions but serve as a constant reminder of Katrina.

An important finding in this chapter is that both mobility and living in a trailer had significant and independent effects on mental health. These effects were larger in magnitude than for household expansion, which suggests that mobility and house type must be taken into account along with household instability in order to gain a detailed understanding of mental health recovery. Although a large percentage of households were unstable in the years following the storm, high rates of contracting and expanding households are often connected to other issues of housing and recovery such as mobility, recovery housing, income, and marital status. Finding a way to provide more resources and support for households that take in others or need to double-up following a disaster should be a priority for policy makers, public health officials, and researchers.

The final empirical chapter (Chapter 4) examined the relationship between perceived social support and mental health recovery by first establishing whether social support increased over time. Respondents reported an increase in nearly all types of social support between Waves 2 and 4, suggesting that they were able to regain a sense of stability in their everyday lives and develop or reestablish social ties. Throughout recovery, respondents maintained high levels of emotional social support, including knowing someone they could count on if they were having family troubles and having someone they could count on for everyday favors. Alternatively, fewer respondents

reported having instrumental forms of social support, including having someone they could count on to lend them several hundred dollars for a medical emergency and knowing someone that could help them locate housing. As there was an increase in nearly all forms of social support, it follows that there was also an increase in those with medium and high levels of social supports. As time passed, respondents found themselves with greater levels of social support—by Wave 4 more than 50 percent of respondents reported possessing four or five different types of social support. While nearly 40 percent of respondents reported little or no social support nearly two years after the storm, this dropped to only 15 percent four years after Katrina. Such a substantial decrease could signify that approximately three to four years after the storm affected residents were able to take dramatic steps in their recovery, especially as it related to regaining perceived social support.

This chapter also examined whether particular types of support mechanisms significantly improved mental health recovery. These analyses revealed that emotional support—rather than instrumental—has the strongest influence on mental health recovery. Specifically, those who were able to gain emotional forms of perceived support over the course of recovery experienced significant benefits to their mental health. It is important to note that gaining this kind of social support may be indicative of greater recovery, as people with emotional support may be more likely to have re-established or developed social ties as their lives became increasingly settled. Similarly, those who were able to gain moderate social support—presumably of particular types—over the course of recovery experienced a positive influence on their mental health. These findings

reinforce the notion that helping disaster survivors get settled can perhaps accelerate the process of reestablishing and developing social ties, which can benefit mental health.

Implications

Perpetual Migration: The Effects of Forced Migration & High Mobility

Katrina was the largest displacement since the 1930s dust bowl migration with approximately 1.5 million people evacuating their homes and communities prior to its arrival (Weber & Peek 2012). This led to what I argued was a unique experience of Katrina survivors called perpetual migration, which is a combination of forced migration and high rates of mobility following a disaster.¹³ As all G-CAFH respondents evacuated and most were displaced from their homes for at least a period of time, a key question was whether perpetual migration negatively affected mental health recovery. These findings support the argument that post-Katrina migration was different from previous disaster migration (i.e. high rates of mobility for several years following initial displacement). However, there does not appear to be a causal link between perpetual migration and poor mental health. In fact, the effect of mobility on mental health is due to between person differences, meaning that those who experienced high rates of mobility were more likely to be of poor mental health.

Even though there is not a causal link, perpetual migration can still be used to help identify an extremely vulnerable post-disaster population. Those with poor mental health following a disaster very often do not pursue counseling or other types of formal mental health services until other aspects of their lives—including housing and family—are settled (Abramson et al. 2015). This makes them a difficult vulnerable population to

¹³ As discussed in Chapter 1, forced migration is defined as when a large-scale hazard causes widespread destruction and forces a population to evacuate (Fussell, Sastry & VanLandingham 2010).

identify and reach. Considering that many Katrina survivors waited months, if not years, to find stable and permanent housing and also reconstitute their families it is possible that those with mental health difficulties did not seek the proper services for quite some time. Determining which groups experienced higher rates of perpetual migration than others provides information on who may need mental health assistance following a catastrophic event, as well as who might face the most serious challenges during recovery.

There was also an important non-finding regarding the relationship between mobility, social support, and mental health recovery. Although high rates of mobility were associated with poor mental health in Chapters 2 and 3, analyses in Chapter 4 suggest that possessing perceived support acts as a mediator for the relationship between mobility and poor mental health. It is well-established that displaced residents can suffer from higher levels of distress because of the unexpected and forced loss of their homes, the loss of ties with friends and family, or the need to find new employment in an unfamiliar area (Morrow-Jones & Morrow-Jones 1991). However, friends and family can be a source of support during recovery. The loss of this kind of support following a disaster, could remove protective buffers against stress. The findings presented in Chapter 4 support the notion that perceived support serves as a core component in disaster recovery, and buffers against the effects of post-disaster distress, specifically as it relates to mobility. It also suggests that it is not the physical act of moving that is associated with poor mental health but that moving disrupts important social ties that protect against the stressors of disasters. If residents are able to maintain social support throughout their multiple moves then they do not appear to suffer from the harmful effects typically associated with high rates of mobility.

There remain several avenues that future research can pursue in order to further examine whether there are mental health consequences of perpetual migration, as well as how perceived support protects against it. Primarily, it is important for studies to collect location data in order to determine the distance of a move, as well as how long a respondent stayed at a particular location. Although G-CAFH contains geocoded data points, it only has this information for where respondents lived at the time they were interviewed and not for each location that they moved to between waves. Displacement and mobility often have additional ramifications such as loss of financial resources, household disruption and damaged social support networks making it difficult to disentangle its true effects (Bonanno et al. 2010). Having geocoded data on these locations, as well as duration, would allow researchers to further understand whether there are consequences related to the distance of a move (i.e. further away from social ties) or duration (i.e. not staying in one location long enough to develop or maintain ties). Secondly, further research is needed on perceived support, specifically on who provides it and how it acts as a buffer during disaster recovery. Asking more detailed questions regarding social support, such as the relationship of the person who might provide the perceived support, as well as whether the respondent tried to access this support during recovery, would be an important step in unpacking this relationship.

Post-Disaster Mental Health Recovery Trajectories

Disaster literature has demonstrated that the mental health consequences of disasters can persist for years (Norris et al. 2002). In fact, prior studies show that psychological problems can persist for more than two years after a disaster, with relocated residents twice as likely to experience symptoms of mental health distress

(Yzermans et al. 2005). Overall, these findings support previous research; however, they also provide evidence that disasters often work to sustain and endure inequalities that existed prior to the event. Undoubtedly, recovery is a slow, and often unequal, process. These findings reveal important aspects that can propel affected residents on different trajectories of post-disaster mental health recovery, as well as who is most likely to experience a particular trajectory. I conclude that there are three main post-disaster mental health recovery trajectories: 1) Resilient Mental Health; 2) Stalled Mental Health; and, 3) Downward Mental Health.

Insert Figure 5.1 Here

Trajectory 1: Resilient Mental Health

Mental health resiliency can best be understood as those who were able to “bounce back” from the stressors brought on by Katrina. Several groups in these analyses displayed mental health scores that suggested that Katrina likely had negative mental health effects but that they experienced improvements steadily over time. For example, the elderly are typically considered some of the most vulnerable following a disaster, and findings suggest that they were highly mobile after Katrina. Although one might expect that seniors would be more likely to experience poor mental health because of their high mobility rates and vulnerability to the event, results suggest that they were quite mentally resilient in the years after the storm. Their ability to “bounce back” may be in part influenced by their life-experience, which typically protects against stressors caused by a traumatic event (Gatz, Kasl-Godley & Karel 1996; Knight et al. 2000).

Another mentally resilient group was those living in households earning more than \$50,000 annually. While all income groups reported similar mean mental health

scores at baseline, higher income respondents experienced substantial increases to their mental health while lower income respondents saw little improvement (i.e. stalled mental health). These findings suggest that financial resources play a significant role in the ability to be mentally resilient to a disaster, likely operating through issues of housing stability, and monetary savings that can protect against future uncertainties. Although policymakers can do little to impose “life experience” on disaster survivors to help make them more resilient, providing proper financial resources during recovery may help alter the mental health trajectory of those with limited means.

Trajectory 2: Stalled Mental Health

Stalled mental health recovery can be defined as those who experience little or negligible improvements to their mental health over time. While most groups demonstrated at least small improvements to their mental health, those who earned less than \$10,000 annually found themselves on a trajectory of stalled mental health recovery. These respondents initially experienced small increases to their overall mental health but by Wave 4 they exhibited mental health scores identical to their baseline scores (39.8). These scores were also below the cutoff for mental health distress (42.0) suggesting that they were suffering from poor mental health. It is possible that these findings provide evidence of the influence that disaster assistance programs can have on recovery, which typically expire two years after an event. While those earning below \$10,000 initially saw improvements to their mental health—presumably when assistance programs could be accessed—when these programs expired three to four years after Katrina they experienced decreases to their mental health. This proposed relationship between income, disaster assistance programs, and stalled recovery should be further examined in future

research. If future studies find that a link exists, then this relationship serves as evidence to extend programs well beyond the time period currently employed by federal and local policymakers. It is possible that offering disaster relief assistance for several years may help propel those with stalled mental health recovery to greater levels of resiliency.

Trajectory 3: Downward Mental Health

Typically, only a small portion of a population exposed to disaster exhibit chronic mental health distress (Bonanno et al. 2010). However, these analyses suggest that there are three main groups who exhibited traits of a downward mental health trajectory, which can be defined as mental health scores that steadily decline over the course of recovery. The first group that exhibits a downward mental health trajectory is those who moved more than five times. Across each wave, this group of high frequency movers consistently displayed the lowest mental health scores among all G-CAFH respondents. Multivariate analyses suggest that those who move more frequently are of poor mental health. However, there are likely debilitating consequences for those are of poor mental health who end up moving countless times following a disaster. Similarly, those who were still living in trailers by Wave 4 also experienced negative effects to their mental health. Previous research has argued that living in FEMA trailers is a stressful experience that can delay the emotional recovery of displaced residents and have long-term recovery effects (Bolin 1982). These findings support previous research and highlight the importance of ensuring that displaced residents find permanent and stable housing soon after the storm rather than linger in recovery housing. Both of these trajectories of downward mental health (i.e. high mobility and living in a FEMA trailer) are intimately connected to issues of post-disaster housing. Generally, these results

further demonstrate that housing difficulties following a disaster can have lasting, independent implications for mental health recovery. Finding displaced residents permanent and stable housing could provide significant benefits to mental health, and possibly alter the trajectory of these individuals from downward to stalled or resilient mental health.

Lastly, results from the hybrid models in Chapters 2 and 3 suggest that pre-existing mental health was a predictor of post-disaster mental health distress. It is possible that a disaster like Katrina acted as a tipping point for those already experiencing poor mental health. Rather than being able to bounce back, those who were already experiencing daily struggles found themselves overwhelmed by Katrina. These individuals appear to be one of the most vulnerable groups to the mental health consequences of disaster. Policymakers should create targeted outreach programs to this group through counseling and other forms of assistance to ensure that they do not occupy a downward trajectory of mental health.

Directions for Future Research

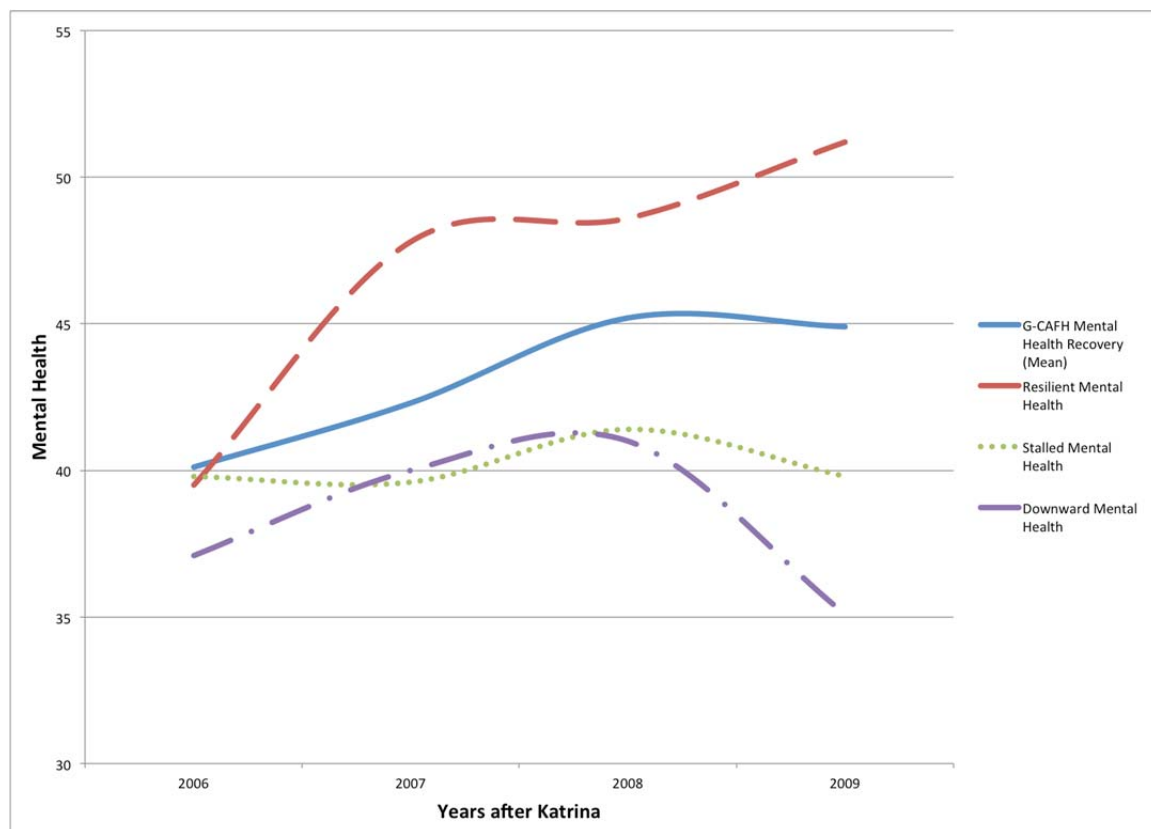
The meteorological event of a disaster typically does not last long—and in the case of Katrina, the storm hammered the Gulf Coast for only half a day on August 29, 2005. Yet, over ten years later the far-reaching effects of the storm continue to be felt in the everyday lives of its survivors and remain visible in neighborhoods like the Lower Ninth Ward of New Orleans. Unlike other forms of trauma, disasters like Katrina have the ability to completely alter the context of people's lives (Bonanno et al. 2010). Yet, important questions remain for future research to consider, especially regarding the mental health recovery of disaster survivors. Primarily, there are significant data

limitations typically associated with disaster research. G-CAFH addresses many of these shortcomings since it is a longitudinal cohort study representative of those highly affected by Katrina. However, like many disaster datasets, it lacks pre-event data and also a range of exposure, including those not exposed to the storm. Future studies should attempt to collect data on unexposed populations, pre-disaster levels of health, housing stability, social support and other important aspects of recovery in order to further examine the trajectories of mental health recovery proposed here. While collecting data prior to a disaster is ideal—although usually coincidental rather than planned—asking respondents retrospectively about certain aspects of their lives could provide a comparison. Alternatively, it is possible for datasets like G-CAFH to be layered with other large-scale datasets like U.S. Census or Medicare data to provide information on these pre-event characteristics. However, these analyses would be at the block-group level rather than at the individual level.

Lastly, it is also important that cohorts of disaster survivors be surveyed long after an event. G-CAFH again is unique in this aspect because it contains four waves of data, and also maintains high levels of retention. However, data collection needs to continue well-beyond five years after an event in order to truly understand the mental health trajectories of recovery. Fortunately, researchers will be returning to the G-CAFH cohort in 2016 to survey these respondents and further understand what improves or impedes mental health recovery. It is possible that several of the questions that remain, including those regarding mobility, social support, and mental health recovery, could be further explored in the coming years. Despite these data limitation, this dissertation takes an important first step in explaining what propels survivors along certain mental health

trajectories following a catastrophic disaster like Hurricane Katrina.

Figure 5.1 Trajectories of Post-Disaster Mental Health Recovery



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