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Predictors of social vulnerability : a multilevel analysis.

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PREDICTORS OF SOCIAL VULNERABILITY: A MULTILEVEL ANALYSIS

by

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M.D.M, University of the Free State, 2008

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DEDICATION

This dissertation is dedicated to my brother, Bernard. Thank you for being an inspiration to so many.

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I thank the University of Louisville for all the opportunities. I hope that I am able to pay it forward.

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ABSTRACT

PREDICTORS OF SOCIAL VULNERABILITY:

A MULTILEVEL ANALYSIS

Regardt J. Ferreira

April 17, 2013

Over the past three decades there has been a rapid increase in the number of disasters occurring worldwide that affect communities, households and individuals. The increase in disasters and the associated impacts are evident in our society. The impact of disasters can have more chronic impacts generating social and economic hardship, loss of employment, dissolution of personal relationships, and the long-term decline of physical and mental health. A study was undertaken to develop an understanding of the predictors of individual social vulnerability on individuals nested within communities. The Behavioural Risk Factor Surveillance System and 14 other community level data sources were used. The model investigated the influence of parish disaster history, operational resilience and socio-economic resilience on individual social vulnerability.

Methods: The research design for the study was a multilevel repeated cross-sectional design with a three level nested structure. The software package MLwiN was used to conduct the multilevel analysis using empirical Bayes Markov chain Monte Carlo (MCMC) estimation. Using a representative sample of

34,685 individuals from 2004 to 2010, nested in 56 Louisiana parishes, the trend study allowed for an understanding of the subjective and objective factors that predict individual social vulnerability.

Results: In each step, the model fit improved using the DIC statistic. Overall the results indicated that there were differences between parishes and their levels of individual social vulnerability; individual social vulnerability decreased from 2004 to 2010 and several statistically significant predictors of social vulnerability were identified. Statistically significant community level predictors of individual social vulnerability were lack of educational attainment, communities with less access to a household phone, community poverty and community unemployment. A trend was detected for age. Statistically significant two-way interactions were number of disasters and total population per square mile, and number of disasters and number of physicians per 100,000 population. A moderate trend was observed for the interaction effect of age and access to a household phone.

Conclusions: With the significant increase of disasters worldwide it is imperative that factors causing social vulnerability are addressed. Results indicated that communities with lower levels of social vulnerability had higher levels of education, access to communication, and lower poverty and unemployment rates. Recommendations for future research are made, with policy and practice implications discussed.

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"Sometimes it takes a natural disaster to reveal a social disaster".

Jim Wallis

Communities worldwide are affected by an increasing number of natural and technological (man-made) disasters (Myers & Wee, 2005). Over the past three decades, there has been a rapid increase in the number of disasters occurring worldwide, affecting communities, households and individuals. It is estimated that there is a disaster occurring, somewhere in the world, every day (Norris, Galea, Friedman, & Watson, 2006). This is particularly troubling given the rapid worldwide increase in disaster fatalities (Mileti, 1999; Wisner, Blaike, Cannon, & Davis, 2004).

With the increase in disaster frequencies, the disruptive effects of disasters on communities have become increasingly long-term and long lasting (Gillespie & Danso, 2010). The increase in disasters and the associated impacts are evident in society. The impact of disasters can have more chronic effects generating social and economic hardship, loss of employment, dissolution of personal relationships, and the long-term decline of physical and mental health (Collogan, Tuma, Dolan-Sewell, Borja, & Fleischmann, 2004). Given the enormity of the ever-increasing number of those in a state of vulnerability having been affected by disasters, the need to understand the associated resilience and

coping characteristics, especially for the individual nested within the community, is more crucial than ever. This issue is highlighted when examining existing empirical evidence. A great deal of research has focused on community disaster resilience without taking into account the individual within a nested structure.

This dissertation will attempt to address this gap by testing a more complex longitudinal model of change in social vulnerability levels of individuals nested in Louisiana parishes, that have been exposed to disasters occurring between 2004 and 2010. The gap will be addressed by asking the following questions:

(1) Do parishes in Louisiana have different levels of individual social vulnerability?

(2) Do parishes in Louisiana experience change, and have different levels of individual social vulnerability over a seven year period?

(3) What are the most important parish disaster history events and community disaster resilience factors that predict individual social vulnerability within and between Louisiana parishes over a seven-year period?

Utilizing a representative sample of 34,685 individuals nested in 56 parishes in Louisiana affected by disasters between 2004 and 2010, allows for an understanding of the subjective and objective factors that predict individual social vulnerability within a disaster context. This large, randomly selected sample would also provide more generalizable results and create a unique multilevel study. As an introduction, this chapter will provide an analysis of the social problem of disasters affecting individuals nested within communities.

Common definitions for related constructs of the study will be reviewed. Finally, it argues for the need for research on subjective and objective predictors of individual social vulnerability within a multilevel study design.

Problem Description: What is a Disaster

Disasters and crises have been part of human existence ever since people started living in groups (Quarantelli, Lagadec, & Boin, 2006). Some of the earliest accounts can be dated back 9,000 years. These events are described in legends and myths, oral traditions and folk songs, religious accounts, and archeological evidence from many diverse cultures and subcultures around the world. With societies evolving, new threats and hazards have emerged, adding new dangers to existing ones. New threats and hazards can include risks from chemical, nuclear and biological agents being added to natural hazards.

With the changing face of disasters and societies suffering the effect for thousands of years, different interpretations have arisen as to what causes a disaster. Historical studies indicate that interpretations as to the cause of disasters within the Western World have varied over time, with disasters being interpreted as “acts of God”, natural events or socially created events (Quarantelli et al., 2006).

The practice of referring to disasters as being “acts of God” dates back 2000 years with the spread of Christianity and the belief that disasters were sent by “God to punish sinners”. This viewpoint was supported by scholars during the Middle Ages. In the nineteenth century citizens in the industrial city of Johnstown Pennsylvania experienced an “act of God” with the Johnstown Flood of 1889

(Wyman, 1911). In recent years the sentiment of disasters being referred to as “acts of God” has been observed with the 2004 Southwestern Asia tsunami interpreted by local populations as “being sent as a test of faith or punishment”. This sentiment was echoed with Hurricane Katrina when some evangelical leaders referred to the disaster as a form of punishment from God for “national sins” (Quarantelli et al., 2006).

The first evidence of the natural event approach is found among the works of Aristotle. He described a disaster as a result of natural phenomena and not manifestations of supernatural interventions. During the 17th century, the viewpoint of Aristotle was supported and interpreted as an accidental or “natural event” (Quarantelli et al., 2006). Wyman (1911) refers to the famous Chicago Fire of 1871 as not being an “act of God”, but instead an event due to some form of human negligence.

Scientists no longer view disasters as supernatural events, but as natural events that can be explained by using scientific methods. Scientific epistemologies have gained distinction over non-scientific ones for understanding the forces behind disasters (Rich & Winters, 2002). Even though the first study of disaster was conducted by Prince in 1920, (Scanlon, 1988) it was only after the Second World War that social researchers began to view disasters as a product of both physical agents and the social setting. Incompatibilities between natural and supernatural events have been present for ages with scholars debating about the actual cause of disasters. It is acknowledged that there is no clear consensus in the United States and abroad as to the conceptualization of what a

“disaster” is (Myers & Wee, 2005; Quarantelli et al., 2006). These disagreements suggest that any brief definition will either include too little or too many types of events (Pampel, 2008).

For building a knowledge base, it is essential to define not only what is included in the phenomenon under study but also what is not. Clarity is needed regarding a standardized definition of disaster, since it is imperative for distinguishing which events are to be included, from those that are to be excluded from an analysis (Norris et al., 2006; Songer, 1999). It is acknowledged that disaster as a concept is a broad term, and in order to provide a clear and logical understanding, interpretations stem from the field of social work, urban planning, psychology and sociology.

The Federal Emergency Management Agency (FEMA) offers 48 definitions for the concept ‘disaster’ (Myers & Wee, 2005). Within disaster research literature, a disaster is defined as an unusual and dramatic event that has occurred in a community that might require some form of external assistance (Norris et al., 2006; Pampel, 2008; Wisner et al., 2004). The motivation to provide assistance differs from country or region. It may be a political judgment to provide assistance to those who are in need. Based on the varying circumstances that call for assistance in the wake of a disaster, it is understandable that there are different definitions as to what constitutes a disaster.

One of the first definitions for disaster was formulated over half a century ago by Charles Fritz. Fritz describes a disaster as:

> *An event, concentrated in time and space, in which society, or a relatively self-sufficient subdivision of a society, undergoes severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and the fulfillment of all or some of the essential functions of the society is prevented* (Mileti, 1999, p.210).

Fritz's functionalist and objectivist viewpoint directed research and strongly influenced national policy when disaster research developed from sociology in the late 1950's. The conceptualization of disaster by Fritz aligns with the view of Kreps (1989). He stresses that Fritz's approach should be retained, but with the modification that a disaster is a social construction, with disasters not existing in and of themselves but being defined as products of human consensus as to what constitutes a disaster.

The objectivist approach still underlines national logic when communities rely on assistance from states and when states in turn, can request federal aid. Fifty years after Fritz's interpretation, opinions still differ as to what constitutes a disaster. Subjectivist theories such as postmodernism, social constructionism, conflict-based and political-economy theories have shaped current interpretations as to what constitutes a disaster (Quarantelli et al., 2006).

Quarantelli's conceptualization of the disaster process has led to a better understanding of various interpretations made by social and behavioral scientists. His interpretation is a seven-step process that describes the characteristics of a disaster (Quarantelli, 1986). Disasters are known as physical agents that include hazards such as earthquakes, floods, fires and explosions.

Secondly, the physical agent is associated with a physical impact. The physical impact is noticeable in some part of the environment, such as land and water movement in an earthquake. The third step is the assessment of physical impacts. There should be an assessment “barometer” of damages beyond which the event can be called a disaster. The next step is associated with disruption in social life. The fifth step is the social constructions of reality. There are perceptions relating to the seriousness and the meaning of the impact. Step six is a political definition process, declaring the event an official disaster that affects actions and requires assistance. The final step is the imbalance between demand and capability in a crisis. The disaster exists when the need for action is exceeded by the capacity for response in a crisis.

Quarantelli et al. (2006) redefines the original seven steps into a more compact description as being (a) sudden-onset occasions, (b) seriously disrupting the routines of collective units, (c) causing the adoption of unplanned courses of action to adjust to disruption, (d) having unexpected life histories designated in social space and time, and (e) posing danger to valued social objects. Disasters represent vulnerability reflecting “weakness within social structures or systems”.

Mileti’s (1999) interpretation is that disasters flow from overlaps of physical, built, and social environments that are “*social in nature*”. He further emphasizes that humans create disasters through their involvement with their physical environment. The International Strategy for Disaster Reduction (ISDR) defines a disaster as (International Strategy for Disaster Reduction, 2004):

"A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources" (p.15).

The ISDR gives its definition a better grounding by incorporating risk:

"A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk'' (p.16).

Within the social work profession, a disaster is seen as a collective stress situation, where many individuals fail to have their needs met through societal processes (Zakour, 2005). Disasters are known as crisis situations, and this view aligns with the use of crisis intervention frameworks in social work disaster research (Miller, 2003).

A personal interpretation for disaster can be defined as:

"*A disaster occurs when vulnerable entities are exposed to a socially and environmentally non-routinely created event, causing the affected entities to revert to external assistance. External assistance is required due to a lack of social, economic, infrastructural, institutional, and community coping capacity within the community*".

Distinguishing between Natural and Technological Disasters

Man has been faced with different kinds of disasters, with large scale disasters becoming a pervasive feature of social life (Picou, Marshall, & Gill, 2004). A distinction is frequently drawn between "natural" disasters and "technological" disasters. Disaster research literature has drawn a distinction between four types of disasters namely natural, technological, natural-technological and terrorism. Disaster researchers have maintained that there

should be a clear distinction between “natural” disasters and “technological” disasters (Picou & Marshall, 2007). Natural disasters are often inoffensively described as “acts of God,” a term that suggests the elimination of human responsibility and causation. The term ‘natural disaster’ is frequently described as uncontrollable, although many of these events are predictable and avoidable (Myers & Wee, 2005). Natural disasters include events such as fires, floods, mudslides, earthquakes, tsunamis, hurricanes, tornadoes, droughts or blizzards.

Diverse events such as nuclear accidents, toxic chemical spills, shipwrecks, plane crashes, explosions, structural failures, fires, dam-breaks, hostage situations and war-related incidents have been included in the general category of what constitutes a technological disaster (Myers & Wee, 2005). Considering the heterogeneity of technological disasters, it is in some instances difficult to determine or predict such an event. The U.S. Subcommittee on Disaster Reduction (Subcommittee on Disaster Reduction, 2005) defines a technological disaster as an event that releases hazardous substances, chemicals, toxic substances, gasoline and oil, nuclear and radiological material, flammable and explosive materials, in the form of gases, liquids, or solids. The release of material can have a severe impact on human health and safety, the environment, and/or the local economy.

Natural disasters are in many cases regarded as “acts of God”, due to the severity and magnitude of the disaster event. The natural disaster recovery- and the technological disaster recovery models (see Figure 1) illustrate the recovery processes associated with natural and technological disasters. The natural

disaster recovery model indicates that recovery and rehabilitation occurs in a timely manner post-disaster, with a relative time-frame associated with recovery. Most natural disasters produce only limited long-term cultural, social, economic, and psychological consequences for individuals and communities. The recovery process allows for “amplified rebound” for the communities that have been impacted by a natural disaster (Picou & Marshall, 2007; Picou et al., 2004).

When human error and technological failure are combined with hazardous materials the results are of a never-ending cycle associated with uncertainty regarding the impact and effects of the disaster (Mileti, 1999). Empirical evidence suggests that a corrosive community process emerges in the wake of a technological disaster. This is often characterized by social disruptions, uncertainty, psychosocial impact and a lack of consensus about what is occurring and who is responsible for the cause of the technological disaster. This ultimately results in a “corrosive community” cycle (Picou & Marshall, 2007).

A comprehensive meta-analysis of 177 disaster research studies conducted by Norris et al. (2002) indicates that technological disasters can in some instances be more psychologically stressful than natural disasters due to the uncertainty associated with the event (Norris et al., 2002). Individual distress and collective trauma are typical responses to disasters, resulting in changes in social dynamics (Ritchie & Gill, 2006). Technological disasters create a more severe and longer lasting pattern of social, economic, cultural and psychological impact than natural disasters (Picou et al., 2004).

Connecting the processes associated with post-disaster recovery, Figure 1 illustrates the natural- and technological disaster recovery models. The natural disaster recovery model displays a linear process regarding the impact of a natural disaster. The model indicates that there is some form of certainty regarding the impact and after-effects of the natural disaster. The technological disaster recovery model characterizes the degrees of uncertainty regarding how long a community will take to establish a sense of community equilibrium (Ritchie & Gill, 2006). Uncertainty in the community resulting from a technological disaster can cause individual distress and collective trauma, lifestyle and environmental change, distrust and secondary trauma, and this has an effect on social capital in the community.

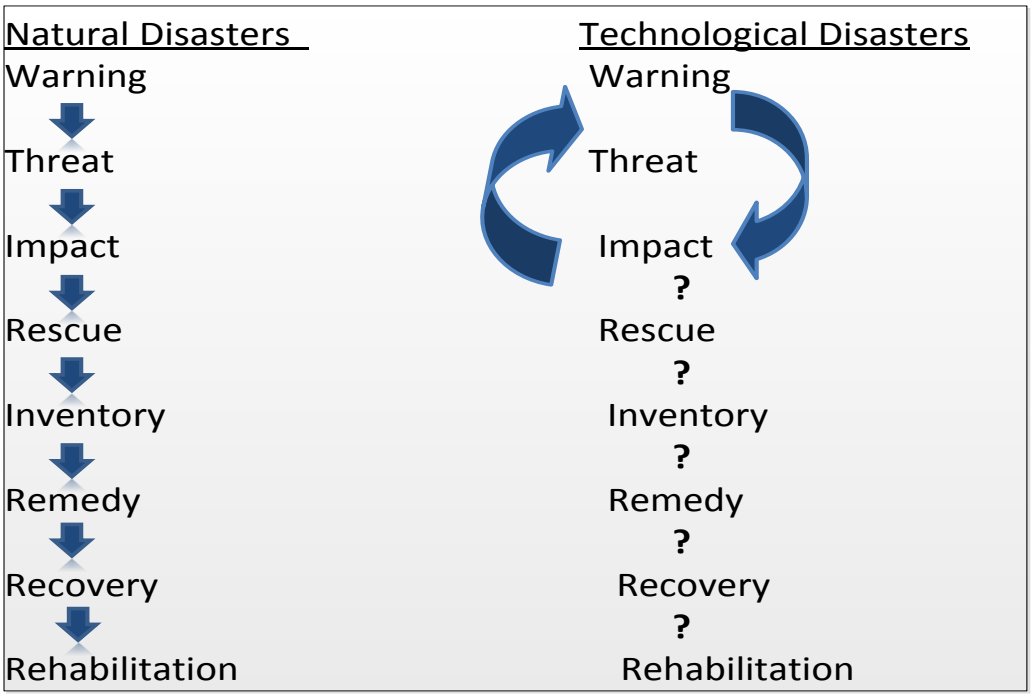


Figure 1. Natural and technological disaster recovery models (Chapman, 1962; Couch, 1996).

With the natural disaster recovery model, it is easier to estimate the recovery process of a community. The model begins with a warning stage, with the likelihood of a calamity approaching. By the time a “threat” period emerges there are clear signs of impending trouble. During the “impact” period, the threat becomes a reality with flying debris, towering walls of fire or raging floods impacting the community. During the “inventory”, and “rescue stages”, the survivors of the disaster begin to assess their losses and conceptualize what has happened. During the “remedy” stage, outside agencies take control and impose a formal structure on the inventory and rescue actions. The “recovery” phase creates an opportunity for the community to reconstruct the old community structure. This period is occasionally associated with an adjustment pattern towards personal and collective life (Couch, 1996).

The interval between warning and rescue is regarded as being brief and in many instances it is only a few minutes. The customary sequence of stages with a natural disaster moves from order, to chaos, to reconstitution of order. The signs of danger and destruction are clear, with a high degree of agreement over what is occurring or has occurred in the community (Couch, 1996).

The technological disaster recovery model is associated with uncertainty. The technological disaster recovery model depicts the uncertainty associated with the impact of a technological disaster. With the sudden and unexpected impact of a technological disaster it is not always possible to conduct loss estimates and determine the severity of the impact.

The technological disaster recovery model differ significantly from the natural disaster recovery model, involving a prolonged, apparently unending, time-frame between warnings of possible danger and the certainty that the worst has passed. People tend to become trapped in the warning, threat, and impact stages. An event that exposes people to contamination rarely impacts all members of the community in the same way, resulting in what is unlikely to become the occasion for shared action, or even for mutual agreement on what stage the disaster is at (Couch, 1996).

This lack of consensus can initiate community conflict, resulting in alienation, coping difficulties, and psychological distress for individuals, as well as social breakdown of the community. This can also cause disaster recovery to be unusually slow and incomplete.

In most cases, the response to technological disasters is inherently political, with the political stages overlying the defined disaster stages. The political stages interrelate with the defined stages in a multifaceted process of altering social and political relationships. The interaction between the social and political relationships can shape the nature of conflict within the community and the likelihood and nature of recovery.

Several studies suggest that most technological disasters result in the occurrence of a “corrosive community”. The impact of a technological disaster is consistent with a pattern of repeated chronic impacts upon the affected system (Picou & Marshall, 2007; Picou et al., 2004). It is pertinent to note that secondary effects of natural disasters can also lead to technological disasters, called

natural-technological disasters as with Hurricane Katrina in the Gulf States region in 2005, and the Japan Earthquake of 2011 (Picou et al., 2004; U.S. Census Bureau, 2011).

Communities experiencing a technological disaster usually undergo three corrosive processes that produce the emergence of and persistence of corrosive communities. In the first place, uncertainty concerning the mental and physical health of the exposed arises. There is a sense of victims blaming governmental structures and organizations responsible (Mileti, 1999; Myers & Wee, 2005). Loss of trust develops between the victims and the entities responsible for the technological disaster. Lastly, protracted litigation ensues prolonging chronic psychosocial stress, delaying community recovery, and interfering with independent research on the impact conducted by both physical and social scientists.

Historical evidence suggests “technological” disaster events of epic proportion have impacted communities to such an extent that recovery to a state of equilibrium is not always possible. For example, the long-term community impact of the Exxon Valdez Oil Spill that occurred in 1989 indicates that the community has still not reached a state of community equilibrium (Picou & Martin, 2007). Where communities are not able to ‘self-organize’ from the impact of a technological disaster, it can be attributed to difficulty in breaking the vicious cycle of the after effects of the disaster, known as the corrosive community cycle. Communities and individuals that are in a state of vulnerability and lack capacity will have a higher degree of disruption when faced with a disaster.

Disaster Management Cycle

A disaster event forms part of a system that contains various causal and interlinked processes. These interlinked processes are found in four distinctive stages namely mitigation, preparedness, response and recovery (Gillespie & Danso, 2010).

The interlinked processes are used to conceptualize and understand the disaster management cycle. The cycle is divided into two phases namely the risk management phase and the crisis management phase. With the risk management phase, the focus is on protecting the community. Protection is done by ensuring that mitigation and prevention practices are established in communities. When the mitigation practices are implemented in the community, preparedness toward disasters will become a priority. Disaster preparedness will allow for prediction and early warning of an imminent disaster.

Once a disaster has occurred the crisis management phase is activated. The crisis management phase focuses on response and recovery. The first step to follow post-disaster would be to conduct an impact assessment to establish the severity of the disaster; this is followed by an actual response to the event, with recovery taking place. Once recovery has taken place communities tend to rebuild and “self-organize” by means of reconstruction. The process is indicated by Figure 2.

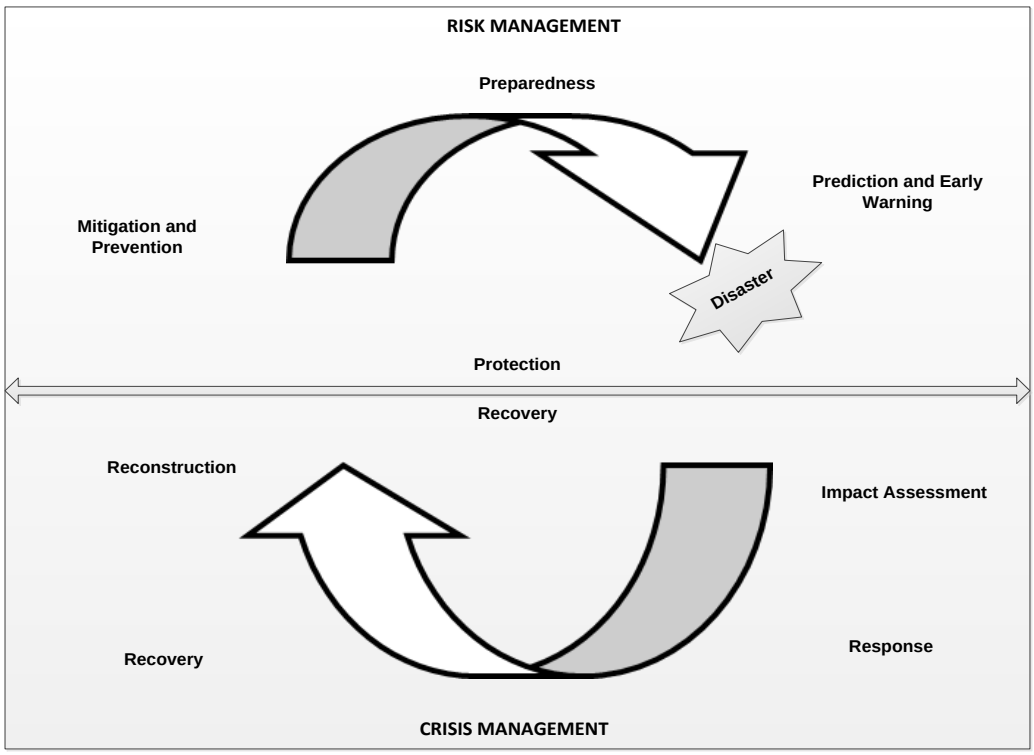


Figure 2. Disaster Management Cycle (Gillespie & Danso, 2010).

Historical overview of Disaster events

The earliest recorded evidence of disasters affecting humans can be traced back to 3000 B.C. (Crossley, 2005). Considerable evidence exists of a significant global paleoclimatological event happening around 3000 B.C affecting sea-level changes, vegetation and surface chemistry. There is speculation that this event was the Biblical Flood of the Old Testament. The first chapter of Genesis in the Bible also accounts for some of the first reports of disasters affecting the well-being of humans (Westermann, 1994).

One of the most violent volcanic eruptions affecting the legendary Minoan civilization that inhabited Santorini Island, Greece, occurred in 197 B.C. Since the major eruption of 197 B.C., the Island has been inhabited again but not without residents having to face multiple disasters spanning nearly 2000 years.

Nine major volcanic eruptions are recorded since 197 B.C., namely in 46 and 726 B.C, and in 1570, 1707, 1866, 1925, 1939, 1950 and 1956 (Genzmer, Kershner, & Schutz, 2007). The first recorded volcanic eruption on Santorini Island led to the extinction of all forms of life on the island. With the collapse of the volcano's magma chamber, a tsunami was triggered. The Tsunami traveled at a speed of around 220 miles per hour. Simulation models estimate that the tidal wave reached a height well over 100 feet, demolishing most of the coastal settlements along the Mediterranean Sea coastline (Genzmer et al., 2007).

The well-known Rome city fire of 64 B.C. destroying nearly all of Rome is regarded as a human induced disaster. The fire was caused by a mill near the Circus Maximus in Rome, Italy. The Black Death of the 14th century is another disaster resulting in a disruption to the well-being of many people worldwide. An estimated 100 million people lost their lives to the pandemic. The Great Fire of London in 1666 was caused by human negligence; it is believed that a bakery caused the fire that raged for four days. The fire left 9 people dead, destroying 85 churches and 13,000 homes (Genzmer et al., 2007). There are other notable devastating disasters in history. The Kamikawa, Japan earthquake of 1730 killed 137,000 people; the Sichuan, China earthquake left 300,000 people dead in 1850, and the South East Asia Tsunami of 2004 left an estimated 300,000 dead, causing severe disruption to social functioning (Genzmer et al., 2007).

Compared to the rest of the World, the United States (U.S.) has been particularly prone to natural disasters (Pampel, 2008). The United States, known as one of the countries in the World most affected by disaster events, has had its

fair share of disasters of epic proportions, causing loss of life and extensive damage to infrastructure. The United States is a prisoner of its own geography with no nation on earth facing more extreme weather phenomena (Kentucky Division of Emergency Management, 2010). Disasters on the mainland range from floods, tornadoes, hurricanes, earthquakes, fires, extreme heat, severe cold and hazmat disasters. For the purpose of this section, the focus is on natural and technological disasters affecting the United States over the past 500 years.

Some of the first recorded evidence of hazards affecting populations on the United States continent was made by Christopher Columbus in 1495. He wrote of terrible winds that uprooted trees. Another recorded hazard is the Great Colonial Hurricane that swept through New England in 1635. The then Massachusetts governor William Bradford, reported that none of the living immigrant and native populations has experienced such a storm (Pampel, 2008).

Settlers had to deal with disasters in the 18th and 19th century ranging from flooding, tornadoes, blizzards and less commonly, tsunamis, earthquakes and volcanic eruptions. The impact of natural and technological disasters has left a lasting effect on the American nation, with loss of life and property in many instances.

On October 8, 1871 two deadly fires, one urban and one rural, caused devastation in areas near the western shore of Lake Michigan. The urban area fire was the Great Chicago Fire. Legend has it that the fire was caused by a cow that kicked over a lantern in a barn. The fire consumed more than 2,000 acres of the urban landscape leaving 17,500 buildings in rubble. The estimated damage

reached $222 million ($3.8 billion today) leaving a third of the city's 300,000 residents homeless and nearly three hundred people killed (NPR, 2005; Pampel, 2008).

The rural area forest fire of October 8, 1871 occurred near Peshtigo, Wisconsin. The fire was not related to the Great Chicago Fire but was fueled by the strong winds of October 8, 1871, as was the case in Chicago. Evidence suggests that human negligence in clearing brush and logs created “fuel” for the fire. The fire was fueled by a dry fall season and unusable brush. The fire ended up burning 1,875 square miles and destroyed twelve towns in the farming region. The estimated death total ranged between 1,200 and 2,500.

The 1889 flood in Johnstown, Pennsylvania, located east of Pittsburgh resulted in the death of 2,209 people including 396 children (Pampel, 2008). Johnstown was built in a river valley on the Appalachian Plateau. In the spring of 1889 a flood of epic proportions left Johnstown in South Western Pennsylvania, in ruins (NPR, 2005). Several days of heavy rains in May 1889 and a dam failure resulted in the catastrophe (Pampel, 2008). Eyewitnesses described the water mass from the flood and dam failure as "a rolling hill of debris about 40 feet high and a half mile wide”. A four-square-mile section of downtown and 1,600 houses were destroyed resulting in $17 million in property damage, - the equivalent of $387 million today (Pampel, 2008). For days, many survivors awaited rescue on top of broken homes and debris, being surrounded by water (Johnston Flood Museum, 2011). The disaster produced extensive and dramatic news coverage, prompting an outpour of relief aid. The event resulted in the first peacetime

mobilization of The American Red Cross. The disaster was ruled as an “act of God” at the time, but was caused by a dam failure which today, would be described as a form of negligence.

A decade after the Johnstown flood the most deadly natural disaster in the history of the United States of America occurred on September 8, 1900. An unexpectedly powerful hurricane hit the Gulf Coast town of Galveston, Texas. A category four hurricane hit the town of 42,000 residents the evening of September 8, 1900. More than 6,000 residents died in Galveston with an estimated 4,000 to 6,000 dying in other parts along the Texas coastline (NPR, 2005; Pampel, 2008). According to reports there were so many bodies scattered through the city that instead of burying them, they were burnt.

On the morning of April 18, 1906, at 5:12 a.m., an underground tremble awakened San Francisco. About 25 seconds later it produced a massive earthquake. San Francisco was hit by an earthquake that registered 8.3 on the Richter scale. This event today is known as the Great San Francisco Earthquake of 1906 (Genzmer et al., 2007; NPR, 2005). The event caused extensive structural damage and lead to secondary effects such as fires and gas leaks. The fires ravaged the city for four days. Eighty percent of the city was destroyed, leaving 250,000 people homeless. The death toll was estimated at 3,000 people that either died from the earthquake or the fires (Pampel, 2008; Popular Mechanics, 2010).

The Tristate Tornado outbreak of 1925 is the deadliest and longest lasting tornado in the history of the United States. The tornado moved through Missouri,

southern Illinois and southern Indiana on March 18, 1925. The path of the tornado covered a 219-mile track, lasting three-and-a-half hours, killing 695 people, injuring 2,027, and destroying 15,000 homes. The outbreak led to $16.5 million in damage ($193.3 million in today's monetary value). The same storm system also spawned many other tornadoes in Kentucky and Tennessee, causing severe damage in certain areas (Pampel, 2008).

Roughly two years later the Midwest region of the United States was ravaged by the Great Mississippi Flood of April, 1927. The flood caused social disruption in seven states. The flooding covered an area of 16.5 million acres, killing between 250 and 500 people, displacing 637,000 people, causing $102 million in crop losses, flooding 162,000 homes and destroying 41,000 buildings (Pampel, 2008).

On September 21, 1938, the United States was ravaged by the New England Hurricane of 1938. The North East Coast of the United States was hit by a Category 3 hurricane making landfall on Long Island on September 21. Between 682 and 800 people lost their lives to the hurricane with 1,754 seriously injured. Property damage was severe, with 57,000 homes damaged or destroyed and causing property losses of an estimated $306 million ($4.7 billion today) (International Strategy for Disaster Risk Reduction, 2008; Popular Mechanics, 2010; Slovic, Fischhoff, & Lichtenstein, 1981).

The Great Alaskan Earthquake of 1964 is the most powerful recorded earthquake in the history of the United States and North America. The magnitude of the earthquake makes it the second most powerful ever to be measured. At

5:36 p.m. on March 27, 1964 a 9.2 magnitude earthquake, equivalent to 63,000 atomic bombs, altered the landscape across south-central Alaska. The earthquake caused ground fissures, and 16 tsunamis that caused 131 deaths. Property damage at the time was estimated at $350-500 million ($2.12 billion today). The earthquake was felt on the U.S. mainland and as far as Africa, where water wells sloshed from the reverberating seismic waves (Popular Mechanics, 2010).

Human negligence in the U.S. has resulted in disasters of epic proportions. The Three Mile Island Nuclear accident and the Exxon Valdez oil spill stand out as preventable technological disasters. The Three Mile Island core meltdown accident on March 28, 1979 near Harrisburg, Pennsylvania resulted in $1 billion in clean-up costs. The core meltdown caused distress in the surrounding communities with 663,500 people put at risk within a 20-mile radius (Britannica, 2011). Roughly 140,000 pregnant women and pre-school children had to be evacuated.

One of the worst human-induced disasters in the history of the United States is the Exxon Valdez Oil spill. The disaster occurred in the Prince William Sound, Alaska, on March 24, 1989. The Exxon Valdez oil tanker struck a reef and spilled 30 million gallons of crude oil in the ocean (Bodin, 2003). The oil spill had a negative effect on the surrounding communities, causing loss of income, social problems and environmental damage. Studies conducted 17 years after the oil spill indicate that there are portions of the community that are still

experiencing severe after-effects from the disaster (Picou et al., 2004; Ritchie & Gill, 2006).

To date, Hurricane Katrina is the largest and most costly natural disaster in the United States. Katrina struck the vulnerable U.S. Gulf Coast in August 2005 with a death toll of 1,836 (Louisiana Department of Health and Hospitals, 2006). Katrina caused a disruption to 15 million people's daily activities (Picou & Marshall, 2007). Together with extensive urban flooding as a secondary effect of the hurricane, insurance estimates ranged between $100-200 billion. The total reconstruction in the Gulf area is to exceed the cost of the Kobe earthquake in Japan. Hurricane Katrina is the most expensive disaster to hit the US, eclipsing Hurricane Andrew in 1992. From Andrew, the death toll was 26 people, but the property damage amounted to what was then, an astonishing $25 billion.

It is evident from the disaster timeline that disasters have affected U.S. residents for centuries. Residents in the United States have experienced an increase in disasters over time, with a great number of people affected, killed and experiencing financial loss.

Disaster Impact

Empirical findings made by disaster researchers and scientists over the past three decades report a significant increase in disasters. During the 1990's, the Federal Emergency Management Agency (FEMA) in the United States declared 460 major disasters as a direct cause of severe weather events and natural phenomena in the United States of America (Myers & Wee, 2005). The reported figure is double that of the reported total of 237 major disasters during

the 1980's by FEMA. From 2000 to 2009, there were 560 disasters declared, affecting communities (Federal Emergency Management Association, 2010). In 2010, 41.2% of all hydrological disasters worldwide occurred on the continent of North America (Guha-Sapir, Vos, Below, & Ponserre, 2011).

Worldwide there has been a significant increase in disasters (Guha-Sapir et al., 2011). Figure 3 illustrates the rapid increase in disasters over the past 35 years. It should be noted that reporting mechanisms for disaster events has improved (EM-DAT: The OFDA/CRED International Disaster Database, 2011). During the same time-frame, disasters of incomprehensible magnitude have caused loss of life and property and have impacted the overall well-being of people in various degrees, worldwide.

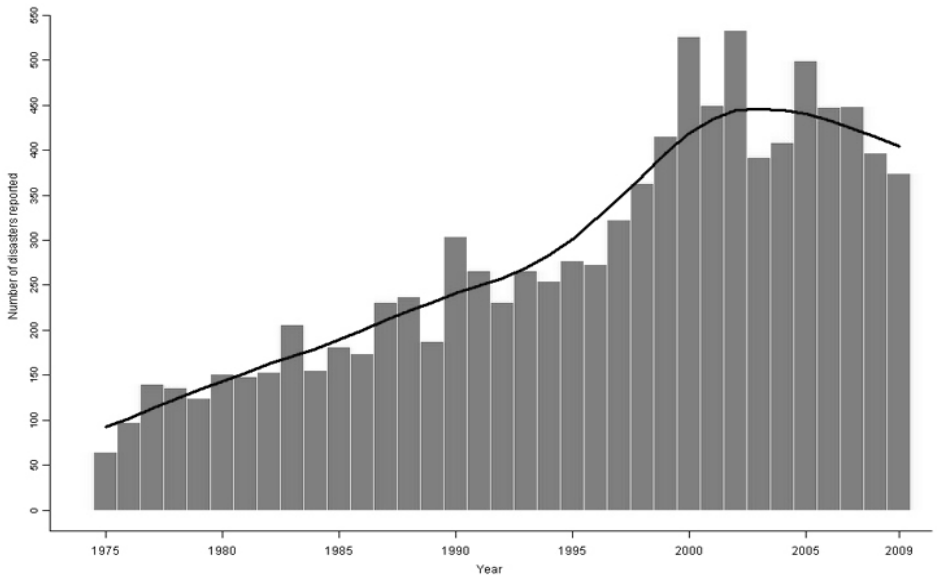


Figure 3. Increase in disasters 1975-2009 (EM-DAT: THE OFDA/CRED International Disaster Database, 2011).

After a relatively moderate year in 2009, the extent of the impact of natural disasters took a turn for the worse in 2010 (EM-DAT: The OFDA/CRED International Disaster Database, 2011). The year of 2010 has been reported as being the warmest year on record with an estimated total of 385 weather-related disasters reported (Guha-Sapir et al., 2011; Henghuber, 2010), having a severe impact on the overall well-being of communities worldwide. The year 2010 is regarded as the worst in 35 years regarding loss of human life related to disasters (Smith, 2011).

An estimated 304,000 people lost their lives in 2010, with many more losing their livelihoods (Henghuber, 2010; Smith, 2011). The multiple disaster events in 2011 in Japan that included an earthquake, tsunami and nuclear meltdown might be the most costly disaster on record. Estimated figures will total well over $300 billion in infrastructure damage and environmental pollution. Insurance companies have stated that the total damage from the multiple disaster events might exceed the damage from Hurricane Katrina in 2005 (Smith, 2011).

Financially the impact of disasters has far reaching effects on a tangible and intangible level for communities (Crowards, 2000). In 2000, reports show that $1 billion was spent every week on disasters in the United States, and $5 billion was spent worldwide each week (Goss, 2000). With the increased cost of living over the last decade, the financial cost related to disasters has significantly increased (U.S. Office of Personnel Management, 2011). So called “acts of God” can have higher financial costs (Picou & Marshall, 2007). This is evident from

Figure 4 with the 1995 Kobe Earthquake in Japan, 2005 Hurricane Katrina and the 2008 Wenchaun earthquake in China, all totaling over $150 billion in disaster losses.

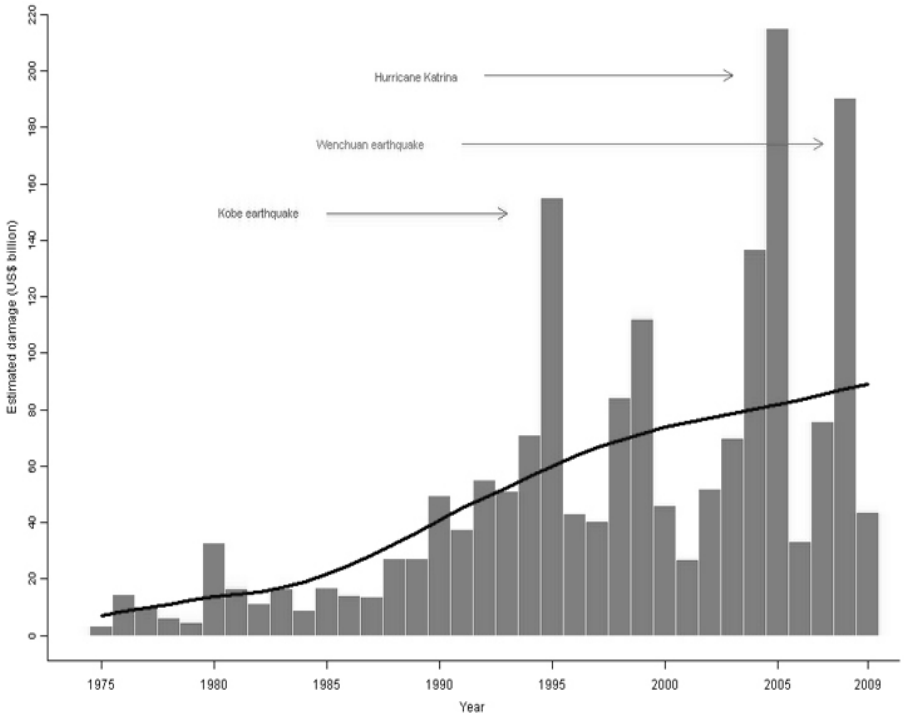


Figure 4. Financial impact of disasters 1975-2009 (EM-DAT: The OFDA/CRED International Disaster Database, 2011).

The human loss of disasters has far-reaching social effects on communities. In 2005, about 510 people lost their lives to disasters in the United States. Globally the figure for 2005 was estimated to be 128,000 people (Myers & Wee, 2005). In 2010, the reported total loss of life worldwide was 304,000. It should be noted that nearly 66% of the 2010 death total is from the Haiti earthquake (Guha-Sapir et al., 2011).

Major differences in numbers of fatalities, victims or damages caused by disasters are observed from year to year. Sudden high-impact events or

disasters that are extensive in time and space create changes in disaster impact tendencies (Guha-Sapir et al., 2011). Economic loss and fatalities from disasters were 2.5 times higher in 2010 than in 2009. Fatalities as a result of disasters in 2010, were 176,000 more than the annual reported figure of 2005 (Myers & Wee, 2005). Outlier years for disasters are to be considered, but reported figures for 2010 makes it the costliest and most fatal year in over two decades.

Disaster Policy and Legislation

To understand how the field of disaster assistance in the United States evolved, it is important to investigate policies related to disasters. Disasters in the United States have had an influence on government's organizational structures over time (Roberts, Ward, & Wamsley, 2012). Disasters can become "focusing events", that are instigators to bring about change in laws, policies, and institutional arrangements (Tierney, Bevc, & Kuligowski, 2006). In many instances Hurricane Katrina is seen as a "focusing event". Policy makers and administrators often craft plans and procedures in response to the last catastrophic disaster (Roberts, Ward, & Wamsley, 2012).

The public's post-disaster expectations and reactions are understandable, but in many instances regarded as unreasonable given the complex nature of governmental structures. This causes a complex and occasionally difficult process for decision-makers involved. With disaster science being a holistic field, there is more than one discipline or jurisdiction involved within the field of disaster policy.

Policy scholars and political scientists have preferred to view participation in policy-making and politics as a process where power is wielded to promote an individual's or a group's interests (Birkland, 2006). The "policy streams" model approach of Kingdon (1995), allows for a better understanding of how policy in the field of disaster relief and emergency management develops. Policy-making according to Kingdon's model is divided into three phases. The three phases are problem recognition, policy ideas and politics, and policy adoption. These phases form independently of each other with no particular sequence associated to it. The phases do join together eventually, and create what is known as the policy window. The policy window allows laws to develop and public policy to emerge (Roberts et al., 2012).

The terrorist acts of September 11, 2001 changed the policy landscape for the Federal Emergency Management Association and emergency management practice in the United States. The role of the federal government in emergency management has always been one of seeking organizational equilibrium. The events of 9/11 caused disequilibrium to emergency management related policies. Disequilibrium causes organizational instability that result in the root of the problem being political, and not scientific. In a complex system with an overlap of political role-players, the failure to achieve an effective response to a disaster can lead to a political blame game (Roberts et al., 2012).

Failure of structures to effectively respond to a disaster can cause an increase in concerns among elected officials. Voters usually vent their frustration at the polls, as with Hurricane Andrew in 1992. Officials were quick to shirk

responsibility and shifted blame. With organizational structure, blame-shift can complicate in-depth analyses of emergency management processes and systems. The difficulty of being able to analyze complex and changing systems in a political environment has contributed to the seemingly inability of the United States government to develop a stable policy-based system to respond to disasters (Roberts et al., 2012).

Political pressure and the search for timely solutions after September 11th lead to the creation of the Department of Homeland Security (DHS). FEMA realigned and was integrated with DHS structure. Presently the federal emergency management system suffers from defects with the creation of DHS. The fact that DHS incorporated emergency management procedures too hastily into its vision of addressing terrorism is seen as the root of the problem of pre and post-disaster service delivery. This policy change is an “Achilles heel” for disaster services in the United States. Policy reform is needed to bring about a paradigm shift in service delivery to communities.

The well-known *Disaster Timeline Charts* developed by Rubin (2012), conceptualizes how a focusing disaster event can lead to policy change. Focusing events create a series of studies that usually lead to legislative, administrative and policy, and or organizational or programmatic changes. In many instances the process associated can lead to new organizations being created. Disaster events such as the 1971 San Fernando Earthquake led to the Earthquake Hazards Reduction Program in 1977. Disaster events in 1960 and 1970 have resulted in the formation of FEMA in 1978. The terrorist attacks of

9/11 resulted in the creation of DHS and the reorganization of numerous federal agencies. The aforementioned responses stemmed from some form of recommendations from commissions and research groups that strived to address the public outcry following one or more disaster that has affected the nation (Roberts et al., 2012).

International disaster policy has been spearheaded by the United Nations International Strategy for Disaster Reduction, succeeding in implementing a 10 year policy strategy for disaster risk reduction. The Hyogo Framework for Action was adopted by 168 Governments on a ten-year strategy from 2005 to 2015, to make the world safer from natural disasters. The Hyogo Framework for Action (HFA) is a global blueprint for disaster risk reduction efforts to substantially reduce disaster losses by 2015 and make communities more resilient towards disasters (International Strategy for Disaster Reduction, 2005).

On a national level there are a number of disaster policies related to reducing the impact of disasters. The efforts range from the establishment of Presidential advisory committees to the implementation of disaster acts. The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) of 1988 is a guidance tool for disaster practice in the United States. The Stafford Act is a federal law, designed to provide structure in an orderly and systematic way when federal natural disaster assistance is needed by state and local governments in providing assistance to citizens (Federal Emergency Management Agency, 2011).

The Stafford Act is an amended version of the Disaster Relief Act of 1974. The Act provides an operational system by which a presidential disaster declaration of an emergency could result in financial and physical assistance through the Federal Emergency Management Agency (FEMA). The Act further provides a blueprint by which FEMA has the responsibility for government-wide coordinating of disaster relief efforts. The Act ensures the collaboration of 28 federal agencies and non-governmental organizations during a time of disaster. Seven guiding areas for emergency management guide the Act. The focus areas within the Act are *Findings; Declarations and Definitions; Disaster Preparedness and Mitigation Assistance; Major Disaster and Emergency Assistance Administration; Major Disaster Assistance Programs; Emergency Assistance Programs; Emergency Preparedness, and Miscellaneous* (Federal Emergency Management Agency, 2011).

In 2000 congress amended the Stafford Act by passing the Disaster Mitigation Act of 2000, and the Pets Evacuation and Transportation Act in 2006. One of the reasons for the Pets Evacuation and Transportation Act was the number of people losing their lives during Hurricane Katrina. Numerous people refused to evacuate their residences, since their pets were not allowed to be evacuated with them resulting in people staying behind with their animals during the disaster. A survey conducted after Hurricane Katrina indicates that 44% of people decided to ride out the storm with their animals due to not being able to evacuate with their pets (McCulley, 2007). Although not empirically proven, it is believed that the refusal to evacuate caused a number of deaths.

The Stafford Act has received criticism over the years. Greater latitude is needed for FEMA when responding to catastrophic disasters such as Hurricane Katrina (Advocates for Environmental Human Rights, 2007). The act is covered in "bureaucratic red tape" making it difficult for role players involved to function at an optimal level. Human rights during a disaster situation is another area of concern, with rights not fully addressed by the Stafford Act. Displaced persons have very little ability to participate in governmental decisions, which affect the recovery efforts in their community. From a social work perspective, the Stafford Act focuses on special needs populations during an emergency, but more consideration should be given to these groups during emergency protocol.

With the focus of this study being on Louisiana, it is important to focus on policies that are used to aid in disaster-related practices. The "*Louisiana Homeland Security and Emergency Assistance and Disaster Act"* is the designated act that guides emergency management operations on a state level in Louisiana. The purpose of the Act is, *"because of the existing possibility of the occurrence of emergencies and disasters of unprecedented size and destructiveness resulting from terrorist events, enemy attack, sabotage, or other hostile action, or from fire, flood, earthquake, or other natural or man-made causes, and in order to ensure that preparations of this state will be adequate to deal with such emergencies or disasters, and in order to detect, prevent, prepare for, investigate, respond to, or recover from these events, and generally to preserve the lives and property of the people of the state of Louisiana*" (p.1).

The Act provides guidance on the areas of mitigation, preparedness, response, and recovery (Governor's Office of Homeland Security & Emergency Preparedness, 2006).

A number of amendments have been made to the Act after Hurricane Katrina. Amendments include legal changes, communications, and delegation of responsibilities during times of disaster (Governor's Office of Homeland Security & Emergency Preparedness, 2006). The original Act has been adapted to accommodate and address some of the problems experienced during Hurricane Katrina. Changes to the Act are necessary since the devastation associated with Hurricane Katrina should be averted at all cost in the future.

Policy reform and change within disaster science will only be perfected if more financial resources are allocated for disaster research. The field of disaster research is mainly dependent on the National Science Foundation for funding, with little funding coming from other sectors (Roberts et al., 2012). The Stafford Act is not perfect, but it does provide a blueprint for structured service delivery during times of disaster.

Scope of the Problem: Louisiana, a State of Disasters

Louisiana is a state in the south of the United States of America with a rich cultural history. From 1686 to 1790, France and Spain colonized and governed the lower Mississippi River Valley. The region is named after Louis XIV, who was King of France in 1682. In the early 1800’s, the United States government purchased land to the west of the Mississippi River. Historically it is regarded as the biggest land acquisition in American history. The acquisition of land granted

the U.S. government the ability to expand westward for settlement, trade and secured borders against any possible threat. The Louisiana Purchase expanded trade, and allowed for a trade route to be established along the Mississippi River (Baker, 2011; Fortier & McLoughlin, 1913; Kelman, 2006).

Louisiana today is bounded on the south by the Gulf of Mexico. On the eastern side of the state of Louisiana, the border is formed by the state of Mississippi and on the western side of Louisiana it is bordered by the Lone Star State, the State of Texas, with the northern border being formed by the State of Arkansas (Fortier & McLoughlin, 1913).

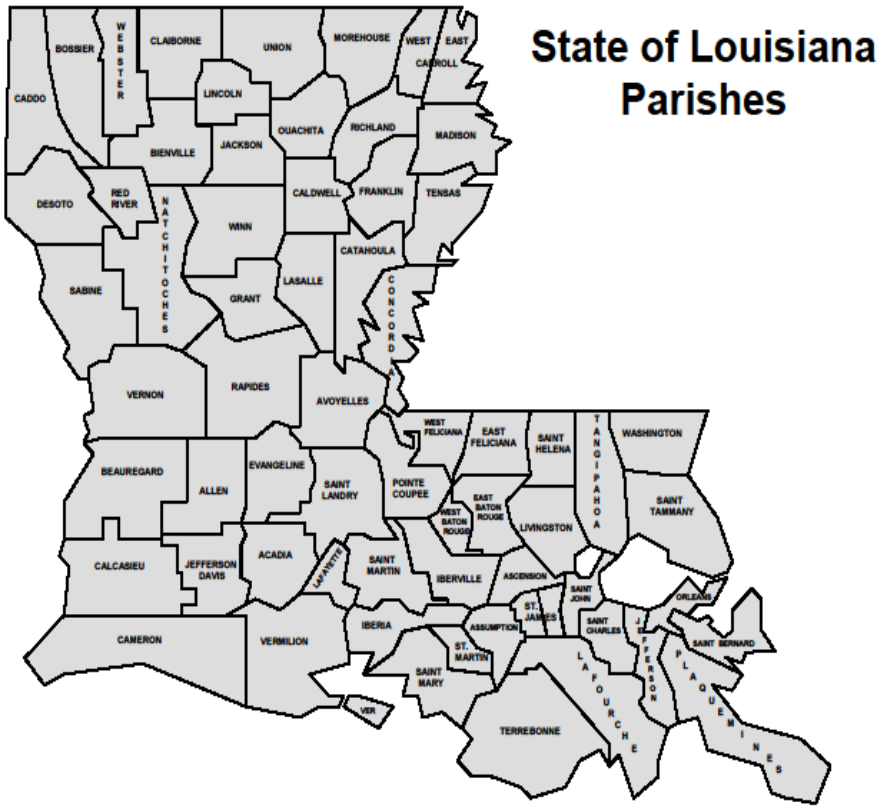


Figure 5. Map of Louisiana parishes.

Louisiana has a rich, colorful, historical background being recognized for its rich multicultural and multilingual heritage. Strong influences from Spanish, French, Native American and African cultures have resulted in a fusion of historical and cultural backgrounds (Bates & Swan, 2007). There is a rich mixture of people residing in Louisiana. Current day residents of Louisiana include the original, first nation Indian inhabitants, as well as descendants of German, Spanish, French, English, Irish, Italians, Acadians, Africans and West Indians (Louisiana, 2012). According to the 2010 National Census report, the state of Louisiana currently has a population of 4,533,372. Race groups are divided into White people 62.6 %, Black people 32 %, Hispanic or Latino decent 4.2%, Asian people 1.5% and American Native Indian and Alaska Native people 0.7% (U.S. Census Bureau, 2011).

Louisiana is dependent on the physical environment as a source of income for the state, with the Mississippi River system and the Gulf of Mexico being economic lifelines to the region (Bates & Swan, 2007; Gordon, Buchanan, Singerman, Madrid, & Busch, 2011; Kelman, 2006; Picou & Marshall, 2007; Van Heerden & Bryan, 2007).

Louisiana is no stranger to disasters. It is common knowledge that the Mississippi River is the largest U.S. river (Kammerer, 1990). The river system drains an estimated 41% of continental United States, with a watershed area of around 1,245,000 square miles resulting in the Mississippi being the third largest watershed of any river in the world (Independent Levee Investigation Team, 2006). The Mississippi River has changed the landscape and psyche of

Louisiana residents with some communities experiencing annual losses due to flooding from the river (Kelman, 2006).

Some of the earliest reported disasters in the State of Louisiana can be traced back as far as 1718. Over the following 290 years, the Mississippi River has caused more than 51 reported flooding events (Independent Levee Investigation Team, 2006). Most notable, the floods of 1719, 1816, 1849, 1871, 1927, 1997 and 2005 stand out as events that caused the worst damage to Louisiana.

Hurricanes strike the coastline of Louisiana with a mean frequency of two hurricanes every three years. From 1759 to 2000 more than 172 hurricanes have caused devastation and loss of life (Independent Levee Investigation Team, 2006). The most notable hurricanes affecting Louisiana are “The Great Louisiana Hurricane” of 1812; “The Great Barbados Hurricane” of 1831; “The Record Hurricane” of 1893; “The Grand Isle Hurricane” of 1915; “Hurricane Betsy” of 1965; “Hurricane Camille” of 1969; “Hurricane Georges” of 1998; “Hurricane Ivan” of 2004; “Hurricane Katrina” of 2005; “Hurricane Rita” of 2005 and “Hurricane Ike” of 2008 (Bates & Swan, 2007; Federal Emergency Management Association, 2010; Independent Levee Investigation Team, 2006). Hurricane Katrina is the worst natural disaster in the history of the United States. The effects of the natural disaster lead to a number of structural failures that caused further damage to the City of New Orleans (Independent Levee Investigation Team, 2006; Picou & Marshall, 2007). Levee failures in New Orleans caused extensive flooding that inundated the city for weeks. Secondary effects of

Hurricane Katrina resulted in a “natural-technological” disaster. Dangerous hazmat releases resulted from toxic oil and chemical spills. The hazmat releases are referred to as “toxic gumbo”. “Toxic gumbo” is bacteria infested hazardous floodwaters that engulfed the region. Louisiana experienced 10 major oil spills with an estimated 134 minor oil spills as a result of Hurricane Katrina. According to estimates, 8 to 9 million gallons of oil were spilled as a result of Katrina’s fury being not only a natural disaster but also a technological disaster. As a natural-technological disaster Katrina caused the third worst oil spill in the history of the U.S. (Picou & Marshall, 2007).

A number of disasters have had a lasting impact on the human psyche in Louisiana. The horrible yellow fever epidemic of 1853 took the lives of nearly ten thousand residents in New Orleans. Historians report that the disaster could have been averted, if it were not for the class and racial segregation in the city. The city was crippled and brought to its knees with the poor being left behind and the wealthiest citizens fleeing the city from the epidemic (Kelman, 2006; Lafayette Cemetery Research Project New Orleans, 2012).

Louisiana has gained notoriety for train wrecks, structural fires, structural disasters, river and maritime accidents and industrial chemical spills. The Mississippi river has claimed a number of steamboats and passengers, with the river being notorious for accidents over the past two centuries (Beitler, 2007; Kelman, 2006; Medical News Today, 2008; The Times-Picayune, 2010).

A standout event occurred on the evening of April 20, 2010. The worst technological disaster in the history of Louisiana and the United States struck the

vulnerable coastline of Louisiana. British Petroleum's (BP) *Deepwater Horizon* oil rig exploded about 50 miles southeast of Venice, Louisiana, causing loss of life and extensive damage to the area (Browning, 2011). The explosion caused the death of 11 men, and the oil rig to sink. The *Deepwater Horizon* oil spill is the worst oil spill in the history of the United States exceeding the damage of the Exxon Valdez tanker, that spilled 11 million gallons of oil in Alaska in 1989 (Huffingtonpost, 2010). It is estimated that close to 205 million gallons of oil were released into the Gulf by the *Deepwater Horizon* oil spill (Browning, 2011; Huffingtonpost, 2010; Robertson, 2010).

Ecological Perspective on Disaster Impacts in Louisiana

With disaster impacts being so extensive it is best to assess it from an ecological systems perspective. An *Ecological System* can be defined as consisting of a micro system, mezzo system, and the macro system (Bronfenbrenner, 1990; Paquette & Ryan, 2001; Schoeman & Ferreira, 2002 ; Zastrow & Kirst-Ashman, 2008). With the utilization of the ecological system approach, the impact of disasters in Louisiana is analysed by means of a holistic approach, since all three levels of the model are interlinked.

The microsystem refers to an individual. A micro system orientation involves focusing on an individual's needs, problems and strengths. The mezzo system is any small group, including work groups, and other social groups. Whereas the individual is enmeshed and forms an integral part of the mezzo system by means of interaction with other individuals, the focus should still be on the group when referring to the mezzo system. The macro system is a system

larger than a small group. A macro system orientation involves focusing on the social, political, and economic conditions that tend to affect people's overall access to resources and quality of life (Zastrow & Kirst-Ashman, 2008).

Impact on Micro System

The impact of a disaster on the individual varies from person to person, depending on their subjective perception of a risk situation (Lindell & Perry, 2000). During a disaster there is consensus on some thoughts, feelings and behaviors to be observed among disaster victims. A meta-analysis on psychosocial reactions of individuals exposed to disasters found that thoughts, feelings and behaviors ranged across the board. Thoughts ranged from concern about basic survival, uncertainty about the future and about relocation. Feelings experienced as a result of the disasters include fear, anxiety, anger, avoidance, depression, post-traumatic stress disorder and feelings of helplessness and betrayal (Myers & Wee, 2005; Norris et al., 2002; Picou & Marshall, 2007; Picou & Martin, 2007). Behavioral problems that arise from disaster exposure over a five-year period are sleep disturbances, domestic violence, alcoholism, drug dependency, disruption in social behavior, fighting with immediate family members and work colleagues. Psychosocial diagnoses relating to social development differ for individuals although symptoms relatively remain the same for individuals as indicated by the meta-analysis (Myers & Wee, 2005; Norris et al. 2002; Picou & Marshall, 2007; Picou & Martin, 2007).

Disaster events have an impact on the chronic health conditions of individuals. Empirical evidence suggests that the impact of disasters have increased

negative effects on asthma, chronic obstructive pulmonary disease (COPD), diabetes, hypertension and other cardiovascular diseases of disaster-exposed populations. Individuals suffering from chronic health conditions might further experience other related mental health problems (Krol, Redlener, Shapiro, & Wajnberg, 2009).

Impact on Mezzo System

The impact of disasters on families and households in Louisiana differs. Socio-economic background is a determining factor as to how a family will respond and recover from a disaster (Myers & Wee, 2005). Families with a higher socio-economic status are able to "self-organize" faster from a post disaster situation compared to families with lower socio-economic status. Families are often forced to adjust their behavior when they are faced with adversity. Previous disaster experience can allow families to adjust to a disaster situation. Recollections can result in "flashbacks" of a previous disaster situation. In some instances flashbacks result in increased stress and anxiety-related symptoms. Sudden change in the family environment can alter the subjective risk perception of family members (Stallings, 1997).

The adjustment towards disaster events can help families to be more resilient in the wake of a disaster. For others it might however, increase stress-related symptoms significantly (Lindell & Perry, 2000; Lindell & Prater, 2000; Lindell & Whitney, 2000). Determining the impact of disasters on the structure of the family, marital status is found to be at risk. Studies suggest that marital stress

increases during a disaster. Disasters increase uncertainty for families regarding their future, due to uncertainty caused by the disaster impact (Norris et al., 2002).

Parenthood is affected during a post-disaster situation. Parents are unsure about the safety and immediate future of their children. Studies indicate that adults with children displayed higher levels of stress and anxiety compared to adults without children (Myers & Wee, 2005). When there are signs of health threats, empirical evidence has shown that mothers tend to become extremely concerned about their children's health (Norris et al., 2002). Other symptoms within the family system caused by disasters are the loss of trust between relatives and conflict arising if a mandatory evacuation has been ordered (Picou & Marshall, 2007). From empirical evidence, it is evident that disasters can have a severe impact on family functioning.

Impact on Macro System

The impact of disasters is evident on the macro level, impacting economical, social, political and environmental conditions for an individual nested within a community. The poverty level in Louisiana is extremely high compared to other states in the United States. The region ranks in the bottom fifth of the U.S. Census ranking of state median incomes. With the region's overall education levels, which can be used as a strong indicator of earning potential, being lower than the U.S. national average, the region is faced with a number of economic, social and political barriers (Gordon et al., 2011).

The American Human Development Index ranks Louisiana in the bottom five states of the nation regarding health, education and quality-of-life indicators

(Social Science Research Council, 2011). With human development being extremely low in the region, a disaster will have a significant impact on the economic-, social- and political functioning of the greater community.

The economic sectors impacted worst by disasters in Louisiana are the crude oil, fishing and tourism industries. These three sectors are financial lifelines for the region. The domestic oil industry is hugely reliant on the Gulf of Mexico with an estimated 110 million barrels being produced annually, injecting revenue of $6 billion dollars into the local economy (Gordon et al., 2011). The region relies entirely on the highly ecological productivity of the north-eastern Gulf of Mexico. When faced with disaster the community structure can cause social and political problems on an interpersonal level. Interpersonal problems between community members that might surface as a direct cause of disasters are (Picou & Marshall, 2007):

- Loss of social, neighborhood and family networks and resources;
- Loss of trust in agencies and governmental departments responsible for protecting residents from the effects of disasters.
- Social conflict between people receiving compensation and those not receiving compensation from disasters
- Uncertainty regarding both immediate and long-term future
- Mental health and health services overstressed
- Massive collective trauma
- On-going agency and organizational corruption
- Absolute disruption of daily norms and expected behavior

- Lack of infrastructural support for the affected parties

The impact from a disaster leads to uncertainty regarding the immediate and long-term future, causing psychosocial problems within the family and for the individual (Picou & Martin, 2007; Ritchie & Gill, 2006).

The impact of disasters on the natural environment has been felt on the inland ecosystem of Louisiana for decades. The Gulf Coast economy clearly has strong ties to the health of the ocean and its delicate eco system (Gordon et al., 2011). The natural environment and its balance are exposed to high levels of risk and the “greed” for fossil-fuel extraction from oil companies.

Wetlands provide irreplaceable biological infrastructure to improve water quality, attract tourism, mitigate storms and provide critical habitat for commercially and recreationally valuable species vital to the coastal livelihoods of Louisiana residents (Gordon et al., 2011). With the region relying on the environment as a lifeline, it is expected that the impact of disasters will negatively affect the ecological system.

The Louisiana wetlands are under constant threat, with the region losing the most coastal land in the United States (Gordon et al., 2011; Van Heerden & Bryan, 2007). Hurricane Katrina left extensive damage to the natural environment and wetlands (Dwyer, Salmon, & Eggen, 2005). New Orleans was covered in the city’s sewage, and pharmaceuticals, food stocks, petrochemicals, stores of industrial and agricultural chemicals, medical waste, and remains of humans and domestic pets were all contained in the stagnant water. The greater part of contaminated water from the city was discarded unwaveringly into Lake

Pontchartrain. The contaminated water affected the quality of water and the wetlands surrounding Lake Pontchartrain (Heitmuller & Perez, 2006).

A wetland the size of a football field disappears into the ocean every half hour in Louisiana. In the case of disasters, this damage is exacerbated. This is troublesome since Louisiana holds 40 percent of the wetlands on continental United States, and it is estimated that 80 percent of all wetland losses occur in the state. Reports indicate that by 2050, Louisiana will have lost one-third of its coastal land (Gordon et al., 2011).

With technological disasters being so prevalent in the region, the damage to the environment has been irreparable. The *Deepwater Horizon Oil Spill* resulted in more than 8,000 birds, sea turtles and marine mammals being found dead six months after the spill. Impact studies indicate that much more wildlife was affected by the oil spill than originally suggested (National Wildlife Federation, 2011).

Long-term damage from the oil spill and chemical dispersants might not be known for several years. The oil spill might cause an unbalanced food web, hitting the region at the peak of the breeding season for many species of fish and wildlife. The habitat of wildlife and fish has also been disturbed and this might lead to an alteration in breeding and migration patterns. With past oil spills, traces of oil have been found to be in the sediment for a period of up to 30 years (U.S. Fish & Wildlife Service, 2004). The *Deepwater Horizon* oil spill is the worst oil spill in the history of the United States of America, with effects on the natural environment of the Gulf Coast being irreparable.

Causal Process: Louisiana, a State of Disasters

Empirical evidence suggests that a number of factors have contributed to the high prevalence of disasters in Louisiana. A causal approach is needed to identify factors causing vulnerabilities within Louisiana. The *Pressure and Release model* (PAR-Model) delineates the causal processes of what caused disaster events in Louisiana from 2004 to 2010 (Wisner et al., 2004). Vulnerability generating processes is a key element within the PAR-Model. Vulnerability in Louisiana is dissected to gain a better understanding of what is causing communities to experience repetitive losses over time.

Vulnerability Defined

Extreme natural events are not regarded as disasters until a vulnerable group of people is exposed to such an event. The concept of vulnerability was coined in the early 1980's as a way to reduce losses from disasters. A renewed emphasis on vulnerability emerged in the early 2000's. The most recent work done on vulnerability is disconnected from a Marxist perspective but still focuses on changes within a system, making it consistent with social work values and practices (Gillespie & Danso, 2010).

Particular social groups are more prone to damage, loss and suffering in the context of differing hazards. Wisner et al. (2004) provide key variables that explain the variations of impact such as class, which includes different levels of wealth within a community. Class levels can include occupation of the target system, caste, ethnicity, gender, disability, health status, age and immigration.

Vulnerability is the reflection of the current state of the individual and his collective social, physical, economical and environmental conditions. The cited elements at hand are shaped recurrently by behavioral, attitudinal, cultural, socio-economical and political influences on individuals, families, communities and countries. Governed by human nature and activity, vulnerability cannot be isolated from on-going developmental efforts. Vulnerability therefore, occupies a critical role in all aspects of sustainable development (International Strategy for Disaster Reduction, 2004).

With vulnerability, the main premises are not only natural events creating disasters, but also processes relating to social, political and economic environments. This process is edified with the PAR-Model. Gillespie (2010) identifies causes of vulnerability and includes a lack of access to information, knowledge and technology; weak or non-existent political representation or power; limited social capital; building age and quality; frail and physically limited individuals; type, quality and age of infrastructure, and lifelines.

Vulnerabilities are structural and situational in nature (Gillespie, 2010). This is attributed to the way lives of different groups of people are structured and shaped by structural patterns based on politics, economics, environmental management practices, race and class relations, the gender-based division of labor, and other factors. Social status and situational or context-specific living conditions that vary over time might also shape vulnerability. In social work, the main conceptual grounding for vulnerability is social and especially within distributive justice. Within this conceptualization, the market value of individuals

and populations is inversely related to the level of vulnerability from natural and technological hazards (Zakour, 2010).

Where hazards appear to be directly related to loss of life and damage to property, the social, economic, and political origins of the disaster remain as possible root causes. In the simplest form vulnerability is created by social, economic, and political processes that affect how hazards affect people in different ways and varying degrees of intensity (Wisner et al., 2004).

The Pressure and Release Model is used to establish the causal process associated with vulnerability generating processes that lead to the high prevalence of disasters in Louisiana between 2004 and 2010. The premises of the PAR-Model are that the source of disasters is more on the basis of a social realm than that of a natural realm. A comparative stance is taken as it is possible to regard an event as a scale of causation (Anderskov, 2004; Wisner et al., 2004). The basis of the Progression of Vulnerability, a link in the PAR-Model, is that a disaster can be described as the crossing of two opposing forces (Anderskov, 2004; Ferreira, 2008). On the one side is a process generating vulnerability and on the other side of the spectrum is exposure to hazards in a physical form. The image that is created is that of a “nutcracker” as pressure on people intensifies from either side over time - from exposure to vulnerability and from the impact of the hazard on those people that are at different degrees of vulnerability. In the case of induced pressures on either side of the PAR-Model the risk of a possible disaster increases. The PAR-Model is divided into the three

interrelated and causal phases of disasters, known as the progression of vulnerability. These three phases/links are (Wisner et al., 2004):

- Root Causes
- Dynamic Pressures
- Unsafe Conditions

The hazard side of the PAR-Model consists of various hazard types. A complete outline of the factors addressed in the model is to be found in Figure 6 (Wisner et al., 2004).

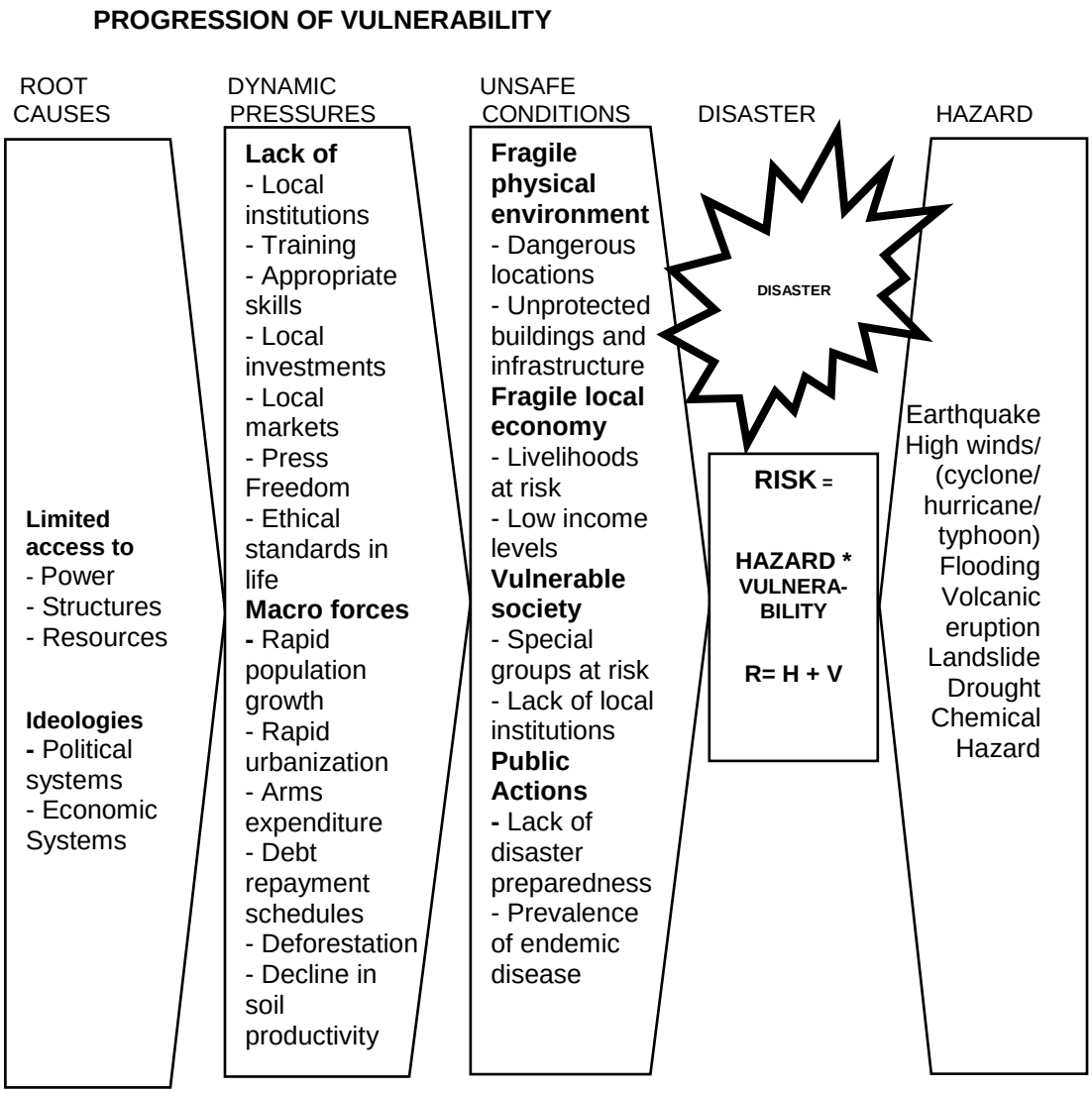


Figure 6. Pressure and Release Model (Wisner et al., 2004).

Accordingly the causes of vulnerability that lead to disasters in Louisiana will be dissected by means of applying the PAR-Model to the problem statement. There are three main elements that are addressed within the discussion, being root causes, dynamic pressures and unsafe conditions.

Root Causes

Root causes refer to a set of widespread and general, interrelated processes within a society. Root causes are regarded as distant in the context of

one or more factors, arising from a “distant” center of economic or political power (Wisner et al., 2004). Examples of a spatial distant element of root causes playing a role in a communities’ functioning are distant economic or political power structures that contribute to an increase in vulnerability. Another distant factor is “temporal” distance that relates to events in history and refers to a decline in welfare that can be exacerbated by history. The final distant factor linking to root causes is distance in cultural assumptions, ideology, beliefs and social relations in the actual everyday existence of the people concerned who are “invisible” and “taken for granted” (Wisner et al., 2004). Determining the most fundamental root cause giving rise to vulnerability in the community are aspects such as economic, demographic and political processes regarded as the main contributors to the increase of vulnerability in a community. These factors also affect the allocation and distribution of resources to different groups of people.

Factors relating to root causes resulting in high levels of vulnerability can be described as very complex. With regard to Louisiana root causes can be attributed to colonization, slavery, racial segregation and marginalization of certain minorities (Bates & Swan, 2007). Louisiana has had a fair share of political ideologies and an economic system affecting its residents negatively. Marginalization of certain race groups started as early as 1751 when there was constant strife reported between the colonists and the natives (Fortier & McLoughlin, 1913). The Natchez and the Chickasaws were often in conflict with the colonists.

One of the first disasters where the needs of the locals were not met was with the yellow fever epidemic of 1853. The response from the authorities was lackluster and caused the deaths of almost 10,000 residents in the city of New Orleans. Residents were left to fend for themselves during the epidemic. The poor and vulnerable were left behind, while the rich left New Orleans to escape the effects of the epidemic (Kelman, 2006; Lafayette Cemetery Research Project New Orleans, 2012).

Almost a hundred and fifty years later, history was repeated with Hurricane Katrina. Portions of the community were able to leave the region in time, with others having no means of evacuation. New Orleans, at the time, had 127,000 residents without vehicles (Van Heerden & Bryan, 2007). Lack of governance and political will from authorities seem to be among the many causes of vulnerability being so high in the state of Louisiana (Van Heerden & Bryan, 2007). Issues of authority and management are deemed extremely complex during times of disaster (Dynes & Rodriguez, 2007). This is evident from the yellow fewer epidemic and Hurricane Katrina.

The high level of vulnerability is also attributed to the marginalization of minorities in Louisiana (Bates & Swan, 2007). Root causes have led to an increase in vulnerability and are partially due to the current political- and economic system in Louisiana.

Dynamic Pressures

The second link in the PAR-Model is dynamic pressures. The second link is the processes of activities “translating” the effects of root causes, both in a

temporal and spatial form, into unsafe conditions. Temporal and spatial features are more contemporary or immediate than conjunctional manifestations of general underlying political, social and economic patterns (Wisner et al., 2004). Dynamic pressures within the context of Louisiana channel the root causes into particular forms of unsafe conditions (Wisner et al., 2004).

Dynamic pressures relating to an increased sense of vulnerability in Louisiana is a result of the lack of appropriate skills and the lack of local investments. In many instances, there has been a lack of appropriate skills when it comes to evacuating for disasters in Louisiana (Van Heerden & Bryan, 2007). This was evident with Hurricanes Ivan, Katrina and Ike. Some citizens have not been able to conceptualize the extent of damage an event such as a hurricane might do to the environment. Apart from the lack of appropriate evacuation skills among citizens, there is a serious lack of disaster preparedness among local officials and residents (Van Heerden & Bryan, 2007). Another problem associated with the lack of appropriate skills, has been the focus on terrorism prevention instead of disaster preparedness in the light of the 9/11 acts of terrorism (Tierney & Bevc, 2007).

The lack of investment in local infrastructure in Louisiana is underlined with the failure of the Levee system during Hurricane Katrina (Kelman, 2006). The 2012 Report Card for Louisiana's Infrastructure supports this statement (Movassaghi, 2012). The Infrastructure Report Card utilizes a 10-point grading scale. Seven fundamental grading components were assigned a weighting factor by evaluation committees. Louisiana's entire current infrastructure received the

highest grade of a B- for dams. Levees and bridges received a grading of C- and D+ respectively. The grade points can be described as representing marginally crumbling infrastructure (Movassaghi, 2012). This is troublesome since this is the infrastructure that would be affected the worst during a disaster event. A real concern is that drinking water received a grade of D+. With a grade point of D+ for drinking water, there could be waterborne diseases associated with water consumption.

A macro force within the dynamic pressure link increasing vulnerability in the region, is the constant threat to the wetlands in the region (Gordon et al., 2011). Wetlands are an essential part of the ecosystem serving not only as a buffer from storm surges, but also as a purification system for water in Louisiana. The biodiversity of the wetlands in Louisiana is under constant threat from residential development, chemical spills and the mining of cypress trees (Gordon et al., 2011; Van Heerden & Bryan, 2007).

Unsafe Conditions

The third link of the progression of vulnerability is unsafe conditions. The vulnerability of a population being expressed in time and space in conjunction with hazards, translates into unsafe conditions. Living within hazardous locations, the inability to afford safe housing and shelter, lack of protection from government, and having to engage in dangerous practices to sustain livelihoods are results from root causes and dynamic pressures (Wisner et al., 2004). These factors are all present within Louisiana. Unsafe conditions are dependent upon the initial level of well-being of the people, and the interaction of the level of well-

being between regions, micro- regions, households and individuals, varies. When referring to unsafe conditions no single element, especially technical and apolitical determinants of people's vulnerability, should be regarded separately from the entire range of factors and processes that tend to create the vulnerable state (Wisner et al., 2004).

Louisiana has a history of being faced with adversity. The region has been put at constant risk with a fragile local economy and fragile physical environment. The fragile local economy has been struggling to recover from the impact of Hurricane Katrina and an aligning U.S. economy. The aforementioned unsafe conditions put lower income level residents in the region at a higher level of vulnerability and create a vulnerable society.

With the intersection of the progression of vulnerability and the high prevalence of hazards, Louisiana has the misfortune (accolade) of being one of the worst disaster-affected states in the United States. The main causes of the high prevalence of disasters in the state of Louisiana are due to areas being inhabited that are not suitable for humans; a culture of dependence of assistance; marginalization of certain groups; and a lack of political will among politicians and administrators to bring about change. The combination of these factors on the one side of the spectrum and the high prevalence of hazards in Louisiana on the other side of the spectrum has created one of the most vulnerable regions in the United States. The progression of vulnerability for Louisiana is depicted in Figure 7.

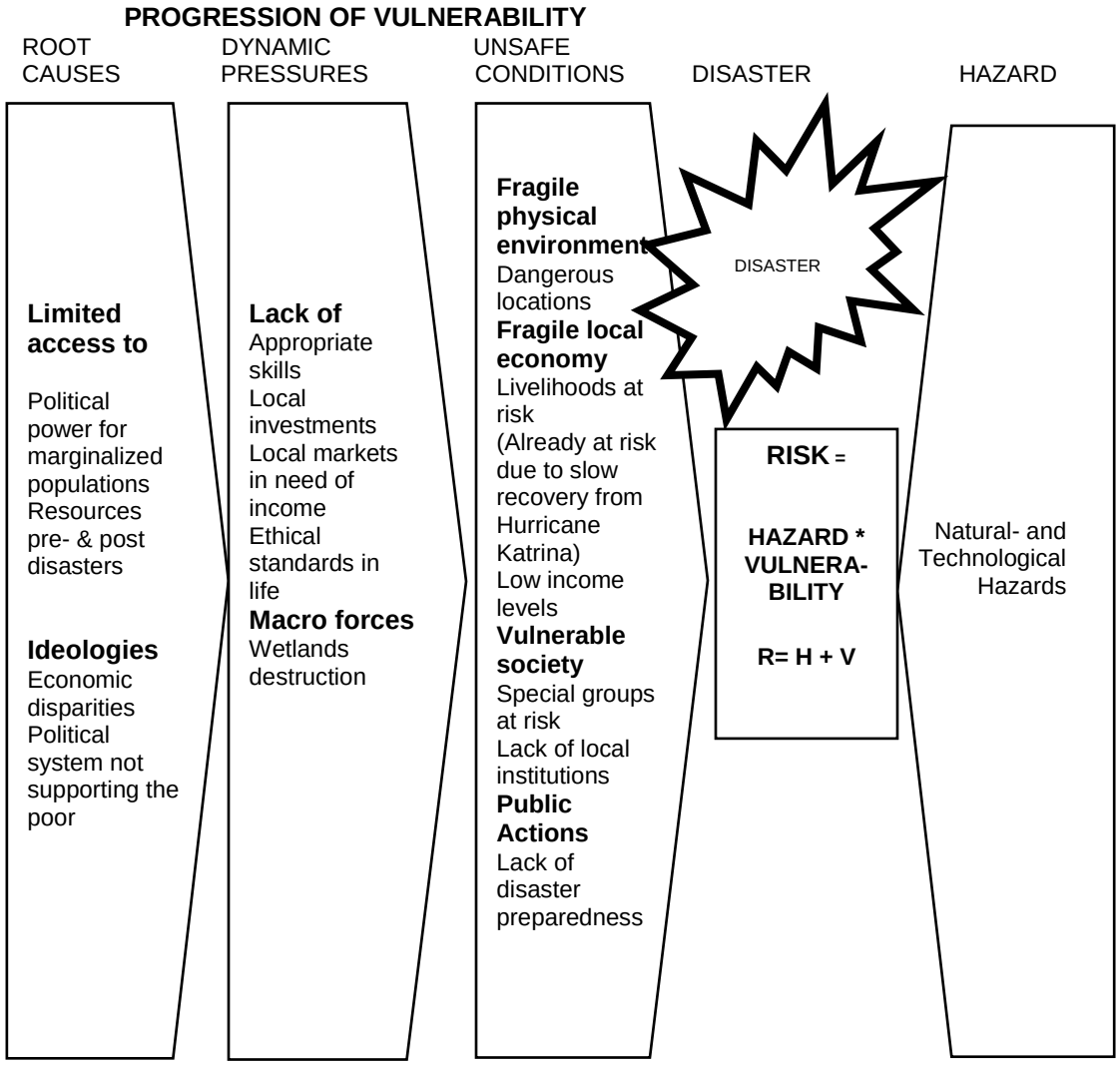


Figure 7. State of Louisiana Pressure and Release

The Pressure and Release Model allows for the assessment of the causal processes leading to a high prevalence of disasters in Louisiana. With the significant increase in disasters worldwide there has been a greater sense of awareness among the public and private sector to be better prepared for disasters. Attempts have been made to quantify aspects of disasters relating to disaster preparedness, disaster resilience, disaster mitigation, risk reduction,

social vulnerability and the exposure of communities to disasters (Simpson & Katirai, 2006). In quantifying disaster related themes, we are able to understand who the most vulnerable is, how to better prepare communities for disasters, and what makes communities disaster resilient. The Pressure and Release model helps with the conceptualization of disaster generating processes in Louisiana between 2004 and 2010. The model also identifies vulnerable populations and sectors that are susceptible to disasters in Louisiana.

Summary and Conclusion

The research and policy community has been searching for answers and solutions as to how communities can decrease vulnerability. The examination of the vulnerability process in Louisiana creates an opportunity to identify the individuals and groups that are most vulnerable within the Gulf Coast region. With the assessment of vulnerable groups, the quantification of resilient traits among communities impacted by disasters for centuries, can be identified. Identifying factors that lead to social vulnerability amongst individuals can create a platform for policy reform.

Within international and federal circles there have been considerable interest from a policy level in the subject of making communities less vulnerable and more disaster resilient. On an international level, the Hyogo Framework of the United Nations has been a driving force behind the concept of decreasing vulnerability, ensuring that communities implement disaster risk reduction initiatives to make their communities more resilient (International Strategy for Disaster Reduction, 2005). On a federal level the Subcommittee on Disaster

Reduction provides a blueprint for fostering community disaster resilience (Subcommittee on Disaster Reduction, 2005). This renaissance has stimulated the initial interest in disaster resilience on a national level (Cutter et al., 2008; Cutter, Burton, & Emrich, 2010). Interest on a federal level has led to the formal establishment of the Office of Resilience within the National Security Council in the White House. The policy community has adopted resilience as a guiding principle for making the American nation more resilient towards disasters. The policy goal, according to Cutter et al. (2010), is clear and pragmatic. By increasing resilience among communities, vulnerability will be decreased ensuring that communities can withstand adversity from disasters (Cutter et al., 2010).

The study will aim to gain a better understanding as to how disaster events in parishes, and community disaster resilience, predict individual social vulnerability. The conceptual model will be tested with multilevel modeling, guided by theory. The focus will be to understand the predictors of social vulnerability, measured among residents residing in one of the 56 parishes in Louisiana affected by disasters between 2004 and 2010. By investigating the relationship between parish disaster history and the objective reality of communities (social-, economic-, infrastructural-, and institutional resilience and community capital), it is believed that, the study will be able to determine changes of predictors of social vulnerability in parishes for individuals living in communities affected by disasters.

Chapter II provides a review of literature related to objective community resilience and individual social vulnerability. Additionally, the relevant theoretical perspectives and literature on disaster resilience are reviewed, serving as a foundation for this investigation. The chapter investigates the interrelated factors and processes of individuals exposed to disasters that result in individuals being socially vulnerable towards disasters. The approach represents a gap in the literature, constituting an emerging field of study and the focus of this dissertation.

CHAPTER II: LITERATURE REVIEW

This chapter provides the theoretical foundation for the study. Within disaster research, a number of theories are applicable to analyze disaster-related aspects such as vulnerability and resilience. This is attributed to the fact that the field of disaster research is holistic and multidisciplinary. In order to provide context for this study five theories will inform the discussion. The selected theories are applicable to the understanding of the concept of social vulnerability and disaster resilience among individuals, families and communities. The theories allow for conceptualization as to how objective reality within communities and subjective reality among individuals play a role in determining individual social vulnerability within a disaster context. The theories have been selected on the basis of the following factors: (a) they accommodate both a micro (individual) and macro (community) focus; (b) they highlight processes needed for creating resilience among the individual, family and the community (c) they accommodate interaction with the immediate environment and (d) allow for the understanding of objective and subjective factors within a disaster research context. The theories applied to the study are structural functionalism vs social constructionism, risk and resiliency theory, crisis theory, social capital theory, and conservation of resources theory. The study utilizes conceptual frameworks and

indices relating to social vulnerability, disaster preparedness and disaster resilience for investigating the social problem.

Structural Functionalism vs Social Constructionism

The main theoretical approach used for guiding the study is structural functionalism. It is necessary to note that there is an overlap of theories and that structural functionalism cannot be fully separated from social constructionism. The two theories are crucial in the process of explaining the objective and subjective factors in a system.

Structural functionalism is seen by disaster researchers as the foundational theory for conducting disaster research. The structural approach is paramount since it sets the standard for what is needed and what needs to be provided within a system pre-disaster and post-disaster. Social structure should start at the societal sphere and be adopted and integrated by the community (Kreps, 1989). Adopting structure in the wake of a disaster will allow a community to self-organize and return to a state of equilibrium (Ronan & Johnston, 2005). Structural functionalism is more of an analytical tool than a theory of cause and effect. Its philosophical roots are found in (a) the general systems theory, explaining how parts function together within a particular structure to constitute the whole, and (b) Durkheim's theory of internalization of shared social values and norms.

Social problem literature come in two main varieties described as "objectivist" and "subjectivist" approaches (Stallings, 1997). The two varieties will form the basis of investigating the problem statement of the study. Structural

functionalism is seen as the objectivist approach. The objectivist approach tends to take the social problem and describe it as being both objectively real and objectively harmful. This allows for the examination of the causal factors, characteristics and consequences of the condition presenting itself. From the objectivist approach disasters are seen as social problems that consist of data being available on various disasters; the causes of disasters can be defined, the annual cost of disasters can be quantified and so forth (Stallings, 1997).

The approach of subjectivists is that objective conditions are not necessary or sufficient for a social problem to exist. Subjectivists believe that social problems are the result of group action. In describing this approach, the term “constructionist” is most fitting for this camp. Constructionists claim that circumstances, whatever their purposes are, turn into problems by means of active promotion, also known as the claims-making process (Kreps, 1989; Stallings, 1997).

The objectivist and subjectivist approaches are used in determining social vulnerability of individuals exposed to disasters. The objectivist view is the structure that is needed within the community to function at an optimal level. This is service provision, infrastructure needed in community, economic and political stability and community capital. The subjectivist view is the viewpoint of the individual as to how he perceives risk and adapts to his environment when faced with a disaster (Lindell & Perry, 2000; Lindell & Prater, 2000; Lindell & Whitney, 2000).

The “objectivist” approach of structural functionalism is an approach used to analyze societies and their component features that focus on their mutual integration and interconnection. Structural functionalism theory is an entity within a system of parts that all serve together for the overall effectiveness and efficiency of society. The concept of structural functionalism concentrates on the positive and negative functions of social structures. Structural functionalism has roots and influences nested within action theory, voluntarism, culture that comprises of values, norms, ideas and beliefs and lastly, emergence, where higher order systems develop from lower (Keel, 2011; Ritzer & Goodman., 2004).

Being a consensus theory, structural functionalism is a theory that sees society as being built upon order, interrelation and balance. Order and balance are essential for maintaining a sense of smooth functioning within the community (Kreps, 1989; Ritzer & Goodman., 2004; University of North Carolina, 2011).

Structural functionalism has seven main underlying assumptions. The assumptions allow for the establishment of the order of function. According to Parsons these assumptions have an emphasis on several levels of analysis (Ritzer & Goodman., 2004; University of North Carolina, 2011):

- Systems have a domain of order and an interdependence of segments - *Societies and social units are held together by working together and creating uniformity.*
- Systems tend toward self-maintaining order, or equilibrium - *Societies and social units function optimally when they function smoothly as an*

organism, with all parts working toward the "natural" or smooth working of the system.

- The system may be static or engaged in an ordered process of modification.
- The nature of one part of the system has an impact on the form that the other parts can take.
- Systems maintain peripheries within their environments - *Natural (peripheral) environments are separate but adapt to each other. The same dynamic occurs within societies and/or social units – if one or more parts significantly conflicts with others, others must adapt.*
- Distribution and integration are two central processes necessary for a state of equilibrium in a system - *Division of work positions help maintain stability; each part interrelates to create efficiency and harmony; the most capable individuals must be motivated to fill the most prominent roles/positions.*
- Systems tend toward self-maintenance from within, involving control of boundaries and relationships of parts to the whole, control of the environment, and control of tendencies to change.

The levels Parsons are referring to are the same levels that are present within an ecological system. Thus, he refers to the macro, mezzo and micro sub-systems (Bronfenbrenner, 1990; Paquette & Ryan, 2001; Zastrow & Kirst-Ashman, 2008). Structural functionalists argue that in order for a society to operate optimally, it has to place and encourage individuals to occupy the

necessary positions in the social structure. Accordingly, society is known to do this in two ways by (a) instilling the desire in proper individuals within society to take up certain positions in society. This can be described as motivation in society, and (b) when proper individuals have filled these positions, society must offer them appropriate remunerations so that they maintain desire to fulfill their positions which are regarded by some as being difficult positions.

The subjectivist perspective for the study is defined by social construction theory. Social construction is a set of complex structures and individual participants influencing each other (Payne, 2005). It is defined by the meanings, notions, or connotations that are linked with objects and events in the environment, and people's notions of their relationships to, and interactions with, these objects. Social constructionist thought is a social construct that is an idea or notion that appears to be natural and obvious to people who accept it but may not represent reality, so it remains an invention or artifice of a given society. Reality is a product of social interaction and is therefore formed by social processes. In the case of individuals being exposed to a disaster, their reality is formed by what they experience. The reality of what is experienced is constructed by means of social processes also known as the subjective reality of the individual.

Structural functionalism, conflict theory and symbolic interactionism can be applied to disaster research in explaining processes that cause distress in a system (Fischer, 1998). Disaster research has its origin within sociology that originated during the early 1950's (Webb, 2006). Structural functionalism was

the most dominant theory applied to disaster research, at the time. In recent years, there has been a shift from structuralism towards conflict and political-economic perspectives to guide their work. Underlying these studies are still elements of structuralism. Social structure in the past has been treated as a dependent variable, but with the paradigm shift it is seen as a causal force, interpreted as an independent variable. With the movement from the classical era to the present, the implementation of structural functionalism has not been prevalent. One of the main reasons is that structural functionalism can only focus on the objective reality and does not take into account that there should also be a focus on the subjective reality. The question is how to reconcile the objectivist and subjective approach within a structuralism framework.

In disaster literature there is a considerable theoretical overlap between structural functionalism and social construction. The overlap causes other theories to form part of the bigger theoretical framework for empirical investigations in the field of disaster research. Structural and constructionist studies were the most dominant in the past, but there has been a paradigm shift towards cultural studies using structural functionalism as a foundation theory and linking other perspectives and theories to structural functionalism (Webb, 2006).

Cultural studies within disaster research are receiving attention with an increase in conceptual papers being published. Quarantelli (2002) is however clear that remarkably little empirical evidence is available on cultural studies within disaster research. According to Webb (2006) future cultural research should focus on prominent cultural symbols and their role in prevention, the

rhetoric or framing of a disaster, persistence of disaster myths, and production of culture in consensus and in conflict events, and the impact of cultural representations on disaster research.

According to Peacock, Morrow and Gladwin (2000), disaster research has inherited structural functionalism. Fischer's (1998) example of structural functionalism, provides a better understanding of the processes associated with the theory. The scenario used is the function the National Guard would fulfill when service is activated during a disaster. The purpose of the National Guard is to serve the function of restoring order and enabling residents to perceive that their possessions are safe as a result of the National Guard's presence in their community. Without the function of the National Guard, the death and injury count of the affected may be higher, with many residents being more inclined to stick it out in their homes protecting their possessions against possible pillaging.

Most notable disaster research work relating to structural functionalism, has been done by Kreps (1989). His premise is that disasters and social structures are related. He is the first to admit, along with disaster research scholars Quarantelli and Dynes, that implementing the theory can be challenging at times. The work done by Kreps is linked with the founding work of disaster researcher, Fritz. Fritz and Kreps underline the fact that there is a mutual relationship evident between a disaster and social structure.

Kreps (1989) points out, from Fritz's definition of disaster, that there are four principal properties that define social structure. Disasters are (a) events that

can be observed in time and space, the event has (b) an impact on (c) social units. The social units enact (d) responses that are related to these impacts.

Kreps defines his approach as the relationship between social structure and disaster, by developing a complex classification system. The system relates to the structure involved with social units and their responses to disasters. His approach consists of four elements namely, Domains *(D)*, Tasks *(T)*, Human and Material Resources (*R*) and Activities *(A)*. Kreps' work is listed below by incorporating the Four-Element form for disasters and structure (Kreps, 1989). The Four-Element Form is D, D-R, D-R-A, D-R-A-T.

An example of the four element approach is presented by the following example of a tornado affecting a town. A Tornado has hit a small town with limited resources. This leads to a situation where a temporary morgue has to be set up, with the county coroner taking charge even though he is not a medical doctor but a local funeral director. He has no coroner's office, no staff and no morgue. He usually just signs autopsy reports completed by hospital pathologists. The tornado has caused mass casualties with the local hospital not able to handle those killed by the event. A discussion between the coroner and two pathologists at the hospital lead to a decision to create a temporary morgue. The coroner requests the use of the local community center for the morgue. The community center manager agrees to the request *(Domain)*. The coroner, the two pathologists, the community center manager, a licensed embalmer, and a marine recruiter go to community center. The community center provides several rooms, and a couple of volunteers agree to help *(Domain-Resources)*. Concurrently,

ambulances start bringing bodies to the morgue (community center); people come to the morgue concerned about the missing; bodies start to be identified (no autopsies are done and none is intended); and ministers who stop by or come with concerned residents start attending to the needs of the bereaved (*Domain-Resources-Activities*). The need for "organization" is expressed by the key participants. The identified and unidentified dead are physically separated, with two pathologists attending to them. The licensed embalmer and marine recruiter take on paperwork tasks. The coroner maintains liaison with the hospital, funeral homes, and next of kin. Two ministers are asked to remain and attend to the needs of the bereaved at another location in the building (*Domain-Resources-Activities-Tasks*). The morgue closes about twenty-four to thirty hours after it opens (Kreps, 1989).

The Four-Element approach of Kreps provide for a structured approach towards analyzing post-disaster situations that could cause distress in the community. A shortcoming associated with the structural approach is that over complexity sets in when trying to analyze disasters from a structural approach. In analyzing 15 disaster events with Kreps's structural approach, there were more than 423 possible instances of structural organization from the disaster events identified. The work of Kreps is still relevant, but emphasis has moved from an objectivist approach to incorporating the subjectivist approach. This statement is supported by the empirical work done by Lindell and Perry (2000), on the subjective reality of individuals in high risk situations.

Structural functionalism guides the process of determining the objectivist factors present in Louisiana parishes. Social constructionism determines the subjectivist reality of individuals exposed to disasters in Louisiana. Structural functionalism is a guiding theory that allows for the other four theories under investigation namely the risk-and-resiliency theory, social capital, crisis theory and conservation of resource theory, to be integrated into one structural system. It is noted that there is an overlap of theories in disaster research and that structural functionalism co-exists with social constructionism. The field of disaster research relies on input from various study fields making it a multidisciplinary field of research.

Risk and Resiliency Theory

The second theory under study is the risk and resiliency theory. High risk situations like a disaster can cause people and communities to function either at a lower or a higher level. This adjustment or self-organizing of functioning at a different level has origins in the risk and resiliency theory. The theory has linkages to both the subjectivist and objectivist aspects, since it allows for the identification of the characteristics that make an individual, a family and a community resilient in the wake of experiencing a high-risk situation like a disaster. Individuals and communities experiencing a disaster find themselves in a high-risk situation at some stage. Exposure to a high-risk situation may cause harm on a physical and psychological level. The harm can transcend from the micro to the mezzo and macro levels of a system (Ride & Bretherton, 2011). In order for people and communities to return to a state of equilibrium after a

disaster, there should be some form of “inner strength” or “self-organizing” characteristic present. The “self-organizing” ability has been evident in numerous disaster situations (Ride & Bretherton, 2011).

From a micro perspective, resiliency inquiry did not devise from academic grounding theory, but as an alternative from *phenomenological* identification characteristics of survivors living in high-risk situations (Richardson, 2002). Vulnerable people exposed to disasters fit the profile of being in a high-risk situation when exposed to a disaster.

Risk and resiliency theory has advanced over the past 40 years. The theory comprises resiliency inquiry, encompassing three waves that stem and flow from one another (Richardson, 2002). The first wave of risk and resiliency theory is associated with probing into what the characteristics are that make a person resilient, as opposed to those individuals who succumb to their own destructive behaviors. Further focus is on the paradigm shift from investigating risk factors that have led to psychosocial problems, to the identification of strengths of an individual. Empirical investigations indicate that high risk situations can lead to individuals rising above their circumstances.

One of the first foundational empirical studies associated with the first wave, was a longitudinal study over a period of 30 years. The study from the mid 1950’s investigated the traits of children in high risk due to four main categories of environmental factors (Werner & Smith, 1992). Nearly 200 of the 700 children found themselves in a high-risk situation resulting from perinatal stress, poverty, daily forms of instability, and serious parental mental health problems.

Approximately 72 of the 200 children rose above their circumstances. Factors attributing to being resilient included being female, robust, socially responsible, adaptable, tolerant, achievement-orientated, being a strong communicator and possessing a strong self-esteem. A caregiving environment also played a vital part in being resilient.

Rutter (Richardson, 2002), piloted a series of epidemiological studies on inner-city London youth and the rural Island of Wight. One quarter of children exposed to risk factors was found to be resilient. Factors contributing to resilience were an easy temperament, being female, a positive climate, self-mastery, self-efficacy, planning skills and a warm close personal relationship with an adult. Garmezy and colleagues conducted the Minnesota Risk Research Project, which investigated intentional and informational-processing dysfunction in children of schizophrenic parents. The study found that children showed resilient traits and became normal functioning adults, even though they were present in a dysfunctional system (Richardson, 2002).

Benson conducted a study with more than 350 000 6^{th} to 12^{th} grade students in over 600 communities (Richardson, 2002). He first identified 30 developmental assets that youth possess to function optimally in life. After continued studies, 40 developmental assets were identified. The assets identified could be of an external or internal nature. External assets ranged from receiving support, feeling a sense of empowerment, knowing boundaries and expectations and finding a constructive use of time. Internal assets were educational commitment, positive values, social competencies and a positive identity.

Empirical investigations done during the first wave of resiliency inquiry laid the foundation for developing the risk and resiliency theory. The first wave provided insight into causal factors that make entities in a high-risk situation, resilient (Richardson, 2002).

Flowing from the first wave of inquiry the second wave of resilience inquiry focused on answering the question: “How are the resilient qualities acquired”? The second wave of resiliency inquiry was a manner to ascertain the known resilient qualities of an individual. The second wave of resiliency became known as the process of enduring and facing adversity. This has been associated with trying to improve oneself through the identification of, and self-enrichment in resilient qualities. It was found that resilient qualities were attained through a law of disruption and reintegration (Greene, 2007).

With the second wave, a conceptual resiliency model was developed by Richardson, Neiger, Jensen and Kumpfer (1990). This detailed process focused on accessing resilient qualities as a possible function of conscious or unconscious choice. The resiliency movement has enlarged the meaning of resilience and resilient reintegration, encompassing growth or adaptation through disruption instead of just bouncing back or recovering. Ranging from Piaget to Kohlberg, the risk and resiliency theory is regarded as a meta-theory encompassing a number of theories.

The third and final wave of the resiliency inquiry process resulted in the development of the concept resilience (Greene, 2007). The third wave is a spiritual source or a form of innate resilience. Everyone seeks a form of self-

actualization, altruism, wisdom and harmony with a spiritual source of strength that can be interpreted as a form of self-righting. This translates to self-organizing when faced with a high-risk situation. Empirical research conducted during the first wave of inquiry links with the third wave, as indicated by Werner and Smith, referring to resilience as being a self-righting mechanism (Richardson, 2002; Werner & Smith, 1992).

In order to describe resilience on the macro level a holistic approach is needed (Norris, Stevens, Pfefferbaum, Wyche, & Pfefferbaum, 2008). Resilience on a macro level, from a social work perspective, allows for the conceptualization of the relationship between human behavior and the social environment, as well as the interaction between social systems and their linked systems and environments (Zakour, 2010). Resilience in general is a higher level of adaptation despite collective adversity experienced within a community (Ride & Bretherton, 2011). When the stressors associated with adversity are extreme, resilience has somewhat less of a proactive connotation and is instead related to successful recovery. Resilience is essential at a transition phase or when entities encounter turning points, such as facing extreme stressors or hazards (Zakour, 2010).

In establishing the various factors relating to community disaster resilience, it is vital to first gain an understanding of resilience from a community context. The terms resilience and vulnerability are opposite sides of the same coin, but both are relative terms. Some scholars argue that the opposite of vulnerability is resilience (Adger, Hughes, Folke, Carpenter S.R., & Rockström, 2005). This approach is too simplistic and deeper analysis is needed to

distinguish the roles of the two concepts within a system. The question has to be asked which individuals, communities and systems are vulnerable or resilient and to what extent? As with vulnerability, resilience can be described as complex and multifaceted. This can include different features or layers of resilience needed to deal with different kinds and severity of stress (Cutter et al., 2008; Twigg, 2007). As complex as it is to define the concept of disaster, interpreting the concept 'resilience' on a community level within a disaster context, is equally confusing to specialists in the field of disaster research (Ronan & Johnston, 2005; Twigg, 2007).

Community resilience is a common feature of complex systems that include cities, communities and ecosystems. These systems continually evolve through cycles of growth accumulation, crisis, and renewal. Renewal is often characterized as leading to self-organizing of the system, reaching a sense of equilibrium. Self-organizing leads to unexpected new configurations within a system. Resilience is more than just possessing 'capacity.' Resilience goes beyond behavior, strategies and measures for the reduction of risk and management. There is, however, difficulty in separating the concepts clearly with capacity and coping-capacity meaning the same as resilience (Twigg, 2007).

For operational purposes, it is more useful to work with broad definitions and commonly understood characteristics. Cutter et al. (2010) agree with this approach, since there are numerous meanings of vulnerability and resilience in hazards literature. According to Twigg (2007) a broader approach will allow for a

better understanding of community resilience. Twigg (2007) defines community disaster resilience as:

- The capacity to absorb stress or destructive forces through resistance or adaptation,
- The capacity to maintain certain basic functions and structures, during a high risk event,
- The ability to "bounce back" or recover after an event.

Klein, Nicholls, and Thomalla (2003), describe community resilience as "*the amount of disturbance a system can absorb and still remain within the same state and the degree to which the system is capable of self-organization (p. 35) …" the degree to which the system can build and increase the capacity for learning and adaptation" (p. 40)*.

The Subcommittee on Disaster Reduction has a similar interpretation as Klein et al. (2003), describing resilience as *"the capacity of a system, community, or society potentially exposed to hazards to adapt, by resisting or changing, in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures" (p. 17)* (Subcommittee on Disaster Reduction, 2005).

Resilience on a macro level is not latent and can be increased or decreased. Individual resilience should be taken into account as a determining factor that can cause an increase or decrease in resilience on the macro level.

From a practical standpoint, community resilience can be increased when a community implements risk reduction measures preparing for the possibility of disaster impact, have the response capacity to minimize the impact of a disaster and lastly, have disaster recovery measures in place (Ronan & Johnston, 2005). If these four components are fostered in communities, community disaster resilience towards hazards can be increased.

For a community to increase its level of resilience towards disaster events, it is imperative that economic resources are developed, community competence is increased, and that distribution of information and social capital is fostered (Norris et al., 2008). By strengthening economic resource levels and equities, diverse communities will increase their economic resilience. Community competence can be increased by ensuring that there is a form of collective action and decision-making skills; collective efficacy in the community empowers communities with decision making capabilities. Information distribution in the community is essential, and in order for this to be effective infrastructure is needed. Information should come from trusted sources that are associated with positive narratives. Lastly, social capital can increase social support and social participation, and allow for bonds, roots and commitments to be formed in the community (Norris, 2009).

The risk and resiliency theory is applicable to this study since it is regarded as an everyday life theory that incorporates and encompasses most of the theories of life. The resiliency course is a life-enriching model, suggesting that stressors and change provide growth and enhanced resilience qualities. Risk

and resiliency can be translated as a straightforward and practical approach as to how one should approach everyday living (Richardson, 2002). The risk and resiliency theory allows for a better understanding as to what the traits are that comprise resilience. One point of interest and value is the fact that the theory is a meta-theory, making use of the best concepts of other theories. Empirically there is also evidence that the theory has been tested and implemented in high-risk situations.

The theory is applicable to the study since it allows for identification of "bounce back" characteristics of individuals and communities. In disaster research literature there has been a paradigm shift towards integrating resilience as a concept, especially on the macro-level. The paradigm shift is from a problem-saturated approach, to a more solution focused approach when working with systems affected by disasters.

In conjunction with the risk-and-resiliency theory, objective community resiliency indicator frameworks are used to define the conceptual model tested. Most notably the *Disaster Resilience Community Indicators* by Cutter et al. (2010), the Disaster Preparedness Index by Simpson and Katirai (Simpson & Katirai, 2006) and the resilient capacities of Norris et al. (2008), are used as baseline conditions for measuring resilience at community level. The aforementioned frameworks are further defined under the conceptual framework section of this chapter.

Crisis Theory

The crisis theory provides a better understanding of disaster-related distress symptoms, as manifested among socially vulnerable individuals in Louisiana. Elements of crisis theory can be traced to 400 B.C., when physicians stressed the significant impact that a crisis has on human functioning (Roberts & Nee, 1970). During the twentieth century, various contributions have helped develop crisis theory into the comprehensive theory it is today. Crisis theory examines the psychological impact of trauma related events, on individuals.

The founding father of crisis theory is Erich Lindemann. He conceptualized the basis of the theory in the 1940's (Rapoport, 1970). Lindemann developed the theory based on the psychological symptoms observed among survivors of Boston's Coconut Grove fire. A total of 493 people lost their lives due to the fire disaster. Observations identified five related symptoms among individuals that survived the fire. Symptoms consisting of acute grief experienced after the traumatic event; somatic distress; preoccupation with the image of deceased; guilt reactions; and loss of patterns of conduct, were observed (Rapoport, 1970). The duration of a grief reaction seems likely to be dependent on the success with which the bereaved handles their bereavement and "grief work." People need to allow themselves a period of mourning. If the normal process of grieving is delayed, negative outcomes will develop.

Caplan (1961) expanded on Lindemann's pioneering work, by studying various developmental crisis reactions and accidental crises experienced by individuals. He related the concept of homeostasis to crisis intervention, by

describing the stages of a crisis. A crisis is an upset of a stable state, in which the individual encounters an obstacle that cannot be overcome through traditional problem-management activities. Caplan describes four stages of the crisis reaction. Initially, a rise of tension originating from the precipitating event, is experienced. Secondly, an increase in the level of tension and disruption to daily living is experienced, since the person is unable to resolve the situation quickly. Thirdly, failed attempts to resolve the crisis through emergency problem-management causes tension that increases to such a high level that the person may experience depression. The final phase may result in a breakdown, or it may result in partly resolving the crisis, by using new coping methods (Kanel, 2007; Rainer & Brown, 2007).

Rapoport's (1970) work aligns with Lindemann's and defines a crisis as "an upset of a steady state" placing the individual in a hazardous state. The crisis situation is perceived as a threat, a loss, or a challenge. Three interrelated factors could create a state of crisis for an individual, namely a hazardous event, a threat to life-goals, and the inability to respond with adequate coping mechanisms.

Rapoport was the first person to conceptualize crisis intervention practice from crisis theory. Individual reactions to adversity such as a disaster are unique and situational. To gain a better understanding of the symptoms experienced by the individual an assessment framework has been created by Rapoport (1970). Assessment of individual crisis reactions should focus on three realms of the individual, namely affective (feeling), behavioral, and cognitive (thinking).

The assessment of the affective domain of the individual defines the primary reaction, which may be distress, fear, anger or depression. Behavioral reactions among the traumatized individual include fight, flight, or freeze reactions. Cognitive reactions signify the client's perception of the event. Individuals may perceive indiscretions of their rights being violated, threats of potential harm, or a sense of permanent loss. These acuities may occur in any realm of life: physical, psychological, social, environmental, values and beliefs (Myer, 2001).

The triage assessment system (TAS) is a fitting crisis intervention assessment of the individual experiencing a traumatic event. In order to establish a triage rating, the affective, behavioural, and cognitive domain responses of the individual receives a rating on a scale of 1 to 10 for each of the three domains. Rating is based on measures to mark intensifying severity of deficiency. A total TAS score can range between 3 and 30, with 3 being no impairment and 30 being the most severe score possible. Rating criteria for the affective realm consist of stability or lability of mood, congruence of affect to the situation, and the degree of action required to maintain volitional control of affect. Behavioral ratings consider the level of impairment in performance of activities of daily living, effectiveness and adaptability of coping behaviours, and potential for harm to self and others (Pazar, 2003). Cognitive impairment ratings consider the ability of the individual to focus and concentrate, problem-solve, and make decisions. The presence of confusion, perceptions not matched by reality, and limited control over intrusive thoughts will elicit higher severity scores on the cognitive scale

(Myer, 2001; Pazar, 2003). The triage assessment system enables a better interpretation of the affective, the behavioral and the cognitive realm of the individual affected during times of adversity (Pazar, 2003).

Crisis theory stems from Modernism, and the approach is mainly problem focused. With the development of crisis intervention from the crisis theory there has been a paradigm shift towards Post-Modernism. The crisis theory and crisis intervention enable the identification of distress among socially vulnerable individuals in a high-risk situation. With the high prevalence of disasters in Louisiana, crisis theory and crisis intervention allow for the identification of distress symptoms experienced by socially vulnerable individuals.

Social Capital Theory

The fourth theory used to analyze the problem statement is social capital theory. Social capital has been in existence ever since the formation of small pockets of communities where human interaction occurred. Human interaction resulted in exchange and trusts (Wade & Schneberger, 2006). The glue holding the fabric of lives together, is described as social capital (Ersing & Kost, 2011). Within disaster research literature, there has been a paradigm shift towards integrating the concept of social capital when working with communities. As with the risk and resiliency theory there has not been an extensive focus on social capital within past disaster studies. With the substantial increase in disasters, however, there has been a shift towards integrating this concept when working with communities in a disaster context.

Social Capital was conceptualized by Hanifan during the 1920's, to describe tangible assets among individuals and families that make up a social unit. There have been different interpretations as to the meaning of social capital, taking on a number of tangible and intangible meanings, and ranging from trust in individuals to structured relationships (Barnshaw & Trainor, 2007). The concept of social capital did not matriculate until the 1960's when Coleman, Kate and Menzel used it to describe the formed relations between individuals nested within families and communities. The findings from Coleman et al. demonstrated that these relations exercise influence on life course outcomes (Barnshaw & Trainor, 2007).

Granovetter in the 1970's expanded on the work of Coleman, extending the idea that social connectivity could be influential, by empirically establishing how social relations or social capital resulted in individuals receiving jobs. Bourdieu expanded on previous conceptualizations of social capital to include both collective resources and the networks that facilitate their shared use. In broader terms, social capital consists of five elements (Wade & Schneberger, 2006):

1. Networks and lateral connections that differ in solidity and magnitude, and are to be found among individuals and groups.
2. Expectancy that in short or long term benevolence and services will be repaid.
3. Conviction to take enterprises in a social context based on the assumption that others will respond as anticipated.

4. Social standards that direct behavior and interaction as spoken communal values.
5. Individual and collective effectiveness, the active and willing engagement of citizens to participate within their community.

These five elements appear in several combinations and inform the dealings between the partners of a group, organization, community, society or simply a network, and can be studied through various perspectives. In linking social capital with the problem statement, it can be interpreted as an intangible resource, aiding in the process of decreasing vulnerability. The soft security provided by social capital, can enhance or reduce a group's resilience. This may include the degree of cohesion or rivalry that might affect rescue and recovery (Cannon, Rowell, & Twigg, 2000).

As social capital developed into a theory and research proliferated through the latter part of the twentieth century, its influence began to extend to disaster studies. Bolin's work was one of the first disaster studies incorporating the importance of social support during disasters (Barnshaw & Trainor, 2007). Other notable contributions from disaster researchers incorporating social capital theory are Cutter et al. (2003), Cannon et al. (2000), Mathbor (2007), Dynes (2002) and Ronan and Johnston (2005). Missing from disaster literature has been the central role social capital, and more specifically social networks play in disaster mitigation and preparedness. Focus has shifted towards understanding the potential these concepts have for reducing vulnerability and building community disaster resilience (Ersing & Kost, 2011).

Often social capital refers to the processes of bonding and bridging. Bonding social capital on a micro level, relate to specific networks and relationships to which individuals belong (Ersing & Kost, 2011; Mathbor, 2007). Bonding allows for the exchange of information and resources between people in order to reach a shared set of goals. Bridging social capital is formed at the macro level, and used by communities to connect diverse groups beyond the more tight-knit and homogeneous relationships that are often forged through bonding (Ersing & Kost, 2011). Bridging provides opportunities for communities to broaden the scope and variety of resources that can be accessed.

Empirical evidence indicates that vulnerable survivors from Hurricane Katrina used both, bonding and bridging social capital, as part of their evacuation and recovery efforts. Close ties forged through established individual networks provided some low-income individuals with a form of access to shared resources for food and shelter. Close ties enabled successful evacuation for a portion of the population (Ersing & Kost, 2011). Long –term recovery and redevelopment needs are supported through bridging across the communities in order to maximize assets and capital, for example providing access to schools, so that parents and children could establish some form of routine after a disaster (Ersing & Kost, 2011).

Disasters affect social capital on a micro and macro level to various degrees. Firstly, stress reactions following disasters can have an impact on social dynamics. Stress in most instances leads to decreased interaction and isolation, causing increased pressure on social capital. Secondly, a corrosive

community involves disruption of relationships, loss of trust, and decline in reciprocity. This leads to a diminished level of social capital among individuals and the community. Thirdly, lifestyle changes produce stress reactions that affect social capital. Fourthly, distrust confronts beliefs about organizational trustworthiness and reliability as well as feelings of security. When trust in the community is diminished, social capital becomes limited. Finally, secondary trauma puts further stress on already depleted social capital. A cumulative loss of social capital may cause additional secondary trauma (Ritchie & Gill, 2006).

Social capital comes in various forms that may enhance or hinder recovery and include support networks, for example, belonging to a church or other group that in some cases may provide mutual aid in times of hardship. Social ties within the community play a beneficial role in the maintenance of the psychological well-being of people (Kawachi & Berkman, 2001). Political power and the capacity for civil society to develop may determine the character and the quality of the social capital available, which also includes peoples' rights to express needs, and access to preparedness (Cannon et al., 2000).

Mathbor (2007), states that communities that are well trained culturally, socially and psychologically are better prepared and are more efficient in situations where response is required in the aftermath of disasters. Community social capital reduces community distress. Events in the community and larger society affect levels of engagement, trust and reciprocity by supporting or undermining pro-social norms and related social practices. Since conditions improve or deteriorate over time, normative beliefs and practices can be either

frustrated or facilitated. This forms the basis that social capital is not static in nature. The effective use and utilization of social capital in the community are essential in building community and institutional capacities (Mathbor, 2007).

With the selected theories, empirical studies containing social capital theory was the most prevalent compared to structural functionalism, the risk-and-resiliency theory, crisis theory and conservation-of resources-theory. Dwyer, Zoppou, Nielsen, Day, and Roberts (2004) conducted research focused within the Australian context and assessed the role that social capital plays in determining a community's level of social vulnerability. They refer to social capital as the imperceptible elements that increase resilience in everyday lives. Based on their findings, they found that communities with a stronger presence of social capital tend to be more resilient.

Murphy and Dolan (2003) found with a repeated-measures study that a community with a water-borne disease disaster recovered from the impact, due to an increased level of social capital present within the community. Social capital in the community helped the community through the event that paralyzed 2300 of the 5000 residents, with 7 people dying as a result of contaminated water. Communication practices, helping one another and doing volunteer work directly contributed to the community's level of social capital.

A majority of the respondents regarded communication between friends, family, the media and the community as important during the disaster. The information allowed the community to address the situation at hand and to reduce the impact of the water-borne disaster. The community bond led to an increase of resilience.

Two years after the disaster the community proved to have become more resilient due to the event drawing them closer. Mathbor (2007) refers to this phenomenon as trained communities that used a crisis event to strengthen their future response capacity towards a disaster. The community was able to implement community social capital allowing for the reduction of community distress. Murphy and Dolan (2003) illustrate that communities can withstand the impact of a disaster by establishing networks and in doing so, become more resilient.

Yamamura (2008), explored the effect of social capital on structural damage resulting from natural disasters. Prefecture level data for the years between 1988 and 2001 were analyzed with regression analysis. Three significant conclusions regarding the value of social capital were drawn. Firstly, social capital helps communities to reduce disaster damage. Secondly, social capital allows people to be more aware of possible risks in the community and lastly, social capital ensures that communities mobilize and protect revenue sources that might be in danger of a possible disaster.

Doerfel, Lai, and Chewning (2010) assessed how inter-organizational communication and social capital aided with organizational recovery after the catastrophic damage caused by Hurricane Katrina. In-depth interviews conducted, enabled a longitudinal analysis. The analysis included a grounded theory model that illustrated how communication differentiated between the four phases of recovery after a disaster. From this analysis it is clear that

organizations and their systems are fundamentally human, and can be reconstructed through forthcoming action.

Social capital theory within the context of disaster research has shown an increase in empirical investigations. Empirical evidence indicates that social capital plays a role in the response-and-recovery process of a community. Communities with higher levels of resilience are indicative of the presence of higher levels of social capital. This causes a higher sense of response and recovery in the wake of a disaster. Social capital has a linkage with the risk-and-resiliency theory. Both theories underline the value of communities being trained culturally, socially and psychologically. Trained communities are better organized and more efficient in situations where post-disaster response is required (Mathbor, 2007). Social capital edifies the value of networking that, in turn, will strengthen the ties in the community, making community members more resilient towards disasters.

Conservation of Resources Theory

The Conservation of Resources theory (COR) is the fifth theory used to guide this study. This theory is applicable to the study, because it provides a better understanding of actions taken by individuals in disaster situations. In the first instance the theory acknowledges the relatively prominent position of the individual and his immediate environment. Secondly, the COR theory is ecological in nature and the centrality of resources to the theory matches and aligns with the disaster research principles mentioned. Lastly, COR theory has

been successfully applied to a number of disaster studies (Birkmann, 2006; Tierney et al., 2006).

Hobfoll is the father of the conservation of resources theory (Adger et al., 2005; Birkmann, 2005; Crowards, 2000). He has emphasized the importance of equal measure of environmental variables and person-centered variables in the coping process. COR is a motivational stress theory (Adger et al., 2005; Birkmann, 2006; Hobfoll, 2002), with the premise that individuals attempt to obtain, retain, and protect what they value. The basic premise of COR is that individuals strive to conserve the quality and quantity of their resources, and to limit any state that may jeopardize the security of their resources. Mental or physical stress-outcomes develop when an individual's resources are threatened with loss, resources are lost, or the individual fail to gain resources following investments of other resources (Birkmann, 2006). In the short term, negative emotions might be experienced, such as anger, frustration or fear. In the long-term it may lead to severe mental and physical consequences, such as burnout, depression, or heart disease.

COR is sociocultural, distinguishing it from other resource-adaption models. With COR being sociocultural it allows for the integration of the individual nested within a social context (Kawachi & Subramanian, 2006). This process indicates that predictive capacity becomes limited when pieces of the unit are separated without reference to the greater context. Communal assessment is stressed over individual idiographic assessment. Coping with adversity is referred to as a shared and communal process. According to Hobfoll, stress

experienced by the individual originates from his social context and the cultural processes present. Disasters can have a severe impact on the stress-experience of the individual. The social context of the individual plays an important role for the individual and his preservation of resources (Hobfoll, 2002).

Resources, according to Hobfoll, are objective and subjective (Crowards, 2000). It is possible that the majority of resource-items present, would be transcultural. Resource conservation can be traced back as far as Maslow's Theory of Self-Actualization (Mattock, 2005). The premises of self-actualization propose that people seek resources in a hierarchical manner, with basic needs being first, then safety needs, social needs, ego and self-esteem needs, and lastly the need for self-actualization.

The four categories of resources are objects, condition, personal characteristic- and energy resources (Birkmann, 2005). These resources are centrally valued themselves, or they can act as a means to obtain centrally valued ends. These resources are all under risk when the individual is faced with a disaster. Individuals in a vulnerable state are more susceptible to experience risk.

The four categories of resources are interlinked with one another. The first resource is referred to as object resources, which are valued because of their physical nature, or the secondary status value stemming from rarity or expense. Condition resources are the second form of resource, and are valued and sought after by the individual. Condition resources refer to marriage or stable employment. The third resource is personal characteristic resources, which refer

to self-esteem, mastery, hope and optimism of the individual. The last form of resource refers to energy resources and can refer to personal health, adequate income and time spent with loved ones (Hobfoll, 2002). Resources are important for the individual, since they carry face value and define who the individual is. The actual or potential loss of these resources can threaten identity or what is prized, and in doing-so the stress process is initiated (Birkmann, 2006).

Resource Change and Distress

COR theory allows for the investigation of psychosocial resources. This is an important aspect of the theory since disasters are known to have a severe impact on the physical and mental well-being of individuals (Collogan et al., 2004). COR theory within a disaster setting, suggests that people exposed to disaster situations seek to obtain, retain, and protect resources. Stress occurs when resources are threatened with loss, or when individuals are unsuccessful in gaining resources after substantial resource investment.

Investment in resources refers to the means by which individuals cope with or resist the negative effects of stress. Investment practices include resource replacement and seeking disaster assistance. Resource substitution is another option, where a lost resource can be substituted by another, from a different resource domain. For example, a disaster victim experiencing multiple physical health impairment may seek support from family, relatives and friends, or choose different resource substitutions such as increasing alcohol consumption. Adjustment to a situation can be either positive or negative.

Acquiring and managing resources is a central process of COR. The process receives increased awareness and momentum when resources are threatened when an individual is exposed to a disaster situation. Resource loss is central to the stress-experience of the individual. Resource gain is the ability to withstand resource loss. The acquisition of resources allows the individual to be resilient and stress resistant. If the individual is not able to allocate resources he might experience resource loss cycles and experience higher levels of social vulnerability. Resource loss cycles are associated with continued loss that intensifies for the individual as time progresses (Hobfoll, 2002).

Greater levels of vulnerability are experienced by individuals that lack resources. Resource-poor individuals or groups are both vulnerable to resource loss; this situation leads to initial and future loss. Empirical evidence supports this statement where disaster exposure of individuals and groups are investigated. Individuals and groups of a lower socio-economic class, marginalized and occupying dangerous locations, tend to display higher levels of vulnerability (Wisner et al., 2004).

Individuals and groups possessing greater social and personal resources are more stable during stressful events and gain more resources when confronted with a crisis. Gain cycles have a shorter life-span and are less meaningful to individuals, than loss cycles (Kawachi & Subramanian, 2006). Hobfoll (2002) provides empirical evidence for his statement. "*The Loss and Gain Spirals*" indicated by Figure 8, illustrates that an individual or group living in poverty is both vulnerable to a disaster and secondary resource losses. The

individual or group in such a situation might experience a ‘loss spiral’ (Mattock, 2005).

Individuals or groups that are rich in resources are more resilient since they may invest in resources, increasing their capacity to respond. Investment in resources is determination and money after chronic/acute losses that could prevent ‘secondary losses’. Investment may lead to possible ‘secondary gains’ such as optimism. Secondary gains promote a ‘gain spiral’ that empowers the individual and the community with a sense of direction.

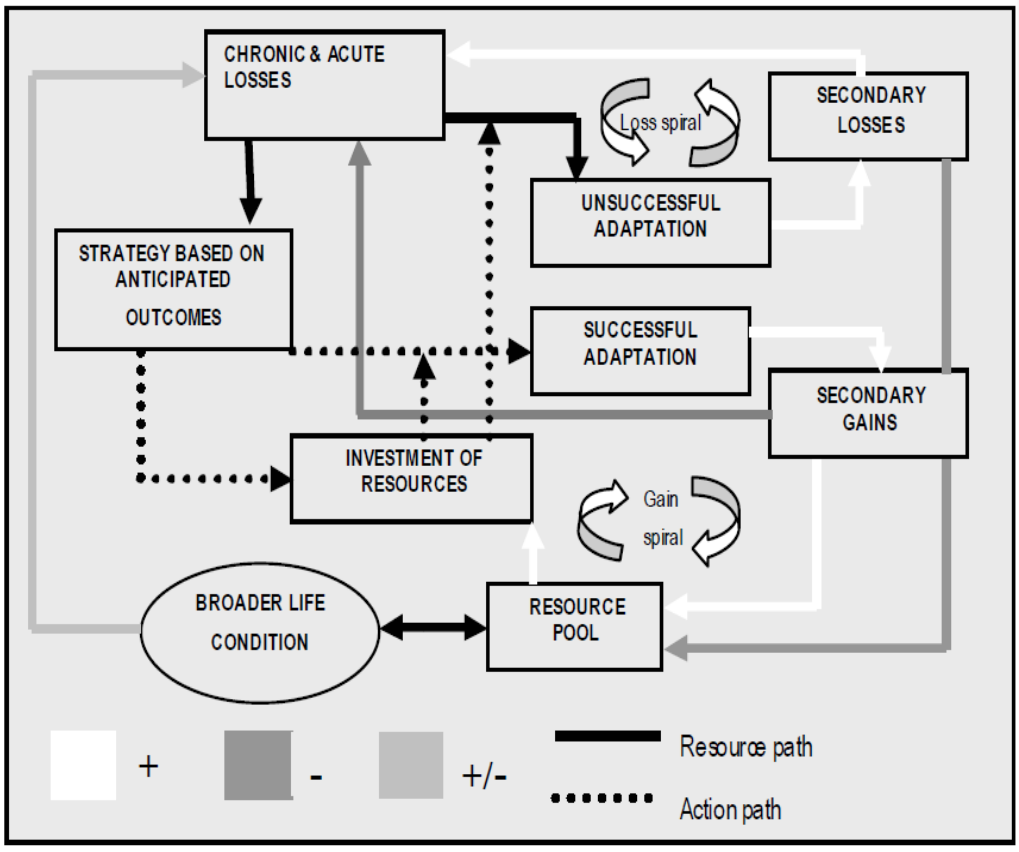


Figure 8. Conservation of Resources Theory

Adapted from “Resource Loss and Psychosocial Distress: An Application of the Conservation of Resources (COR) Model to the 2004 Asian Tsunami in Sri Lanka”. By J.L. Mattock, 2005. Masters of Science, University of Northumbria at Newcastle, Newcastle, United Kingdom.

Disaster research studies support COR theory as a guidance framework. The multitude of studies appraised for the purpose of the literature review, focused on a broad spectrum of disasters. Disaster impacts ranged from Hurricane Katrina; South East Asia Tsunami; Sierra Madre Earthquake and informal settlement fires in Cape Town, South Africa (Ehrlich et al., 2010; Freedy, Saladin, Kilpatrick, Resnick, & Saunders, 1994; Mattock, 2005; Stewart, 2008).

The associated studies indicate that a lack of resources leads to a loss spiral for vulnerable populations exposed to disasters. With the Sierra Madre Earthquake study the COR stress-model allowed for the prediction of psychological distress among individuals with limited resources. Three hypotheses of the study were supported by the findings. The first being, that resource loss is positively associated with psychological distress; secondly, resource loss predicted psychological distress when other predictors were statistically controlled; and lastly, resource loss was associated with mild to moderate elevations of psychological distress. Freedy et al. (1994), indicate that the findings of the study supported the core underpinnings of COR theory.

A repeated-measures study investigating the impact of Hurricane Katrina on the occurrence of depression in individuals indicated that depression was higher among individuals experiencing loss of resources. Results from the study suggest the need for preventive measures aimed at conserving psychosocial resources, in order to reduce the long-term effects of disasters (Ehrlich et al., 2010).

Both the South East Asia and South African studies indicate that the substitution of resources was not possible for individuals and groups affected by the respective disasters. The affected groups were in a vulnerable state before the disasters. Individuals and groups that were not able to substitute resources found themselves in a loss spiral after the disaster. The lack of resources led to several symptoms of distress that were experienced by the exposed population (Mattock, 2005; Stewart, 2008).

Theoretical Discussion

In this section the five theories chosen for investigating the problem statement, are integrated to serve as a guidance framework. The selected theories allow for the identification of variables related to the study, a general framework for data analysis and an essential part in formulating the conceptual framework of the study. The ecological model (Bronfenbrenner, 1990; Paquette & Ryan, 2001) places the five chosen theories within a systemic framework applicable to Louisiana. This is important since the study is multilevel in nature and focuses on both micro and macro aspects, influencing the individual and his level of social vulnerability. The chosen theories allow for a better understanding of vulnerability and resilience as central concepts of the study.

Structural functionalism as a theory is one of the first theories used in disaster research and provides a better understanding on structural aspects related to disasters in Louisiana. Systems that function with structure tend to have a higher level of functioning during times of adversity (Kreps, 1989). The theory is applicable to the study, since it delineates the objective processes

present within communities. Disasters in Louisiana have exposed the lack of structure in systems related to disaster practices (Van Heerden & Bryan, 2007). Hurricane Katrina caused severe disruption to structural functioning on a macro level affecting the micro level in turn (Bates & Swan, 2007). Lack of structure during a disaster on a macro level can cause dysfunction to basic services, needed by individuals in crisis. The lack of basic services results in individuals being in a state of vulnerability (Cannon et al., 2000). For Louisiana as a society to operate optimally, it has to appoint and encourage individuals to occupy the necessary positions in social structure.

Structural functionalism falls within the camp of objectivism. Structural functionalism within the context of the study cannot be separated from social constructionism, which is central to the subjectivist camp. The subjectivist approach is essential to the study since it provides a better understanding of the individual and his experience on a micro level. With the approach of integrating structural functionalism vs. social constructionism, the assessment of objectivism and subjectivism in Louisiana on a macro and micro level, is ensured.

Communities that emphasize the importance of structure and manage it in their immediate environment will ensure that vulnerability is decreased on both a macro and micro level. This can be attributed to the fact that conditions relating to the physical, social, economical and environmental aspects are managed to the advantage of their residents. Providing structure within society will further result in capacity increasing. Higher levels of capacity will ensure that, when

faced with adversity, there will be a management component that takes over to ensure that the community reaches a sense of equilibrium.

The opposite seems to be true for communities that have a lack of structure. Vulnerability will increase on a macro and micro level where structure is absent, resulting in competition among community entities for physical, social, economical and environmental resources. The lack of structure within some sectors in Louisiana results in a lack of resources, causing the already vulnerable to become more vulnerable. The lack of structure seems to be the case in Louisiana, with this state ranking in the bottom fifth for state median incomes, education levels, health, education and quality of life indicators (Social Science Research Council, 2011).

With resilience forming an integral part of the study, the risk-and-resiliency theory is applicable to investigate the problem statement. The theory creates a better understanding as to what factors make an individual and his greater environment resilient. Resilience as a concept is holistic and there are many definitions, resulting in confusion (Birkmann, 2006). With the lack of consensus it is essential that theory related to resilience provides guidance in dissecting the problem statement. With risk and resiliency theory being a meta-theory, it provides a holistic approach to how different macro factors play a role in individuals becoming resilient in Louisiana. The individual nested within a family or household has the ability to transcend resilience to the family or household. The household and family can transfer resilient practices to the community. With the high prevalence of disasters in Louisiana, it is essential that measures are

investigated as to what not only affects micro and macro entities, but also what causes them to be more resilient.

The crisis theory provides insight into the experience of individuals exposed to a crisis situation, such as a disaster. The crisis theory is ideal for investigating the problem statement, since it identifies the processes that cause physical and mental impact among vulnerable individuals exposed to high-risk situations. The crisis theory and risk-and-resiliency theory have similarities. The theories originate on the micro level, making it applicable to the individual exposed to disasters in Louisiana. With the associated exposure to disasters in Louisiana an individual can find themselves in high-risk situations. Crisis theory and risk-and-resiliency theory allow for the identification of symptoms that cause the individual to fall into a state of social vulnerability.

Within the context of Louisiana, the crisis theory is a theory that analyzes the world of the client. From a theoretical standpoint, the theory puts an emphasis on formal written social science theories and empirical data (Payne, 2005). In analyzing social work theories Payne (2005), describes that there are three types of theories namely reflexive-therapeutic, socialist-collectivist and individualist-reformist. The crisis theory and risk-and-resiliency theory have a foundation within all three aforementioned types of theories. Identifying differences between the two theories, the crisis theory stems from modernism, and is mainly problem focused. With the development of crisis intervention from crisis theory there has been a paradigm shift towards post-modernism. The risk and resiliency theory, in turn, stems from post-modernism and strengths

perspective, and is solution- centered, focusing on empowering the individual, family and the community within the context of Louisiana.

The fourth theory guiding the study is social capital theory. This theory is used to investigate network resources during times of disasters. Social capital theory enables the identification of traits that cause systems to be more resilient in the wake of a disaster. The noted empirical investigations in this chapter underlined the value of social capital in helping communities to become more resilient during the post-disaster phase.

For communities in Louisiana to be resilient, it is vital that a presence of social networks, social contacts, social cohesion, social interaction and solidarity exists in the community. The main ingredients of social capital are trust, mutuality and reciprocity. Social capital refers to ties between different layers of groups, wealth and society. These aspects, according to the problem statement, are absent in a number of instances (Bates & Swan, 2007). Such networks are essential in the process of accessing resources, ideas and information from formal institutions beyond the immediate community in Louisiana. If the mentioned assets are present within Louisiana communities, then individuals will tend to be more resilient when exposed to possible high-risk situations, such as disasters.

The conservation-of-resources theory provides the context for a better understanding as to what resources the individual might lose or gain during a disaster. The theory provides a better understanding of the vulnerability-generating processes of marginalized individuals in Louisiana. The lower levels

of living standards in Louisiana do result in a form of “competition for resources” among individuals. This finding is also underlined by structural functionalism theory, where a lack of resources causes the vulnerable to become more vulnerable. A lack of access to physical, social, economic and environmental resources results in a state where vulnerable individuals are in a vicious cycle for survival. This became evident with the Yellow Fever Outbreak of the 1850’s and with Hurricane Katrina, where the vulnerable had limited resources to better their circumstances. COR theory does provide value to the field of disaster research. This, in part, can be attributed to the fact that disaster research has a focus on vulnerability-causing aspects (Birkmann, 2006).

The chosen theories align and provide a theoretical basis for investigating the problem statement of the study. The five theories have social work values and characteristics that provide a foundation for the study. In choosing the theories it is acknowledged that a systemic approach is needed to investigate the problem statement. This resulted in the inclusion of micro and macro level theories that align with disaster research principles. The inclusion of the objective and subjective approach when investigating a problem statement is an important principle in disaster research (Stallings, 1997). In the process of aligning the study with past disaster research studies, it was ensured that the chosen theories have elements of both the objective and subjective factors causing vulnerability to individuals.

Conceptual Framework

The conceptual framework is based on an extensive and holistic literature review on disaster social work-related aspects over the past century. Parish disaster history and objective disaster resilience determine the level of social vulnerability of the individual exposed to disasters in Louisiana between 2004 and 2010. The conceptual framework of the study is shown in Figure 9. The first phase of the conceptual framework relates to disaster history of parishes in Louisiana between 2004 and 2010. The impact and historical significance of disasters in Louisiana are accounted for with this phase of the framework. The historical dimension of disasters should be included in disaster analysis to gain a better understanding of the vulnerability-generating process in a community (Birkmann, 2005). The next phase of the conceptual framework relates to parish disaster history and the objective community resilience predictors in Louisiana parishes from 2004 to 2010. With the individual influenced by his environment, it is important to investigate the aspects in the community that has an influence on his / her level of social vulnerability. Communities maintaining equilibrium and self-organizing skills, when faced with adversity, will be more resilient. Communities with higher resilience levels will have fewer individuals that are vulnerable. The fact that there will be less vulnerable individuals nested within a “resilient” community can be attributed to the fact that there are structures in place that result in more resources, competence and coping capacity to improve the living conditions of individuals in communities. The objective predictors of community disaster resilience are represented as operational resilience and

socio-economic resilience factors. Operational resilience relates to institutional- and infrastructure resilience, and socio-economic resilience relates to social-resilience, economic-resilience and community capital. The outcome variable is represented in the conceptual framework as an imputed weighted score of individual social vulnerability of parish residents.

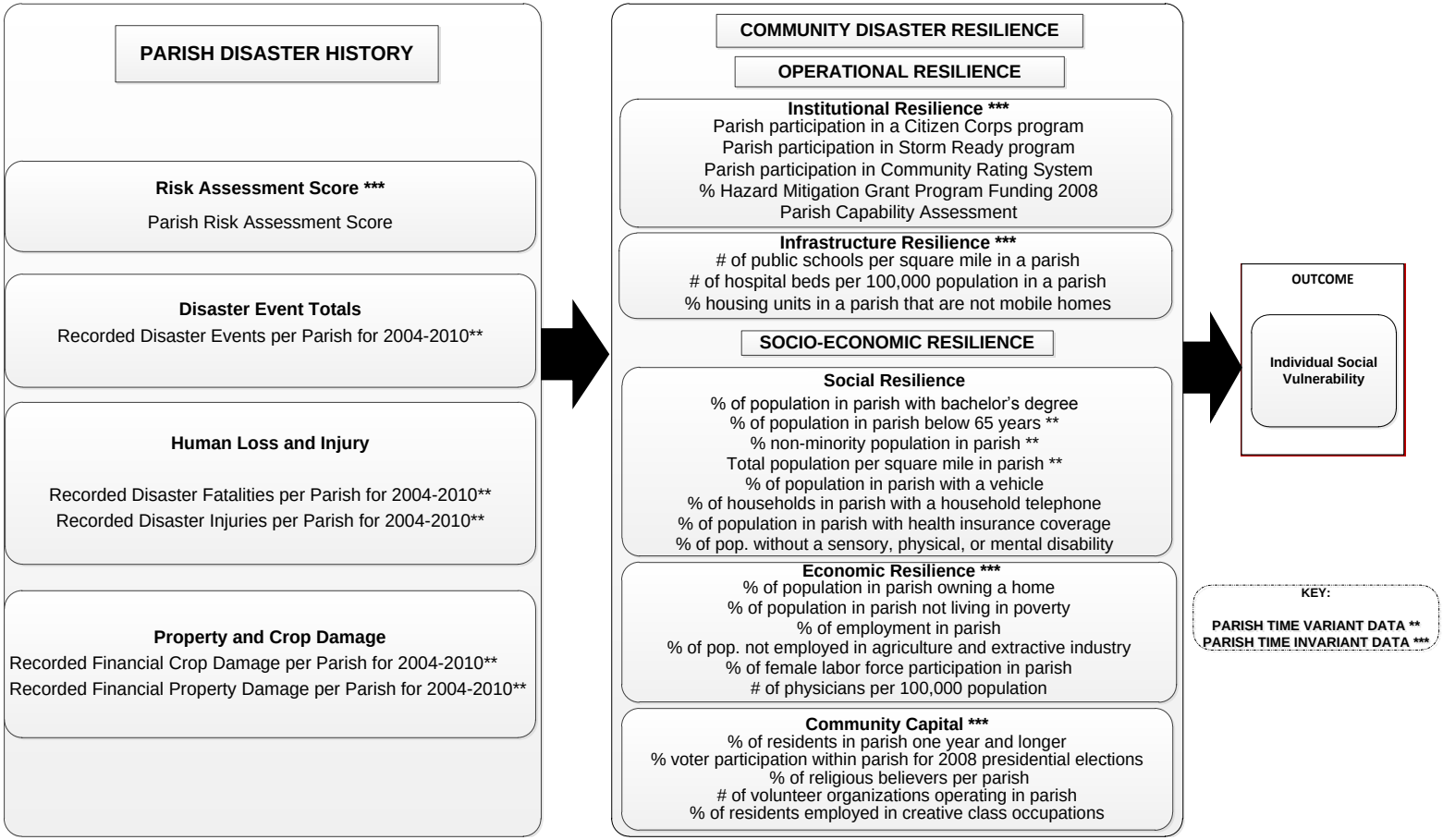


Figure 9. Conceptual framework for determining individual social vulnerability.

Parish Disaster History

Disasters have affected Louisiana for centuries (Governor's Office of Homeland Security & Emergency Preparedness Louisiana, 2008). For the purpose of this study, disaster history data are included in the conceptual model. A number of measures can be used to estimate the comparative vulnerability to natural disasters, based on past historical information. Measures used to conduct this type of assessment include the number of historical disaster events, changes in the macro economy, damage costs, number affected and the number of deaths as a result of the disaster (Crowards, 2000). According to Birkmann (2006), a fundamental question needs to be clarified regarding the role the ecosphere plays on human vulnerability. This question is partially addressed with investigating the predictive role of parish disaster history on the individual, and his level of social vulnerability from 2004 to 2010.

Risk Assessment Score:

Parish Risk Assessment Score: A risk assessment score indicates what level of risk a community might have towards hazards. A higher risk score results in more vulnerability for a parish. People are particularly vulnerable to disasters if they occupy dangerous locations such as river banks, flood plains, reclaimed land and highly populated settlements near airports and industrial areas. Occupation of these areas result in increased vulnerability, and the frequent exposure to hazardous events. Parishes with a higher risk score have a higher prevalence of hazardous events (Myers & Wee, 2005; Wisner et al., 2004).

Disaster Event Totals:

The intensity and severity of disaster events differ on an annual basis. Being able to assess the impact of disasters on an annual basis provides a better understanding as to the extent of a given disaster on the vulnerability levels of an individual. Continued disaster exposure causes severe disruption for individuals, families and communities. Socially vulnerable entities in a state of “normal vulnerability” will be impacted worse by constant disaster exposure. Normal vulnerability is a term used to refer to an individual household, where the annual income is used for covering all basic living expenses. Disaster exposure results in living expenses increasing, due to unaccounted expenditure as a result of the disaster. The extra expenditure result in shortcomings on other basic needs levels, and further increase the vulnerability of the affected (Birkmann, 2005). Specifically, the following variable will be measured under this subcomponent:

Recorded Disaster Events per Parish for 2004 to 2010: This variable assessed the total recorded number of parish disaster events that occurred between 2004 and 2010. The variable provides a better understanding as to how disaster totals influenced the social vulnerability levels of individuals in parishes, for the period 2004 to 2010. Being in a vulnerable state as a result of continued disaster exposure results in an increase in vulnerability for individuals and communities (Myers & Wee, 2005; Norris et al., 2002; Wisner et al., 2004).

Human Loss and Injury:

With the rapid increase in the annual number of fatalities and injuries from disasters, it is important to investigate causes of loss of human life, and injury

(Mileti, 1999). The loss of human life is the ultimate price to pay, when faced with disaster. Fatalities and injuries to people cause social problems for the individual (Myers & Wee, 2005).

Recorded Disaster Fatalities per Parish for 2004-2010: This variable assesses the total number of fatalities resulting from all disasters occurring in a parish from 2004 to 2010. The number of deaths gives an idea of the severity of a disaster, and is an indication of the overall impact of a disaster (Crowards, 2000). A unique stressor in a disaster situation is the exposure to dead bodies. Bodies reflect the violence of a disaster (Myers & Wee, 2005). The death of a family- or household member results in further distress for the individual, since it leads to physical, material, and personal loss for the primary victim. The secondary victims are those who witness the disaster, but not the actual impact. The primary victims are likely to display higher levels of vulnerability than secondary victims exposed to a disaster (Bolin, 1986; Roberts, 2005).

Recorded Disaster Injuries per Parish for 2004-2010: This variable assessed the total number of disaster injuries per parish from 2004 to 2010. Injuries resulting from a disaster can result in psychological problems for the individual. Apart from psychological problems for the individual, there might also be disfigurement and loss of mobility (Bolin, 1986). Disaster injury creates higher levels of social vulnerability for the individual, with daily activities being influenced.

Property and Crop Damage:

The initial damage caused by a natural disaster does not represent the full range of economic consequences, but can be used as a proxy for the overall impact (Crowards, 2000). Property and crop damage resulting from a disaster can cause the already vulnerable individual to “fall” into a state of prolonged vulnerability (Bolin, 1986; Myers & Wee, 2005; Substance Abuse and Mental Health Services Administration, 2012). Property provides stability and structure to communities (Mileti, 1999). The loss of property results in instability for communities, resulting in vulnerability among individuals that are dependent on the particular property structure in a community (Wisner et al., 2004).

In many instances communities are reliant on one source of income, such as agriculture. Agriculture is more prone to extreme climatic events. The United Nations Committee for Development Policy (Crowards, 2000), has identified the loss of agricultural production as a measure of a region’s vulnerability to natural disasters. This happens to be the case in most rural areas (Mileti, 1999). Being dependent on one source of income causes a community to fall into a vulnerable state when faced with disaster (Wisner et al., 2004). The vulnerable state due to crop damage and loss can lead to further complications for the individual in a state of vulnerability. This subcomponent reported the financial impact of disasters on properties and crops within Louisiana parishes. Specifically, the following variables will be measured under this subcomponent:

Recorded Financial Property Damage per Parish for 2004-2010: The variable assessed the monetary value of property damage per parish resulting from all disasters occurring from 2004 to-2010.

Recorded Financial Crop Damage per Parish for 2004-2010: The variable assessed the monetary value of crop damage per parish resulting from all disasters from 2004 to-2010.

Disaster history forms an important part of the study. With the inclusion of parish disaster history data, the impact of disasters on the individual is analyzed more extensively. Data from parish disaster history further allowed for the interpretation of factors that caused certain individuals to experience higher levels of social vulnerability than other individuals nested within Louisiana.

Objective Community Disaster Resilience

The objective community disaster resilience level aims to incorporate the various factors that relate to disaster resilience on a community level within Louisiana. In measuring the objective community disaster resilience relating to the conceptual model, the study will utilize factors relating to *The Community and Regional Resilience Initiative* known as CARRI (Cutter et al., 2008), *Disaster Resilience Indicators for Benchmarking Baseline Conditions* (Cutter et al., 2010), *Measuring Capacities for Community Resilience* (Norris et al., 2008), *Characteristics of a Disaster-Resilient Community* (Twigg, 2007), and the *Disaster Preparedness Index* (Simpson & Katirai, 2006).

The *Community and Regional Resilience Initiative (CARRI)* is a coalition of experts on disaster research from the South Eastern region in the United States (Cutter et al., 2008). The CARRI project included social vulnerability, infrastructure, natural systems and exposure, and hazard mitigation and planning as indicators of community disaster resilience. Disaster resilience has since been redefined from the initial *Community and Regional Resilience Initiative (CARRI)* project according to Cutter et al. (2010). The most recent interpretation on disaster resilience by Cutter et al. (2010) includes Social Resilience, Economic Resilience, Institutional Resilience, Infrastructure Resilience and Community Capital. The FEMA Region IV (*Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina and Tennessee)* analysis focused on the level of disaster resilience in the South Eastern region of the United States and was the first empirical study that included the five resilience variables. Due to the variability of measuring environmental resilience factors it was deemed as non-applicable for inclusion as a subcomponent of disaster resilience. For the purpose of this study community disaster resilience is divided into two main components being operational resilience and socio-economic resilience. Operational resilience within the framework of the study consists of institutional and infrastructure resilience. These two components are closely linked to the disaster management cycle, consisting of traditional emergency management activities. The second component for community disaster resilience is socio-economic resilience consisting of social resilience, economic resilience and community capital. The second component of community disaster resilience is a

social work orientated approach to quantifying community disaster resilience. Accordingly, operational resilience and socio economic resilience are defined:

Operational Resilience

The disaster management cycle is a well-known conceptual model for illustrating the phases associated with a disaster. Disaster resilience research in the past, have mainly focused on activities associated with the disaster management cycle. The disaster management cycle is only one component of the ecological system, as it relates to community disaster resilience. Cutter et al. (2010), have indicated that institutional and infrastructural resilience activities are associated with mitigation, preparedness, response and recovery. Institutional resilience and infrastructure resilience, for the purpose of this study, is defined as operational resilience accordingly:

Institutional Resilience

Institutional resilience as the first subcomponent of operational resilience contains traits related to disaster mitigation and disaster preparedness. This component is a traditional hazard and disaster research component (Cutter et al., 2010). Resilience is influenced by the capacity of communities to mitigate risk, engagement of local residents in local mitigation planning, creation of organizational linkages, and enhancement and protection of social systems within a community. Specifically, the following variables were measured under this subcomponent:

Parish participation in a Citizen Corps program: The Federal Emergency Management Agency encourages all Councils and Community

Emergency Response Team (CERT) programs to register with the new National Citizen Corps Council and CERT Program registries. Individuals covered by the Citizen Corps program increase institutional resilience within communities. Individuals in communities where there is a low level of community participation in programs such as the CERT program, can cause higher levels of vulnerability (Phongsavan, Chey, Bauman, Brooks, & Silove, 2006). The variable assesses participation in the CERT program (Godschalk, 2003; Simpson & Katirai, 2006).

Parish participation in Storm Ready program: Communities participating in the Storm Ready program will have higher levels of institutional resilience. This is achieved by increasing communities' levels of capacity and awareness towards severe weather conditions (Godschalk, 2003). Having lower levels of trust and feeling unsafe is associated with higher levels of individual vulnerability (Phongsavan et al., 2006). Communities that are participating in the Storm Ready program can provide a greater sense of safety to its residents.

Parish participation in Community Rating System: The *Community Rating System* recognizes and encourages community floodplain management activities that exceed the minimum National Flood Insurance Program requirements. Communities participating in the Community Rating System will have a higher sense of preparedness and response compared to communities who do not partake in the program (Simpson & Katirai, 2006). Individuals in communities where there is a low level of community participation in programs such as the CRS program can cause higher levels of individual vulnerability (Phongsavan et al., 2006).

Percentage of State Hazard Mitigation Grant Program funding allocation for 2008: The Federal Emergency Management Agency's Hazard Mitigation Grant Program (HMGP) provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters. Communities that participate in mitigation activities are deemed to be better prepared for a disaster situation (Simpson & Katirai, 2006). Individuals in communities where there is a lower sense of safety and security in programs such as the Hazard Mitigation Grant Program, can experience higher levels of mental health risk (Phongsavan et al., 2006). The variable assesses the statewide percentages allocated from the 2008 budget to parishes in Louisiana. Data were only available for the 2008 financial year.

Parish Capability Assessment: Parishes with a capability assessment integrated into their local hazard mitigation plan will have a better sense of their ability to respond and recover from a disaster situation. Being able to understand your capabilities in times of adversity can increase competence towards disasters, and provide a sense of security for individuals residing in the community. Having higher levels of trust and feeling safe are consistently associated with lower levels of individual vulnerability (Phongsavan et al., 2006).

Infrastructure Resilience

Infrastructure resilience is the second subcomponent of operational resilience, and is quantified as the response and recovery capacity of a community in the wake of a disaster. Infrastructure indicators provide an

assessment of the amount of property that may be vulnerable to sustaining damage, and likely economic losses. Specifically, the following variables were measured under this subcomponent:

Percentage housing units in a parish that are not mobile homes: Mobile homes are more vulnerable than built homes. If a community has a high number of mobile homes, it is more susceptible to the impact of a disaster and therefore the presence of more built homes would minimize the damage of a disaster impact (Cutter et al., 2003). Housing has been studied in relation to mental health. Building types appear to correlate with social vulnerability and individual features of a structure (Evans, Wells, & Moch, 2003).

Number of hospital beds per 100,000 population in a parish: The number of available hospital beds within a community is essential. This seems to be the case during a disaster, where long-term health effects might not initially be known (Auf der Heide & Scanlon, 2007). Access to health services post-disaster can ensure that the individual receives the needed attention, limiting possible health problems that causes an increase in vulnerability for the individual (Krol et al., 2009).

Number of public schools per square mile in a parish: This variable assessed the number of public schools present within a community. Schools are an excellent source for distribution of information to learners and their immediate family members. From an infrastructural level, schools are great resources for housing incident command centers, and can be utilized as shelters when needed. Communities that are able to re-establish immediate school service in a

post-disaster situation will provide a higher sense of normality. Normality is associated with a sense of security for the individual, minimizing the effects of individual vulnerability (Phongsavan et al., 2006; Ronan & Johnston, 2005).

Socio-Economic Resilience

Socio-economic resilience is the social, economic and community capacities that affect people's ability to respond to external stressors such as a disaster. Accordingly, social resilience, economic resilience and community capital are presented as the three subcomponents of socio-economic resilience for the study. The three subcomponents are presented as follows:

Social Resilience

The first subcomponent of socio-economic resilience is social resilience. Social resilience is incorporated from the disaster resilience index by Cutter et al. (2010). Social resilience captures the variance of social capacity within and between communities. Specifically, the following variables will be measured under this subcomponent:

Percentage of population in parish with bachelor degree: Research studies indicate that people with a post-secondary degree will be able to recover faster from the impact of a disaster. They have higher levels of income and cash reserves compared to people of a lower socio-economic class (Morrow, 2008; Norris et al., 2008). The ability to recover faster from a disaster can ensure that the individual has lower levels of social vulnerability post-disaster (Bolin, 1986; Ehrenreich & McQuaide, 2001).

Percentage of population in parish below 65 years: Higher percentages of older adults in a community can result in a higher level of vulnerability. Older adults are faced with various issues, including their level of mobility and overall health (Ehrenreich & McQuaide, 2001; Morrow, 2008). This variable assessed the percentage of people below age 65.

Percentage non-minority population in parish: Belonging to a minority race can cause groups and individuals from the minority race to be more vulnerable when faced with disaster. This can be attributed to political and social processes that marginalize certain groups (Bates & Swan, 2007; Cutter et al., 2003).

Total population per square mile in parish: Areas with higher numbers of people per square mile are able to rely on a wider variety of essential resources and services. Areas with lower numbers of people per square mile are more likely to reside where services and resources are limited. When faced with disaster, individuals and groups in lower populated areas are more likely to be in a state of vulnerability (Mileti, 1999).

Percentage of population in parish with access to a vehicle: Transportation is essential in times of disaster. Having access to own transport allows for people to leave an area pre- and post- disaster, to avert possible harm (Tierney, 2009). Social vulnerability can increase if the individual is not able to evacuate a disaster area in time.

Percentage of households in parish with a household telephone: Communication is essential and can reduce distress levels, if the correct

information is received (Norris, 2009). Having access to a landline telephone or a cellphone can ensure people receive disaster alert communication in time and keep them updated about a disaster situation when needed (Colten, Kates, & Laska, 2008).

Percentage of population in parish with health insurance coverage: Having health insurance coverage decreases the level of social vulnerability and distress among individuals (Ehrenreich & McQuaide, 2001; H. John Heinz III Center for Science Economics, 2002).

Percentage of population in parish without a sensory, physical, or mental disability: This variable focuses on the percentage of people without a sensory, physical, or mental disability. People with some form of a sensory, physical or mental disability may experience increased social vulnerability. Disabled individuals are more likely to experience marginalization, isolation, and "secondary victimization." They are at greater risk of post-disaster malnutrition, infectious diseases (e.g., in a shelter situation), and of the effects of lack of adequate health care (Ehrenreich & McQuaide, 2001).

Economic Resilience

The second subcomponent is economic resilience. This subcomponent measures the economic strength of communities. From an empirical study conducted on Mississippi, economic resilience was regarded as being essential to a community's ability to recover and self-organize from a disaster (Norris et al., 2008).

Sector employment dependence provides a measure of whether the local economic base is more resilient, or largely based on a single sector such as agriculture or fishing, causing the community to be less resilient. In the context of disasters affecting Louisiana, it can be deemed that a number of communities are at a constant risk due to their livelihoods revolving around single sectors being either fisheries or tourism (Pagnamenta, 2010). Specifically, the following variables were measured under this subcomponent:

Percentage of population in parish owning a home: Individuals owning their residence are more likely to have a higher level of economic resilience than individuals renting property. Renters are more socially vulnerable, due to the possibility of being without a residence when affected by a disaster (Cutter et al., 2008; Cutter et al., 2003).

Percentage of population in parish not living in poverty: This variable measures the inverse of poverty. People living above the poverty median are regarded as being less vulnerable than those who are living in poverty. Living above the poverty line will allow access to more resources post-disaster and a faster process of disaster recovery will be ensured. Individuals living in poverty are more likely to be in a state of social vulnerability (Bolin, 1986; Cannon, 2000; Ehrenreich & McQuaide, 2001; Wisner et al., 2004).

Percentage of employment in parish: The higher the percentage of people employed within a community the more likely they are to withstand and recover from the impact of a disaster on a financial level. For unemployed individuals, a lack of income results in social vulnerability being increased.

Disaster situations can exacerbate social vulnerability for the unemployed individual. Unemployment will require external resources to be utilized in order to move from a state of vulnerability (Bolin, 1986; Myers & Wee, 2005; Tierney, 2009).

Percentage of population in parish not employed in farming, fishing, forestry, and extractive industries: Communities that are dependent on more than one sector of employment are more likely to withstand the impact of a disaster. Individuals in communities with only one sector level of employment are more likely to experience a higher level of social vulnerability. This is attributed to a loss of income when a disaster impacts the community (Adger, 2000; Berke & Campanella, 2006).

Percentage of female labor force participation in parish: A higher level of female employment within a community, leads to higher levels of economic resilience. Females are regarded as the “back bone” of an economy (National Research Council (NRC), 2006).

Number of physicians per 100,000 population: The number of physicians within a community can determine health access for people affected by a disaster. Limited access to physicians results in a lack of essential health services. The lack of essential health services post-disaster, leads to increased physical and mental health problems. Lack of access to health services for the individual causes the development of more severe health disorders. The more physicians available, the higher the accessibility to health services will be (Krol et al., 2009; Norris et al., 2008).

Community Capital

The final sub component of socio-economic resilience is community capital. This component encapsulates the relationships that exist between individuals and their larger neighborhoods and communities. Cutter et al. (2010) aim to include three essential dimensions of social capital on the community level: the sense of community, place attachment, and citizen participation. Community bonding is the concern for community issues, respect for and service to others, and a sense of connection (Norris et al. 2008). Specifically the following variables will be measured under this sub-component:

Percentage population residing in parish one year and longer: Being familiar with your environment and knowing what to expect from your environment result in an increase in community capital. Residing in the same area for a given period can allow for the individual to become accustomed to local disaster occurrence patterns. Individuals less familiar with their environment are more socially vulnerable. Residing in a particular area for longer than a year will allow the individual to be familiar with his immediate environment and the customs of the community (Mathbor, 2007; Phongsavan et al., 2006; Warfa et al., 2012). Indigenous knowledge relating to your community will also ensure that community capital is increased (Vale & Campanella, 2005).

Voter participation within parish for 2008 presidential elections: Being able to make a decision as to who should make political decisions in a community, is essential for building community capital. Political engagement by means of voting ensures a higher sense of community competence. Community

competence can ensure that residents are safe from danger and harm in their environment. Individuals with a sense of safety will have lower levels of social vulnerability (Cannon et al., 2000; Morrow, 2008; Norris et al., 2008; Phongsavan et al., 2006).

Percentage of religious believers per parish: Religious worshipers in communities are able to establish stronger social networks within their community (Morrow, 2008; Murphy & Dolan, 2003). Individuals practicing religion will have lower levels of distress when faced by a high-risk situation (Myers & Wee, 2005; Roberts, 2005). The percentage of people in a parish practicing religious beliefs will be measured.

Number of volunteer organizations operating in parish: Community engagement by non-governmental, community based organizations and Volunteer groups ensure for a greater sense of community. These organizations can attend to, and address the needs of community members. By establishing various community-based programs, community members are better prepared in case of a disaster (Morrow, 2008; Murphy & Dolan, 2003). This variable assesses the number of non-governmental, community based organizations and volunteer groups present within a parish. More socially vulnerable individuals will be found in communities where there is a low level of community participation in programs aimed at civic engagement (Phongsavan et al., 2006).

Percentage population employed in creative class occupations: People within the creative class occupation, will increase community capital within their respective communities. Creative class refers to occupations focusing

on science, engineering, education, computer programming, and research, with arts, design, and media workers forming a small subset of the occupation pool for creative class. Innovative people and their skills allow them to be adaptable to their environment and make contributions that are essential for community development and progression (Norris et al., 2008). Being employed in a creative class can ensure a faster return to normalcy post-disaster, limiting the possibility of being in a state of social vulnerability.

Outcome: Individual Social Vulnerability

The outcome variable for the study is *Individual Social Vulnerability*. The concept of social vulnerability has received a lot of attention over the past decade, partly due to the fact that there has been a significant increase in disaster-related impact on vulnerable populations (Cannon, 2000; Cannon et al., 2000; Cutter et al., 2003; Dwyer et al., 2004; Norris et al., 2002; Wisner et al., 2004). Parish Disaster History and Objective Community Disaster Resilience predictors are set to determine the outcome variable of the study. The individual social vulnerability of individuals nested in Louisiana parishes affected by disasters from 2004 to 2010, is the designated outcome variable for the study. Individual social vulnerability for the study consists of a holistic approach and incorporates the work done by Cannon et al. (2000), Cutter, Boruff and Shirley (2003), Dwyer et al. (2004) and Roberts (2005). Individual social vulnerability relates to the Social Vulnerability Index (SoVi) developed by Cutter et al. (2003). The proposed outcome variable for individual social vulnerability further aligns with the work done by Cannon et al. (2000). Their approach to individual social

vulnerability consists of well-being, livelihood, self-protection, societal protection and social support indicators (Cannon et al, 2000). Individual social vulnerability for the purpose of the study incorporates a demographic subcomponent that focuses on demographic information of the individual that is derived from the SoVi. The imputed weighted outcome variable excludes self-protection due to the complexity in measuring the variable. The five subcomponents of the outcome variable are applicable to the study and are measured as follows:

Demographics

The first sub-component relating to subjective individual social vulnerability is demographics. Within this sub-component the core of the Social Vulnerability Index (SoVi ®) is included. The SoVi ® was developed by Cutter et al. (2003). The first application of the index was administered among all the counties within the United States. The index synthesizes 31 socio-economic variables. For the purpose of the study the SoVi ® is adapted from a macro to a micro focus. The SoVi ® has been administered to different communities since 2000. With the 2005 to 2009 analysis of the SoVi ®, seven significant components explained 69% of the variance in the data. The seven components are race, extreme wealth, elderly residents, ethnicity, care-dependent females and service industry employment. At a national level, over 20% of counties within the United States are deemed to be socially vulnerable (Hazards and Vulnerability Research Instititute, 2011). The demographics subcomponent provides an overview of the demographic characteristics present within Louisiana

parishes. Specifically, the following variables will be measured under this sub-component:

Belonging to a minority race: Race can be a factor in the degree of social protection an individual might receive during a disaster. With Hurricane Katrina some individuals were marginalized and experienced an increase in their individual vulnerability. This is a direct result of race, and was a direct cause of higher levels of social vulnerability (Bates & Swan, 2007; Curtis, Warren Mills, & Leitner, 2009).

Older than 65 years: Adults above the age of 65 are deemed more vulnerable and susceptible to the impact of a disaster (Cutter et al., 2003).

Female: Females are more vulnerable and susceptible to the impact of a disaster. Vulnerability is increased if they are not supported by employment or a household structure. Lack of employment and household structure cause females to be more socially vulnerable towards the impact of a disaster (Cutter et al., 2003; Myers & Wee, 2005; Wisner et al., 2004).

Presence of children in household: In the event of a disaster, many parents' first concern is the well-being of their children. Exposure of children to high-risk situations causes distress for adults, and higher levels of social vulnerability (Myers & Wee, 2005). Taking care of children during a disaster is an extra burden on the individual, and affects his/her personal well-being (Cutter et al., 2003).

High School Diploma: Empirical evidence shows that having less than a 12th grade education can cause an individual to be vulnerable towards the impact of a disaster (Cutter et al., 2003; Wisner et al., 2004).

Livelihood

The capacity and ability of the individual to reinstate a livelihood pattern in the aftermath of a disaster form the core of the second component. Livelihood includes factors such as continued employment, financial position and social context (Cannon, 2000).

Exposure to a disaster may result in a lower degree of livelihood security for the individual, post-disaster. In many instances financial backup to recover from the event might not be sufficient. The impact of a disaster is detrimental, with people lacking sufficient funds to recover from adversity. Loss of employment and livelihood as a result of a disaster create social vulnerability for the individual (Bolin, 1986; Myers & Wee, 2005). Specifically, the variable associated with livelihood is described under this subcomponent as:

Household income level below $50 000: The state or condition of having little or no money, goods, or means of support. Being poor causes a person to be in a vulnerable position. During times of distress the individual lapses further into vulnerability. Empirical evidence suggests poverty causes physically- and mentally-associated problems (Carter-Pokras, Zambrana, Mora, & Aaby, 2009; Curtis et al., 2009; Wisner et al., 2004).

Social Support

Social support is an element, having a strong relation to the broader and more intangible indicators of individual social vulnerability. Events in the community and larger society affect the levels of engagement, trust and reciprocity. Since conditions can improve or deteriorate over time, normative beliefs and practices are frustrated or facilitated. Social support is therefore not static in nature. The ability to receive social and emotional support from an immediate network, improves the level of social support of the individual. Higher emotional and social support result in lower levels of social vulnerability for the individual when faced with adversity (Ersing & Kost, 2011; Phongsavan et al., 2006). Specifically, the variable associated with the social support sub-component is described as:

Living alone: Individuals living alone are more vulnerable when faced with adversity. Not being able to rely on immediate assistance during times of crisis causes individuals living alone, to be more susceptible to possible harm (Cannon, 2000; Cannon et al., 2000; Cutter et al., 2003).

Societal Protection

The fourth sub-component relating to individual social vulnerability is societal protection. Societal protection is the degree to which the individual feels the societal sphere is providing security for his/her needs. In this study, the focus is primarily on how a lack of health needs can result in vulnerability for the individual. The ability or willingness of social and political structures to provide protection against health disparities in the form of providing health services can

be referred to as societal protection (Cannon, 2000; Cannon et al., 2000; Robinson, 1996; Warfa et al., 2012; Wisner et al., 2004). Specifically, the variables associated with the societal protection subcomponent described as ***Health Care Access*** include the following subcomponents:

Not having health coverage: Individuals who do not have any form of health-care during time of disaster might experience a higher degree of individual vulnerability. Vulnerable populations should be able to receive some form of health-care, to ensure that their mental- and physical health is maintained (Curtis et al., 2009; Krol et al., 2009).

Not having access to a primary care physician: Having access to a trusted primary care physician ensures the individual has a trusted relationship. Familiarity with a health-care provider allows the individual to receive medical assistance during time of disaster (Robinson, 1996).

Well-Being

Well-being assesses the health status of the individual. For the purpose of this study, well-being relates to physical and mental health status. Physical health status is indicative of the individual's capacity to cope with illness and certain types of injury, resulting from a disastrous event. Well-being specifically includes variables relating to general self-rated health and mental health status (Roberts, 2005). Respiratory and circulatory problems were most prevalent among disaster survivors of Hurricane Katrina. The disaster actually exacerbated some of the symptoms already experienced by individuals (Krol et al., 2009). Lower levels of well-being cause mental health disorders for the individual, with

disaster situations exacerbating distress (Curtis et al., 2009). Specifically, the variables under this subcomponent are:

Self-rated health status: Self-rated health status is related to the physical health status of an individual and his subjective interpretation of his health condition. Individuals with a higher level of general health are less likely to experience physical health problems when faced by a high-risk situation (Myers & Wee, 2005; Roberts, 2005).

Self-rated mental health status: Self-rated health status focuses on the mental health status of an individual, and his subjective interpretation of his mental health condition. Individuals with lower levels of self-rated mental health are more susceptible and socially vulnerable when they are exposed to disasters. Exposure to a disaster event causes further exacerbation of health problems for individuals in a state of social vulnerability (Myers & Wee, 2005; Roberts, 2005).

Summary and Conclusion

In summary, the narrative presented is replete with literature related to the predictors of the study and the outcome variable. There is a lack of consensus and evidence on factors related to the social vulnerability of individuals nested within a system. The lack of consensus and evidence represent the gaps in knowledge that this dissertation aims to address. Individuals displaying lower levels of social vulnerability are considered to have coping measures in place. The coping measures ensure “self-organizing” to be fostered when faced with disaster situations. Identifying and underlining specific coping characteristics

resulting in lower levels of vulnerability adds value to the field of social work disaster research.

CHAPTER III: METHODOLOGY

This chapter provides a detailed discussion of the methodology applied to the study. The methodology employed in this study is determined by the research questions, hypotheses and the most probable manner of obtaining appropriate data. As identified in disaster literature there is currently a need for Hierarchal Linear Modeling (HLM), or multilevel modeling known as HLM. Multilevel modeling is an extremely powerful statistical analysis that has gained prominence over the past three decades within the social science arena.

Multilevel modeling is described as lower-level units that are contained within higher-level units, such as individuals nested within families, within neighborhoods and societies (Luke, 2004). The National Institute of Health has stressed the need for integrating social science research into interdisciplinary, multilevel studies (Luke, 2004). The goal of the multilevel model is to predict values of a dependent variable based on a function of predictor variables, at more than one level (Luke, 2004).The simplest argument for implementing multilevel modeling techniques with this study is that disaster resilience is multilevel in nature, and consists of more than one level within a system. Within the context of disaster resilience an entity can be found to be nested within multiple systems. This creates the need to use theories and analytical techniques that are also multilevel. The focus of disaster in the past has primarily been on

one level of analyses only, either being the individual or the community level, but not combined within one analysis.

Research Goal and Hypotheses

The purpose of the study is to develop an understanding of the factors that predict social vulnerability among individuals exposed to disasters in the state of Louisiana. More specifically, the study tests a conceptual model integrating the work of Cutter et al. (2003, 2010), Simpson and Katiria (2006), Twigg (2007) Ronan and Johnston (2005), Dwyer et al. (2004), Cannon et al. (2000), and Roberts (2005).

The model investigates the predictive ability of parish disaster history and objective community disaster resilience indicators in Louisiana, in order to predict individual social vulnerability levels for Louisiana residents from 2004 to 2010.

Specific Aim 1: To determine if the parishes in Louisiana have different levels of individual social vulnerability.

H_1= Parishes in Louisiana have different levels of individual social vulnerability, with some parishes having more individual social vulnerability than others.

Specific Aim 2: To determine if the parishes change differently in their individual social vulnerability over a period of seven years.

H_2= Louisiana parishes change differently in their levels of individual social vulnerability over a period of seven years, with some parishes where individual social vulnerability improve, and other parishes where individual social vulnerability decrease or not change at all.

Specific Aim 3: To determine what the most important parish disaster history events and community disaster resilience factors are that predict individual social vulnerability within and between Louisiana parishes over a seven-year period.

H_3= Some parish disaster history events and community disaster resilience factors will be more important in predicting individual social vulnerability in Louisiana parishes over a seven-year period, than others.

Research Design

The research design for the study is a multilevel repeated cross-sectional design with a three level nested structure. Being a trend study, secondary data were utilized for seven different yearly (2004-2010) cohorts gathered from the *Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System.* Trend studies investigate changes within some general population over time (Rubin & Babbie, 2011). A trend study is used to answer the following question: *Do parishes improve or deteriorate in terms of their individual social vulnerability levels after exposure to disasters over a period of seven years?* Individual differences cannot be investigated over time with this design, as different samples are investigated at the various measurement occasions. Therefore, the focus was on changes at the yearly cohort level, investigating the profiles of the different cohort groups, and how these profiles changed over time within different parishes, together with some possible explanations for these differences.

The study is multilevel, since it included data at the individual level *(level 1)*, nested within cohorts over a seven-year period *(level 2)*, and nested within

parishes *(level 3)*. The multilevel structures and classifications for this study are shown in Figure 10.

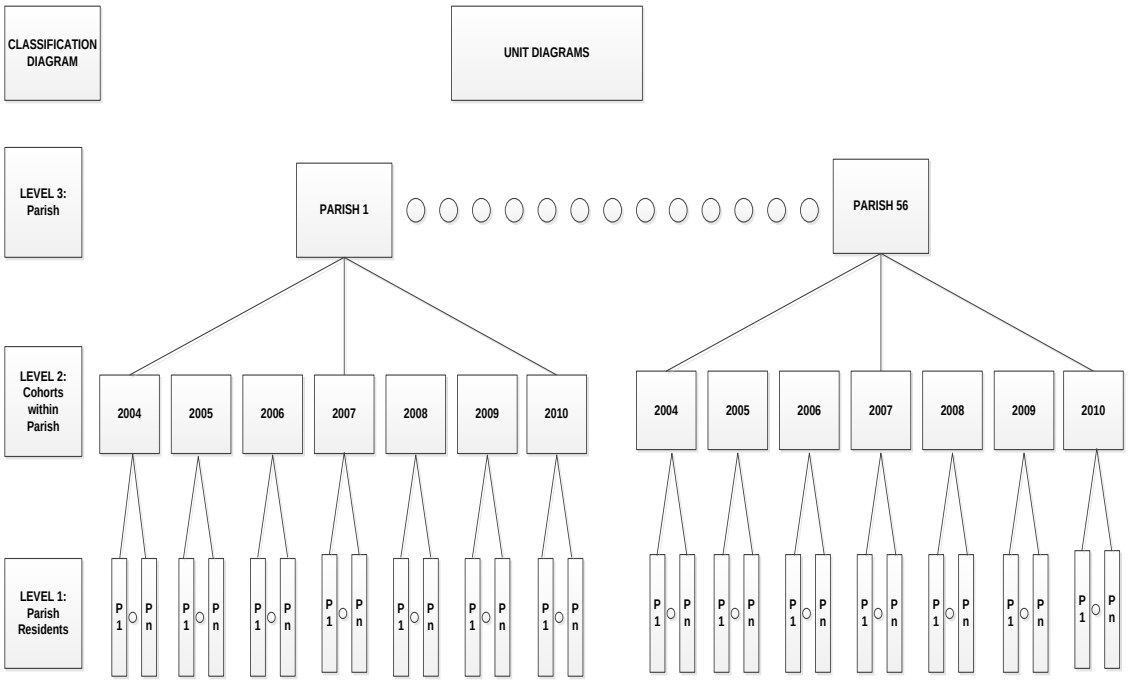


Figure 10. Multilevel structures and classifications.

Threats and limitations related to the design of the study were acknowledged. Random errors might occur, since scores could be affected by the random fluctuations in how each participant felt on any given day when participating in the telephone survey. Threats to internal validity for this study include history and maturation. Threats to internal validity were controlled for.

Data Source

The data used in this study were derived from a combination of national secondary data sources. Individual data (***level 1***) was collected from the Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS) survey for years 2004-2010. Being the world's largest, ongoing

telephone health survey system, the BRFSS has been tracking health conditions and risk behaviors in the United States yearly, since 1984. Currently, data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands, and Guam.

Cohorts within parishes' data were based on yearly estimates relating to parish cohort data ***(level 2)***; data used were for 2004-2010 for the state of Louisiana. Level two data for the study focused on disaster occurrences in parishes and included socio-economic resilience indicators. Disaster history data were gathered from the National Climatic Data Center (NCDC) and the Louisiana State Hazard Mitigation Plan for 2008. The National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) maintains the world's largest climate data archive. NCDC provides climatological services and data to every sector of the United States economy, and to users worldwide. Parish disaster history data from NCDC focus on natural hazard event types such as thunderstorms, hurricanes, floods and tornados. For each event, the database includes the beginning date, location (parish and state), property losses, crop losses, injuries, and fatalities that had an effect on each parish. Data related to age and race for 2004-2010 were collected from the American Community Survey.

Parish level data ***(level 3)*** included data collected from the U.S. Census's American Community Fact Finder, County Business Patterns, FEMA, Citizen Corps, City and County Data book, Louisiana VOAD, National Atlas, Public

Broadcast Data Base, Storm Ready, HAZUS-MH, County Health Ranking and USDA Economic Research Service. All estimates were based on data from 2010.

Sample

The data for this study represents a stratified random sample of 34,685 individuals that have been affected by disasters from 2004 to 2010, representing (296) parish cohorts over the seven-year study period. Inclusion criteria for the BRFSS Annual Survey were that people had to live in one of the 56 parishes in the sample and had to have access to a landline telephone. Parishes that were not included in the study were Caldwell, Cameron, East Carroll, Madison, Red River, St. Helena, Tensas and West Carroll.

Power

The power of statistical tests normally rests on sample size and additional design aspects, namely effect size or, more generally, parameter values, and on the level of significance (Snijders, 2005). With multilevel modeling, it is imperative that statistical power is addressed on all levels. Statistical power issues in multilevel modeling can be complicated as the power varies for fixed effects versus random effects as a function of effect size, intra-class correlation, and the number of groups and cases per group (Cohen, Cohen, West, & Aiken, 2003; Soper, 2011).

Simulation studies (Kreft & De Leeuw, 1998) suggest that large samples are needed for adequate power in multilevel models, and the number of individuals included is more powerful than the number of measurement occasions per individual. Power for level 1 was based on the amount of

individuals (34,685), power for level 2 on the number of parish cohorts (296) and power for level 3 on the number of parishes (56). Snijders (2005) states that it is preferable to have as many possible units at the top level of a multilevel hierarchy, with a minimum of 20 units recommended (Kreft & De Leeuw, 1998). In the case of this study, there were 56 parishes, showing enough power to detect cross-level interactions.

The significance level for the study was set at 0.05 and the intra-class correlation at a small size of 0.05. This small size is recommended for health and mental health research (Spybrook, Raudenbush, Liu, Congdon, & Martínez, 2008). The aim was to detect at least a medium effect size (0.4) and achieve at least 80% power with this model.

Operationalization of Variables

The conceptual model previously illustrated in Figure 9 includes a range of independent variables as predictors that were selected based on an extensive review of disaster literature.

Outcome Variable: Individual Social Vulnerability

The outcome variable was measured on Level 1, and includes indicators of individual social vulnerability. It is a weighted score for individual social vulnerability derived by means of confirmatory factor analysis. This form of analysis is appropriate since it describes variability among observed, correlated variables in terms of a potentially lower number of unobserved variables, called factors. A unifactor subscale confirmatory factor analysis (CFA), using AMOS 20 (Arbuckle, 2011), was done to determine individual social vulnerability. The focus

here was on developing a social vulnerability score for residents of the 56 parishes in Louisiana, measured for the period 2004 to 2010.

This type of interdependent analysis is mostly used in the development of measurement instruments. With factor analysis, a large sample of more than 200 is required (Meyers, Gamst, & Guarino, 2006). The sample of this study fulfilled this requirement with a sample size of 34,685 individuals.

Questions related to individual social vulnerability was taken from the Behavioral Risk Factor Surveillance System questionnaire. Five indicators consisting of a number of variables were reduced into a single factor, namely individual social vulnerability. The factor analysis indicators include demographics, livelihood, social support, societal protection, and well-being. Individual social vulnerability was eventually classified as not at all vulnerable, some vulnerability, and vulnerable.

Based on theory, each selected item would have a nonzero loading on the indicators it was designed to measure, and zero loadings on all other factors. It was further hypothesized that all five indicators chosen would be correlated, and that the error terms associated with the item measurements would be uncorrelated (Brown, 2006; Byrne, 2010). Model evaluation was done by first reviewing the parameter estimates in terms of their feasibility, appropriateness of their standard errors, and their statistical significance. The model as a whole was assessed with a range of goodness-of-fit statistics as recommended by (Byrne, 2010) and shown in Table 1.

Table 1

Goodness-of-Fit Statistics used to Evaluate Model

Goodness-of-Fit Statistics	Criteria for good-fit	Reference	Explanation of Statistic
CMIN/DF	Below 3	Klein, 1998	Chi-square/df
CFI	Close to 0.95	Byrne, 2010	Similar to the Goodness-of-Fit Index, taking sample size into account
RMSEA	Equal or below 0.6	Hu & Bentler, 1999	The root mean square error of approximation

Table 2 indicates which standardized measures were used in developing the criterion variable for the study. Each of the items mentioned in table 2 was assigned a value of 0 or 1. Vulnerability items were assigned a score of 1. The first indicator for individual social vulnerability is demographics. *Demographics* consist of belonging to a minority race, being older than 65 years, female, the presence of children in the household, and having a high school diploma only. *Livelihood* consists of household income level below $50,000 per year. *Social support* consists of living alone. *Societal protection* consists of not having health coverage and not having access to a primary care physician. *Well-being* items consist of self-rated health status and self-rated mental health status.

Table 2

Outcome variable (Level 1)

Variable	Operationalization	Values used in analysis
	Individual Social Vulnerability	
Demographics	Belonging to a minority race	0- Not belonging to a minority race 1- Belonging to a minority race
	Older than 65 years	0 – Younger than 65 years 1- Older than 65 years
	Female	0 – Male 1- Female
	Presence of children in household	0- No children present in household 1- Children present in household
	High school diploma	0 – High school diploma or better 1 – Less than high school diploma
Livelihood	Household income level below $50,000	0 – Household income higher than $50,000 1 – Household income less than $50,000
Social Support	Living alone or without a partner	0 – Not living alone 1 – Living alone
Societal Protection	Not having health coverage	0 – Have health coverage 1 – No health coverage
	Not having access to a primary care physician	0 – Access to primary care physician 1 – No access to primary care physician
Well-Being	Self-rated health status	0 – Excellent/Very good/Good 1 – Fair/Poor
	Self-rated mental health status	0 – No depressed days 1- One or more depressed days

Main predictor variables

The independent variables for the study on the three levels are parish cohort disaster history for disaster occurrences and socio-economic resilience indicators from 2004 to 2010 ***(level 2)*** and objective community disaster resilience indicators ***(level 3)***. The outcome variable is individual vulnerability ***(level 1)***. The conceptual model shows the main categories for the different independent variables. Accordingly, Table 3 represents the parish disaster history (level 2) and Table 4 represents objective community disaster resilience indicators as measured on the cohort and parish levels **(*level 2 and 3*)**.

Table 3

Parish disaster History (Level 2) (Data derived from NCDC and 2008 Louisiana State Hazard Mitigation Plan)

Variable	Operationalization	Data Source
	Risk Assessment Score	
Risk Assessment Score	Parish Risk Assessment Scores for each parish were developed by creating a composite risk assessment score. The overall vulnerability, community assets value and probability of a hazard occurring were assigned ordinal scores. Final scores were summed to create a parish risk assessment score ranging from high (145-100), medium (99-72) and low (71-56).	Louisiana State Hazard Mitigation Plan (2008)
	Disaster Event Totals	
Disasters 2004-2010	Recorded disaster events per parish for 2004-2010.	NCDC (2004-2010)
	Human Loss and Injury	
Fatalities 2004-2010	Recorded disaster fatalities per parish for 2004-2010	NCDC (2004-2010)
Injuries 2004-2010	Recorded disaster injuries per parish for 2004-2010	NCDC (2004-2010)
	Property and Crop Damage	
Property Damage 2004-2010	Recorded financial property damage per parish for 2004-2010	NCDC (2004-2010)
Crop Damage 2004-2010	Recorded financial crop damage per parish for 2004-2010	NCDC (2004-2010)

Table 4

Objective Community Disaster Resilience Indicators (Level 2 and 3)

Variable	Operationalization	Data Source
	Operational Resilience	
	Institutional Resilience Level 3	
Citizen Involvement	Parish participation in a Citizen Corps program. Parishes participating in the program received a score of 1 and a score of 0 for no participation.	Citizen Corps
Storm Ready	Parish participation in Storm Ready program. Parishes participating in the program received a score of 1 and a score of 0 for no participation.	National Weather Service: Storm Ready Program
Community Rating System	Parish participation in Community Rating System. Parishes participating in the program received a score of 1 and a score of 0 for no participation.	Federal Emergency Management Agency
Hazard Mitigation Grant Program Funding 2008	Percentage of Hazard Mitigation Grant Program Funding allocated to parishes for 2008	Governor's Office of Homeland Security and Emergency Preparedness Louisiana, 2008
Parish Capability Assessment	Parish capability assessment. Parishes with a capability assessment received a score of 1 and a score of 0 for no capability assessment.	Louisiana State Hazard Mitigation Plan
	Infrastructure Resilience (Level 3)	
Housing Type	Percent housing units in a parish that are not mobile homes.	American Community Survey 2010
Health Access	Number of hospital beds per 100,000 population in a parish.	American Hospital Directory www.ahd.com
Schools	Number of public schools per square mile in a parish.	National Clearinghouse for Educational Facilities
	Socio-Economic Resilience	
	Social Resilience (Level 2 and 3)	Level 2 indicated by **
Educational Attainment	Percentage of population in parish with bachelor's degree.	American Community Survey 2010
Age below 65 years **	Percentage of population in parish below 65 years.	American Community Survey 2004-2010

Percentage Majority **	Percentage non-minority population in parish.	American Community Survey 2004-2010
Total Population Per Square Mile **	Total population per square mile in parish.	American Community Survey 2004-2010
Vehicle Access	Percentage of population in parish with a vehicle.	American Community Survey 2010
Household Phone Access	Percentage of households in parish with a house telephone.	American Community Survey 2010
Health Coverage	Percentage of population in parish with health insurance coverage.	County Health Rankings 2011
Special Needs	Percentage of population in parish without a sensory, physical, or mental disability.	American Community Survey 2010
	Economic Resilience (Level 3)	
Housing Capital	Percentage of population in parish owning a home.	American Community Survey 2010
Wealth	Percentage of population in parish not living in poverty.	American Community Survey 2010
Employment	Percentage of unemployment in parish.	American Community Survey 2010
Multi Sector Employment	Percentage of population in parish not employed in farming, fishing, forestry, and extractive industries.	County and City Data Book 2007
Female Employment	Percentage of female labor force participation in parish.	American Community Survey 2010
Medical Capacity	Number of physicians per 100,000 population in a parish.	Health Resources and Services Administration
	Community Capital (Level 3)	
Place Attachment	Percent population residing in parish one year and longer.	American Community Survey 2010
Voter Participation	Voter participation within parish for 2008 presidential elections.	County and City Data Book 2007
Religious Believers	Percentage of religious believers per parish.	Association. of Religion Data Archives
Volunteer Organizations	Number of volunteer organizations operating in parish.	Louisiana Volunteer Organizations Active during Disasters
Innovation	Percent population employed in creative class occupations.	USDA Economic Research Service

Analysis Plan

The most appropriate analysis for the research was multilevel modeling. The use of multilevel modeling allowed for the identification of patterns within and between parish cohorts, and testing of interactions between predictors and time (repeated measures). After retrieving the relevant data related to the study, IBM

SPSS Statistics 21 was used for data management and preliminary analyses. In preparing the dataset for analysis, the data were organized and sorted into level 1, 2 and 3. Outliers were removed from the analysis and the distribution of each variable was inspected in order to meet the assumptions of multilevel analyses. After conducting descriptive analyses for individual, cohorts and parishes levels, the data were uploaded to a specialized multilevel software package, MLWin Version 2.26 (Steele, 2008).

Model fit was accomplished by Bayesian modeling, first making use of Iterative Generalized Least Squares (IGLS) followed by Markov Chain Monte Carol (MCMC) estimation. Unlike classical methods that converge to a point, MCMC methods are stochastic converging to a distribution. MLWin utilizes a Metropolis Hastings sampling method to sample diffuse preceding distributions. In order for chains to converge to the distribution of interest a “burning” period is used. The chains are subsequently a dependent sample of values from the distribution of interest. As a result of dependence, a suggested effective sample size (ESS) of 250 is advised for model convergence. ESS values exceeded 1,000 with 50,000 iterations (Jones, 2012; Steele, 2008).

Preliminary analysis investigated the structure of each variable on each level. The distribution of each variable, including outliers, was inspected and corrected as needed to ensure that there were no violations of functional form in the predictor variables. After the preliminary analysis, the analytic model for the dependent variable (not at all vulnerable, some vulnerability and vulnerable) was developed in four steps, utilizing a multinomial ordered categorical model fitting

strategy. The first step (a) consisted of fitting the unconditional model. This step described the probability of either being not vulnerable, having some vulnerability, and being vulnerable (Model A), using the following formula: $resp_{ijkl} \sim$ Ordered Multinomial (Constant $_{jkl}$, π_{ijkl}), $(\gamma_{0jkl}) = \beta_0$Constant (<=Not at all vulnerable) $_{ijkl} + h_{jkl}$; $(\gamma_{1jkl}) = \beta_1$Constant.(<=Some Vulnerability) $_{ijkl} + h_{jkl}$; (b) fitting the unconditional growth model depicting the probability of experiencing individual social vulnerability over time across individuals (Model B); (c) fitting the main effects to explain the change in the dependent variable (Model C); and (d) fitting the interaction effects of parish disaster history and community disaster resilience with main effects to explain the change in the dependent variable (Model D). Each model was first estimated using IGLS estimation and followed by MCMC estimation. This was done to compare models. Predictor variables that did not contribute to the model fit were excluded from the final model. This process was followed to allow for the most parsimonious model.

Summary and Conclusion

This chapter provided the methodological foundation for the study, by discussing the proposed research questions, research design, sampling procedure, data sources, and operationalization of variables, as well as explaining the data analyses plan in detail. The following chapter provides the detailed results of the statistical analysis of each research question and hypotheses.

CHAPTER IV: RESULTS

The purpose of this study is to develop an understanding of the factors that influence individual social vulnerability among residents residing in one of the 56 parishes in Louisiana, from 2004 to 2010. Findings related to the three research questions are described in this chapter: (1) Do parishes in Louisiana have different levels of individual social vulnerability? (2) Do parishes in Louisiana experience change, and have different levels of individual social vulnerability over a seven-year period? (3) What are the most important parish disaster history events and community disaster resilience factors that predict individual social vulnerability within and between Louisiana parishes over a seven-year period? This chapter will explain data preparation activities and preliminary analyses, describe the study sample, detail the model building process, and present the results.

Data Preparation

Retrieving and Merging Data

In order to draw a sample for the study, data were retrieved from different data sources for the three levels represented in the study. Individual level data (level 1) were obtained from the Behavioral Risk Factor Surveillance System (BRFSS) for 2004 to 2010. Once the data were downloaded, it was extracted for the appropriate variables related to this dissertation. Parish disaster history data

were gathered from the National Climatic Data Center (NCDC) for 2004 to 2010 and the Louisiana State Hazard Mitigation Plan for 2008. Age, race and population per square mile for 2004 to 2010 data were collected from the American Community Survey (*Level 2*). Parish level data (*level 3*) was downloaded from the American Community Survey, County Business Patterns, FEMA, Citizen Corps, City and County Data book, Louisiana VOAD, National Atlas, Public Broadcast Data Base, Storm Ready, HAZUS-MH, County Health Ranking and USDA Economic Research Service.

Creating the Person-Period Data File

Multilevel analysis requires that data used for analysis be structured in a long file format (Singer & Willett, 2003). The horizontal layout which consists of separate columns for each repeated measure of a variable must be restructured to a person-period data file. This results in a vertical layout, with multiple rows for each measurement occasion captured in the data set. The person-period data file has four (4) kinds of variables: a) unit identifiers for each individual, each year and each parish; b) outcome variable; and c) predictor variables. For each of the three levels associated with the multilevel structure in Figure 10, the data downloaded was entered into the IBM SPSS Statistics 21 software program.

Data Screening

Data screening consisted of cleaning the data and of removing missing data. Records that contained missing data on a nominal level of measurement were handled by removing the actual record from the data set. Variables with a

level of measurement higher than nominal containing missing data, were replaced by the variable mean.

Preparation of outcome variable

The first step taken in the process of data screening for *level 1* was to examine the level of missingness across the seven-year period data set of 2004 to 2010 from the *Behavioral Risk Factor Surveillance System* (BRFSS). Upon screening it was found that the data would allow for the creation of a dependent variable.

The first indicator of individual social vulnerability was **Demographics**. The variable consisted of *belonging to a minority race*, *older than 65 years, female, presence of children in household* and *high school diploma*. Belonging to a minority race was created from the original variables related to race in the BRFSS data set. The first variable used from the BRFSS was related to race group, Hispanic origins and whether a respondent was of mixed race. The three variables were combined for the purposes of creating a race variable for the analysis. The original race variable consisted of eight possible response categories, namely White, Black or African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native and Other. The Hispanic variable consisted of whether the respondent was Hispanic or Non-Hispanic. The mixed race variable reported whether the respondent was of mixed race. The race variable, Hispanic and mixed variable were transformed into the race category variable. The race category used for analysis variable consists of four categories, 1=White Non-Hispanic, 2=Black Non-Hispanic, 3=Hispanic, and

4=Other (Mixed race, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native and Other). The new race variable was then recoded into the race vulnerability variable of *belonging to a minority race.* Not belonging to a minority race was recoded with=0 (being White Non-Hispanic) and 1=belonging to a minority race (Black Non-Hispanic, Hispanic and Other). Older than 65 years was created from the original age variable from the BRFSS. Age was recorded as the actual age of respondents and recoded into being younger than 65 years=0 and being older than 65 years =1. The *Female* variable was created from the gender variable with 0=male and 1=female. *Presence of children in household* was created from the children variable in the BRFSS. The variable was recoded into no children present in the household=0 and the presence of children in the household =1. *High school diploma* was derived from the education categories variable. Education categories consisted of some high school, high school and some college. High school and some college were recoded as high school diploma or better=0 and less than high school diploma =1.

The second indicator of individual social vulnerability was **Livelihood**; the indicator consisted of *household income level below $50,000*. The variable was created from the original income level variable from the BRFSS data set. The original variable consisted of eight annual income levels ranging from below $10,000 to above $75,000. The categories were recoded into above $50,000=0 and below $50,000 =1.

The third indicator of individual social vulnerability was **Social Support**. *Living alone* was the only variable related to social support and was created from the marital status variable. The variable consisted of six categories of relationship statuses, consisting of married, divorced, widowed, separated, never married or a member of an unmarried couple. The variable was recoded to not living alone=0 and living alone =1.

The fourth indicator created for individual social vulnerability was **Societal Protection**. The indicator consisted of two variables, and was created from the *health plan* variable and *access to health care professional* variable from the BRFSS. The health plan variable was recoded into have health coverage=0 and no health coverage =1. Access to health care professional was recoded into access to primary care physician=0 and no access to primary care physician =1.

The final indicator contributing to individual social vulnerability was **Well-Being**. Two variables in the BRFSS data set contributed to the well-being indicator, namely general health status and mental health status. *Self-rated health status* was created from general health status, with responses ranging from excellent to poor for self-rated health. The variable was recoded into excellent/very good/good health=0 and fair to poor health =1. The *self-rated mental health status* variable ranged from 0 to 30 days feeling depressed. The variable was recoded into no days feeling depressed=0 and one or more days feeling depressed =1.

Table 5 highlights the number of study participants per year with complete data on the dependent variable.

Table 5

Study Participants per Year Complete Data on the Outcome Variable

Year	Study Participants Per Year			
	Overall *f* (%)	Not at all Vulnerable *f* (%)	Some Vulnerability *f* (%)	Vulnerable *f* (%)
2004	6,899 (19.9)	1,823 (26.4)	2,439 (35.4)	2,637 (38.2)
2005	1,621 (4.7)	490 (30.2)	573 (35.5)	558 (34.4)
2006	4,686 (13.5)	1,615 (34.4)	1,603 (34.2)	1,468 (31.3)
2007	4,393 (12.6)	1,641 (37.4)	1,481 (33.7)	1,298 (29.5)
2008	4,422 (12.7)	1,660 (37.5)	1,510 (34.1)	1,252 28.3
2009	7,268 (21.0)	2,488 (34.2)	2,238 (30.7)	2,542 (34.9)
2010	5,396 (15.6)	1,860 (34.5)	1,718 (31.8)	1,818 (33.6)
Total	34,685 (100.0)	11,550 (33.3)	11,562 (33.3)	11,573 (33.4)

Predictor Variables: Data related to parish disaster history and objective community disaster resilience were screened for missingness. *Parish risk assessment score*, *disaster totals, fatalities, injuries, property damage* and *crop damage* were used. For each recorded natural hazard occurring in a parish, annual totals were summed for yearly total scores. All data related to parish disaster history were screened for form.

Objective community disaster resilience data-screening consisted of the reviewing of all *level 2* and *level 3* variables, related to community disaster resilience. In order to create the Total Population per Square Mile variable, the number of residents in a parish was divided by the square mile size of each parish. This process allowed for the creation of a Total Population per Square Mile variable for each parish associated with the study. Variables in the data set

with a percentage score were inversed from the original variable. This was done in order to create a higher scoring variable closer to 100 percent. Schools *per* Square Mile and Multi Sector Employment, Vehicle Access, Voter Participation and Employment were transformed for form. Checking for form was an important part of data screening.

Confirmatory Factor Analysis to Develop Outcome Variable

The confirmatory factor analysis indicators were guided by theory as discussed in chapter 2 of this document. Specifically, the work of Cannon (2000), Cannon et al. (2000) and Cutter et al. (2003) were used to provide grounding for the analysis. The indicators used in the analysis included *demographics, livelihood, social support, societal protection* and *well-being*. The model tested in *Figure 11* showed very good fit, with no changes needed to the model to improve fit or correct structural errors as shown in Table 6.

Table 6

Goodness-of-Fit Statistics for CFA Model – Individual Social Vulnerability

Goodness-of-Fit Statistics	Criteria for good fit	Model
CMIN/DF	Below 3 (Klein, 1998)	2.97
CFI	Close to 0.95 (Byrne, 2010)	0.99
RMSEA	Equal or below 0.6 (Hu & Bentler, 1999)	0.01

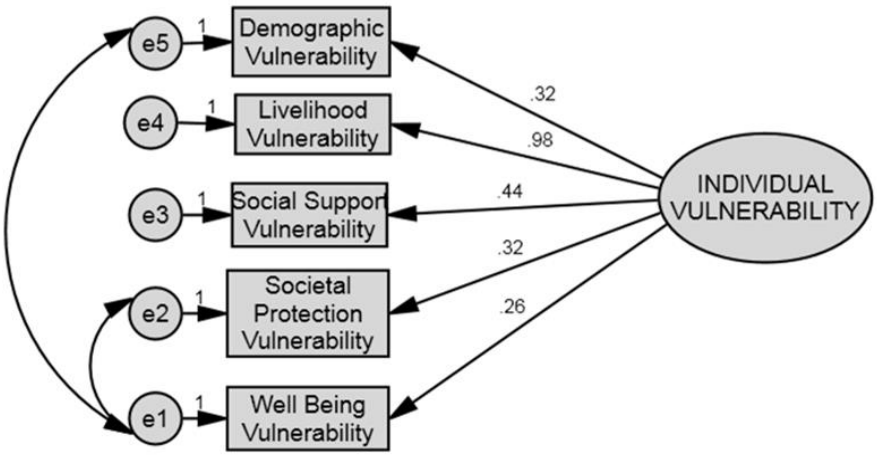


Figure 11. *C*onfirmatory factor analysis for individual social vulnerability.

The confirmatory factor analysis allowed for the creation of an outcome variable. Individual social vulnerability was classified into three categories, not at all vulnerable with a 0 score, some vulnerability with a 1 score, and vulnerable with a score of 2.

Description of Sample

The final sample included 34,685 individuals on *level 1,* 296 yearly cohorts for 2004 to 2010 on *level 2*, and a total of 56 parishes on *level 3*. This section will describe the study sample for each level presented in the multilevel structure of the study.

Individual Social Vulnerability

Table 7 presents the demographic characteristics of the sample on *level 1.* Data on the individual level confirmed the notion that the majority of the sample had high percentages related to social vulnerability. Apart from the less than high

school education variable (11.0%), all other variables had a percentage of 15 percent or higher. Three notable variables with high percentages in the sample were not married or living without a partner 44.5 percent (15,418); income less than $50,000, 61.1 percent (21,204); and females accounting for 65 percent (22,588) of the sample.

Table 7

Level 1 Demographics of study population (N=34,685)

Characteristic	***F***	**Percentage**
Demographics		
Female	22,558	65.0%
Minority	9,960	28.7%
Having Children	12,307	35.5%
Less than High School Education	3,832	11.0%
Older than 65 years	7,531	21.7%
Livelihood		
Income of less than $50,000 annually	21,204	61.1%
Social Support		
Not married or living without a partner	15,418	44.5%
Societal Protection		
No health coverage	5,920	17.1%
Not having a primary care physician	5,576	16.1%
Well-Being		
Self-rated health as poor or fair	7,636	22.0%
Depressed more than 0 days a month	9,734	28.1%

Table 8 represents the 34,685 individuals represented in the study nested within the 56 respective parishes. The table indicates how many times each state

participated in the study. East Baton Rouge had the most individuals in the dataset (3,387; 9.8% of total), with West Baton Rouge having the least amount of individuals (35; 0.1% of total). Catahoula provided data only once in 2004, whereas 16 parishes had cohort representation during all study years. For 2005, individual level data accounted for only 4.6 percent of the total sample of 34,685.

Table 8 *Level 1 Demographics of study population per parish 2004-2010*

Parish	Overall *f (%)*	Years in Study	Parish	Overall *f (%)*	Years in Study	Parish	Overall *f (%)*	Years in Study
Acadia	439 (1.3)	6	**Jackson**	111 (0.3)	3	St. Landry	681 (2.0)	7
Allen	235 (0.7)	5	**Jefferson**	2,639 (7.6)	7	St. Martin	347 (1.0)	6
Ascension	628 (1.8)	7	Jefferson Davis	311 (0.9)	5	St. Mary	540 (1.6)	6
Assumption	163 (0.5)	4	Lafayette	1,641 (4.7)	7	St. Tammany	1997 (5.8)	7
Avoyelles	415 (1.2)	6	Lafourche	953 (2.7)	7	Tangipahoa	943 (2.7)	7
Beauregard	409 (1.2)	3	La Salle	83 (0.2)	3	Terrebonne	1077 (3.1)	7
Bienville	95 (0.3)	6	Lincoln	432 (1.2)	6	Union	233 (0.7)	5
Bossier	867 (2.5)	7	Livingston	919 (2.6)	7	Vermillion	475 (1.4)	6
Caddo	2,018 (5.8)	7	Morehouse	267 (0.8)	5	Vernon	445 (1.3)	6
Calcasieu	2,234 (6.4)	7	Natchitoches	322 (0.9)	6	Washington	499 (1.4)	6
Catahoula	41 (0.1)	1	Orleans	1897 (5.5)	7	Webster	361 (1.0)	6
Claiborne	139 (0.4)	4	Ouachita	1443 (4.2)	7	West Baton Rouge	87 (0.3)	3
Concordia	167 (0.5)	4	Plaquemines	60 (0.2)	3	West Feliciana	35 (0.1)	3
De Soto	135 (0.4)	3	Pointe Coupee	78 (0.2)	3	Winn	135 (0.4)	4
East Baton Rouge	3,387 (9.8)	7	Rapides	1587 (4.6)	7	Total	34,685 (100.0)	
East Feliciana	79 (0.2)	3	Richland	149 (0.4)	4			
Evangeline	204 (0.6)	5	Sabine	213 (0.6)	5			
Franklin	150 (0.4)	4	St. Bernard	122 (0.4)	4			
Grant	206 (0.6)	5	St. Charles	416 (1.2)	6			
Iberia	540 (1.6)	6	St. James	163 (0.5)	5			
Iberville	138 (0.4)	4	St. John the Baptist	335 (1.0)	6			

Table 9 details the number of parishes that participated in each of the respective cohort years of the study from 2004-2010.

Table 9

Yearly parish representation for cohorts

Year	Parishes *f*
2004	46
2005	16
2006	33
2007	36
2008	55
2009	55
2010	55
Total	296

Parish Disaster History

Tables 10, 11, 12, 13, 14 and 15 respectively describe *Parish Risk Assessment Score, Number of Disasters, Fatalities, Injuries, Property Damage and Crop Damage* from 2004 to 2010.

Risk Assessment Score

The mean for Parish Risk Assessment Score was 90.25 (SD=24.02), ranging from 57 to 145. Based on the mean parish risk assessment score, the majority of parishes are in a medium level of risk towards hazards. Lincoln parish had the lowest risk assessment score of the 56 parishes in the sample with a score of 57. Jefferson parish had the highest score, with a risk assessment score of 145.

Table 10

Parish Risk Assessment Scores

Variable	$\bar{X}$ (SD)	Range
Parish risk assessment score	90.25 (24.02)	57-145

Number of Disasters

Table 11 describes the *number of disasters* experienced in Louisiana parishes from 2004 to 2010. The year with the highest total number of disasters experienced, was 2009. A mean of 14.23 number of disasters (SD=14.25) was reported, that ranged from 1 to 75 disasters experienced. In contrast, 2010 had the lowest recorded mean of 6.14 number of disasters (SD=6.41), that ranged from 0 to 38.

Table 11

Number of Disasters per Parish

Variable	Years	Parishes (*N*)	$\bar{X}$ (SD)	Range
Disasters 2004-2010	2004	46	9.30 (SD=5.78)	1-33
	2005	16	11.62 (SD=8.94)	1-36
	2006	33	9.93 (SD=4.72)	0-19
	2007	36	8.41 (SD=6.81)	1-35
	2008	55	12.05 (SD=8.70)	0-45
	2009	55	14.23 (SD=14.25)	1-75
	2010	55	6.14 (SD=6.41)	0-38

Fatalities

Table 12 details the descriptive statistics for disaster fatalities from 2004 to 2010. The year 2009 had the highest percentage of reported disaster fatalities in parishes with 6 (10.9%) of the parishes reporting loss of life as a result of disasters. In contrast, during 2010, only 1 (1.8%) parish experienced fatalities as a result of disasters.

Table 12

Fatalities experienced per parish 2004-2010

Variable	Years	Parishes (*N*)	Parishes Reporting Fatalities *f (%)*
Fatalities 2004-2010	2004	46	1 (2.2)
	2005	16	1 (6.3)
	2006	33	2 (6.1)
	2007	36	3 (8.3)
	2008	55	4 (7.3)
	2009	55	6 (10.9)
	2010	55	1 (1.8)

Injuries

Table 13 describes the descriptive statistics for disaster injuries from 2004 to 2010. Cohort year 2009 had the highest number of disaster injuries, with 12 (21.8%) parishes reporting injuries. The lowest number of disaster injuries happened in 2010, with only 2 (3.6%) parishes experiencing injuries as a result of disasters.

Table 13

Injuries experienced per parish 2004-2010

Variable	Years	Parishes (*N*)	Parishes Reporting Injuries *f (%)*
Injuries 2004-2010	2004	46	5 (10.9)
	2005	16	2 (12.5)
	2006	33	9 (27.3)
	2007	36	10 (27.8)
	2008	55	8 (14.5)
	2009	55	12 (21.8)
	2010	55	2 (3.6)

Property Damage

Table 14 details the descriptive statistics for disaster property damage experienced in parishes, from 2004 to 2010. Based on the results most of the cohort years reported at least some property damage as a result of disasters. From 2005 to 2009, over 90 percent of the parishes in the sample reported

property damage as a result of disasters, with 2005 being the highest. In 2005, 93.8% percent of the parishes sampled experienced some form of property damage. A significantly lower number of parishes reported property damage as a result of disasters in 2010. In 2010, 76.4 percent of parishes experienced property damage.

Table 14

Property damage experienced per parish 2004-2010

Variable	Years	Parishes (*N*)	Parishes Reporting Property Damage *f (%)*
Property Damage 2004-2010	2004	46	43 (93.5)
	2005	16	15 (93.8)
	2006	33	30 (90.9)
	2007	36	33 (91.7)
	2008	55	51 (92.7)
	2009	55	51 (92.7)
	2010	55	42 (76.4)

Crop Damage

Table 15 provides an insight into the descriptive statistics for crop damage experienced in parishes from 2004 to 2010. Comparing the impact of disasters on property damage with that of crop damage, it was less severe on crops in Louisiana from 2004 to 2010. No crop damage was reported for 2005 and 2007. The 2008 cohort is the year with the severest crop damage with 20% of all parishes sampled, experiencing crop damage. Twenty percent of parishes in the sample reported crop damage as a result of disasters in 2008.

Table 15

Crop damage experienced per parish 2004-2010

Variable	Years	Parishes (*N*)	Parishes Reporting Crop Damage *f (%)*
Crop Damage 2004-2010	2004	46	1 (2.2)
	2005	16	0 (0)
	2006	33	1 (3.0)
	2007	36	0 (0)
	2008	55	11 (20)
	2009	55	5 (9.1)
	2010	55	2 (3.6)

Objective Community Disaster Resilience

This section details the descriptive statistics for *level 2* and *level 3* objective community disaster resilience variables. Objective community disaster resilience consists of operational and socio-economic resilience as its two main components.

Operational Resilience

Operational resilience for the purpose of the study consisted of institutional resilience and infrastructure resilience. Detailed descriptive statistics for institutional resilience and infrastructure resilience predictors are provided in Tables 16, 17 and 18.

Institutional Resilience

Table 16 and 17 details the descriptive statistics for institutional resilience. More than half of the parishes in the sample did not participate in any of the programs associated with institutional resilience. Only 12.5 percent of parishes in the sample have conducted a capability assessment, assessing their capacity to respond to a disaster situation. The mean percentage for receiving funding from

the 2008 Hazard Mitigation Grant Program for parishes, were 2.97 percent (SD=2.90).

Table 16

Level 3 Institutional Resilience Predictors

Variable	Parishes (*N*)	Participating Parishes *f (%)*
Citizen Involvement	56	20 (35.7)
Storm Ready	56	13 (23.2)
Community Rating System	56	24 (42.9)
Parish Capability Assessment	56	7 (12.5)

Table 17

Hazard Mitigation Grant Program Funding

Variable	$\bar{X}$ (SD)	Range
HMGP Funding	2.97 % (2.90)	0.0-13.0%

Infrastructure Resilience

Descriptive statistics for level three infrastructure resilience are presented by table 18. The mean for schools per square mile was 44.08 square miles (SD=5.85), ranging from 3.38 to 118.81 square miles. The mean for hospital beds per 100,000 population was 266.83 (SD=211.82), ranging from 0.0 to 886.0 beds per 100,000 population. In parishes 80.2 percent (SD=6.97) of housing were not mobile homes, ranging between 60.37 percent and 98.1 percent.

Table 18

Level 3 Infrastructure Resilience Predictors

Variable	Parishes (N)	$\bar{X}$ (SD)	Range
Housing Type	56	44.08 (SD=5.85)	3.38-118.81
Health Access	56	266.83 (SD=211.82)	0.0-886.0
Schools	56	80.2 (SD=6.97)	60.37-98.1

Socio-Economic Resilience

The second main component of objective community disaster resilience is socio-economic resilience. This main component consists of social resilience, economic resilience and community capital. Detailed descriptive statistics for social resilience (level two and level three variables); economic resilience and community capital predictors are provided in Tables 19, 20, 21 and 22.

Social Resilience

Table 19 details the descriptive statistics for the *level 2* social resilience predictors of age, race and total population per square mile. The mean for percentage population below 65 years had an overall consistent mean for the seven years of the study. The mean for 2004 to 2010 ranged from 86.96 percent (SD=2.18) to 88.92 percent (SD=1.59) for population below 65 years. Based on the mean percentage for population below 65 years nearly 8 out of 10 people in Louisiana are younger than 65 years.

The mean percentage for non-minority population in a parish had a relative consistent mean over the study period. The mean from 2004 to 2010 for non-minority population ranged from 66.50 percent (SD=11.92) in 2004 to 63.38 percent (SD=11.61) in 2010. Based on the mean there has been a decrease in the non-minority population in Louisiana from 2004 to 2010.

Louisiana has experienced a significant decrease in their total population per square mile from 2004 to 2010. The mean for total population per square mile in 2004 was 220.01 persons per square mile (SD=486.53). In 2010, the

mean for total population per square mile in the sample indicated a decrease of nearly 41 persons to 179.47 persons per square mile (SD=358.31).

Table 19

Level 2 Social Resilience Predictors

Variable	Years	Parishes (*N*)	$\bar{X}$ (SD)	Range
Age below 65 years	2004	46	87.79 (2.10)	83.60-92.69
	2005	16	88.82 (1.59)	86.47-92.21
	2006	33	87.97 (1.98)	83.5-91.66
	2007	36	87.87 (1.88)	83.54-91.63
	2008	55	87.20 (2.17)	81.59-91.47
	2009	55	87.07 (2.18)	81.50-91.24
	2010	55	86.96 (2.18)	81.51-91.12
Percentage Majority	2004	46	66.50 (11.92)	26.51-92.19
	2005	16	65.86 (15.27)	26.48-91.99
	2006	33	65.24 (12.14)	33.07-91.51
	2007	36	65.02 (12.78)	31.24-91.11
	2008	55	63.71 (11.64)	30.41-90.58
	2009	55	63.57 (11.61)	30.35-90.33
	2010	55	63.38 (11.61)	30.59-90.16
Total Population Per Square Mile	2004	46	220.01 (486.53)	14.76-2914.79
	2005	16	511.70 (754.11)	86.74-2917.91
	2006	33	242.56 (358.45)	27.64-1442.10
	2007	36	234.30 (372.20)	22.72-1586.49
	2008	55	172.28 (331.12)	16.21-1781.83
	2009	55	176.20 (346.21)	16.20-1935.08
	2010	55	179.47 (358.31)	16.09-2053.47

Table 20 provides a detailed description of the *level 3* social resilience indicators. A very low percentage of residents in Louisiana has a bachelor degree or higher with a mean of 15.68 percent (SD=6.12). The lowest percentage was 8.50 percent, with the highest being 32.90 percent. Nearly all residents have access to a vehicle based on the mean of 96.90 (SD=1.35). Based on the mean for access to household phones nearly 70.06 percent (SD=7.34) of households had access to a house phone. The access to household phones ranged from 47.0 percent to 83.20 percent. The parish with the highest level of household phone access still has nearly 20 percent of their

households without phone access. Having access to health coverage had a mean of 73.53 percent (SD=3.55), ranging from 58.0 percent to 80.0 percent. The mean percentage for non-special needs population in the sample was 83.74 percent (SD=2.91), ranging from 76.40 percent to 87.80 percent. Based on the range, all of the parishes have residents with special needs.

Table 20

Level 3 Social Resilience Predictors

Variable	Parishes (N)	$\bar{X}$ (SD)	Range
Educational Attainment	56	15.68 (SD=6.12)	8.50-32.90
Vehicle Access	56	96.90 (SD=1.35)	93.76-99.33
Household Phone	56	70.06 (SD=7.34)	47.00-83.20
Health Cover	56	73.53 (SD=3.55)	58.00-80.00
Special Needs	56	83.74 (SD=2.91)	76.40-87.80

Economic Resilience

Table 21 details the descriptive statistics for level 3 economic resilience predictors. Based on housing capital, 72.35 percent (SD=7.30) of residents own their property. The range indicates that there are parishes with more than half of its residents not owning property, with the lowest ownership being 49.30 percent. The parish with the highest home-ownership was 84.40 percent. The mean for people living above the poverty level was 80.81 percent (SD=5.16). The parish with the lowest level of wealth was 69.20 percent, with the highest being 90.60 percent. The mean percentage of people unemployed was 8.80 percent (SD=1.98), with the lowest level of unemployment being 5.80 percent. The parish with the highest percentage of residents unemployed was 13.50 percent. Multi-Sector employment had a mean of 3.02 (SD=0.77), with a range of 0.09-16.89. Female employment had a mean percentage of 46.53 percent (SD=2.66)

indicating an almost equal level of gender employment based on the mean in Louisiana. The parish with the lowest percentage of female employment, had 4 out of 10 females employed (37.70%), whereas the parish with the highest level had more than 5 out of 10 females employed (52.90%). The number of physicians per 100,000 had a mean of 139.81 (SD=136.49) per 100,000 population, with a range of 26.20 to 637.80 physicians per 100,000 population.

Table 21

Level 3 Economic Resilience Predictors

Variable	Parishes (N)	$\bar{X}$ (SD)	Range
Housing Capital	56	72.35 (SD=7.30)	49.30-84.40
Wealth	56	80.81 (SD=5.16)	69.20-90.60
Employment	56	8.80 (SD=1.98)	5.80-13.50
Multi Sector Employment	56	3.02 (SD=0.77)	0.09-16.89
Female Employment	56	46.53 (SD=2.66)	37.70-52.90
Medical Capacity	56	139.81 (SD=136.49)	26.20-637.80

Community Capital

Table 22 details the descriptive statistics for the level 3 community capital predictors. The place attachment variable had a mean percentage of 85.80 percent (SD=4.76), ranging from 71.01 percent to 94.57 percent. Based on the parish mean nearly 9 out of 10 people have been residing in the same area for a year or longer. The 2008 general elections voter participation mean was 69.52 percent (SD=4.59), ranging from 55.00 percent to 81.00 percent. The percentage of religious believers had a mean average percentage of 59.55 percent (SD=14.10), with a range of 21.0 percent to 91.0 percent. The number of volunteer organizations active in parishes had a mean number of 22.51 (SD=1.80), with a range of 19 to 30 volunteer organizations active in parishes. Based on the innovation mean, 16.22 percent (SD=4.43) people were employed

in the creative working class in Louisiana, with a range of 9.50 percent to 30.10 percent.

Table 22

Level 3 Community Capital Predictors

Variable	**Parishes (N)**	$\bar{X}$ **(SD)**	**Range**
Place Attachment	56	85.80 (SD=4.76)	71.01-94.57
Voter Participation	56	69.52 (SD=4.59)	55.00-81.00
Religious Believers	56	59.55 (SD=14.10)	21.00-91.00
Volunteer Organization	56	22.51 (SD=1.80)	19.00-30.00
Innovation	56	16.22 (SD=4.43)	9.50-30.10

Table 23

Relationships between Outcome Variable and Predictors (Across all Measurement Occasions)

	INDIVIDUAL VULNERABILITY				
	Not at all Vulnerable	Some Vulnerability	Vulnerable	f/χ^2	p
	Mean for parishes				
Parish Disaster History					
Risk Assessment Score	109.10 (21.25)	107.88 (22.51)	105.82 (23.22)	63.61	0.001
Number of Disasters	12.99 (11.65)	13.20 (12.0)	13.07 (12.36)	0.934	0.393
Fatalities	11.3%	10.7%	9.9%	11.39	0.003
Injuries	21.8%	21.8%	20.6%	7.07	0.029
Property Damage	96.4%	95.9%	95.7%	7.59	0.023
Crop Damage	5.7%	5.2%	4.6%	12.94	0.002
Objective Community Disaster Resilience					
Parish participation in a Citizen Corps program	48.7%	46.1%	47.7%	15.20	0.001
Parish participation in Storm Ready program	48.0%	49.3%	53.3%	69.86	0.001
Community Rating System	20.8%	24.4%	29.6%	241.88	0.001
Percentage of State Hazard Mitigation Grant Program funding allocation for 2008	3.10 (2.91)	2.95 (2.88)	2.88 (2.91)	17.80	0.001
Parish Capability Assessment	77.4%	77.8%	78.6%	5.48	0.065
Percentage housing units in a parish that are not mobile homes	86.70 (7.96)	86.38 (8.11)	85.53 (8.02)	65.88	0.001
Number of hospital beds per 100,000 population in a parish	381.32 (215.45)	384.56 (223.02)	385.20 (220.21)	1.03	0.357
Schools per square mile	4.43 (2.03)	4.60 (2.16)	4.89 (2.19)	135.65	0.001
Percentage of population in parish with bachelor's degree	21.77 (7.27)	21.09 (7.30)	20.02 (7.38)	166.77	0.001
Percentage of population in parish below 65 years	88.09 (1.64)	87.95 (1.72)	87.77 (1.73)	97.68	0.001
Percentage Majority Race	63.57 (13.66)	62.44 (13.69)	62.24 (13.52)	31.93	0.001
Total Population Per Square Mile	471.32 (561.35)	478.78 (612.06)	439.22 (625.18)	14.19	0.001

Percentage of population in parish with access to a vehicle	96.97 (1.18)	96.84 (1.25)	96.78 (1.27)	72.37	0.001
Percentage of households in parish with a household telephone	67.40 (7.92)	66.73 (7.89)	66.68 (7.87)	30.26	0.001
Percentage of population in parish with health insurance coverage	75.36 (3.06)	74.93 (3.18)	74.45 (3.22)	239.38	0.001
Percentage of population in parish without a sensory, physical, or mental disability	85.32 (2.50)	85.05 (2.62)	84.70 (2.75)	165.25	0.001
Percentage of population in parish owning a home	69.13 (8.14)	68.49 (8.10)	68.58 (7.97)	21.40	0.001
Percentage of population in parish not living in poverty	82.56 (4.58)	81.92 (4.60)	81.22 (4.61)	243.86	0.001
Percentage of employment in parish	7.76 (1.38)	7.94 (1.47)	8.11 (1.58)	163.416	0.001
Percentage of population in parish not employed in farming, fishing, forestry, and extractive industries	1.32 (0.82)	1.35 (0.81)	1.40 (0.82)	30.75	0.001
Percentage of female labor force participation in parish	47.11 (2.43)	47.16 (2.55)	47.16 (2.58)	1.10	0.331
Number of physicians per 100,000 population	275.60 (174.91)	275.09 (185.45)	260.31 (187.10)	26.17	0.001
Percentage population residing in parish one year and longer	84.39 (4.01)	84.22 (4.21)	84.38 (4.36)	6.22	0.002
Voter participation within parish for 2008 presidential elections	68.29 (4.07)	67.96 (4.26)	67.81 (4.32)	39.20	0.001
Percentage of religious believers per parish	58.45 (11.71)	58.89 (11.36)	60.01 (11.62)	56.37	0.001
Number of volunteer organizations operating in parish	23.78 (2.68)	23.68 (2.66)	23.51 (2.56)	31.31	0.001
Percentage population employed in creative class occupations	21.03 (5.32)	20.35 (5.20)	19.46 (5.25)	262.55	0.001

Based on the results of Table 23, individual social vulnerability differed significantly among the different individual social vulnerability groups. Based on

parish disaster history, it is clear that most vulnerable individuals live in parishes with lower risk assessment scores than the individuals who are not vulnerable. Furthermore, less of the vulnerable individuals live in counties where there were fatalities. More injuries were reported among the not-vulnerable-at-all-group than the vulnerable group. Property and crop damage had a higher representation among the not-vulnerable-at-all group than with the some-vulnerability and vulnerable groups.

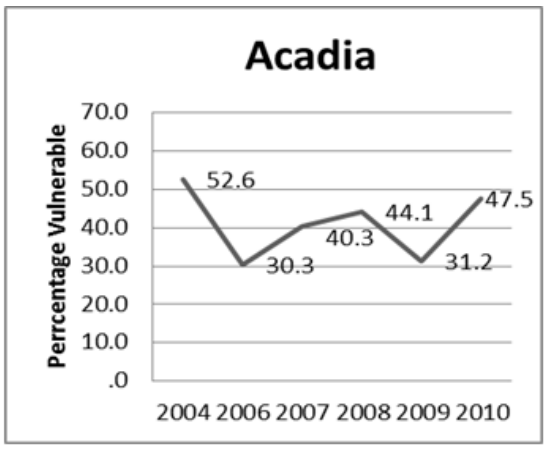
Involvement in the citizen corps program was higher among the not-at-all-vulnerable group than the other two individual social vulnerability groups. The vulnerable group had a higher level of participation in the storm ready program and the community rating system than the not-at-all-vulnerable and some-vulnerability groups. Not-at-all-vulnerable individuals compared to vulnerable individuals had higher levels of education, vehicle access, access to household phones, health cover, home ownership, voting participation and innovation. Vulnerable individuals had higher levels of unemployment and there were more religious believers among them, than the not-at-all-vulnerable group.

The next section describes the model building process. First, preliminary considerations linked to the multilevel structure of the data are discussed. Following the considerations, the particulars of building several sub-models and the final model are defined. Discussion of the results is guided by the three research questions.

Model-Building

Assessing the Need for the Multilevel Model

An easy way to initially assess patterns of change in a study population is to graph actual growth trajectories for a sample of cases and visually inspect them (Singer & Willett, 2003). Based on the outcome variable the percentages of residents in vulnerability were plotted for the 56 parishes. The percentage is represented by Figure 12. With the individual growth plots, several observations can be made. First, some parishes (e.g. Evangeline, Morehouse) displayed a significant decrease in social vulnerability over time, while others (e.g. Jackson, Plaquemines) displayed an increase in social vulnerability over time. There were parishes with significant trajectory changes over time (e.g. Iberia) with increases and decreases displayed. St. Tammany had the most constant level of social vulnerability with very little change over the study period.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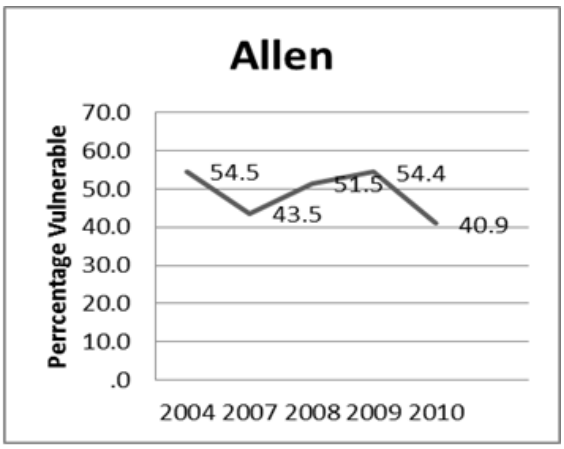
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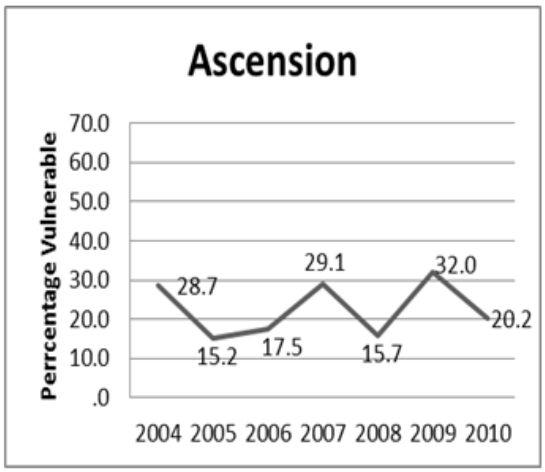
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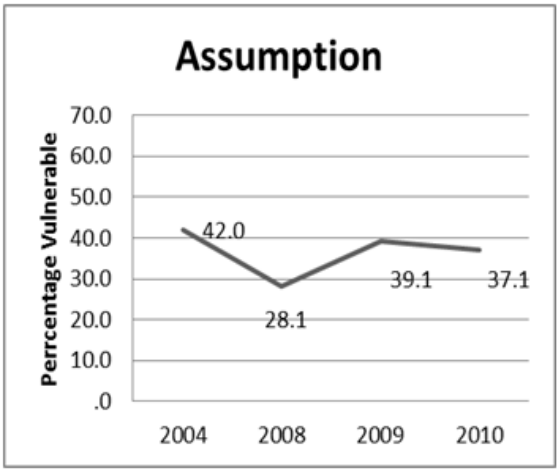
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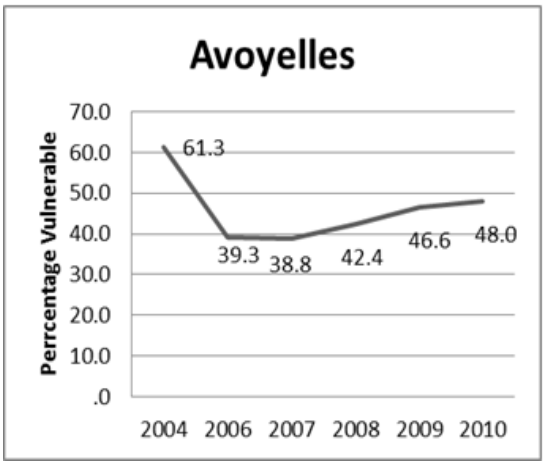
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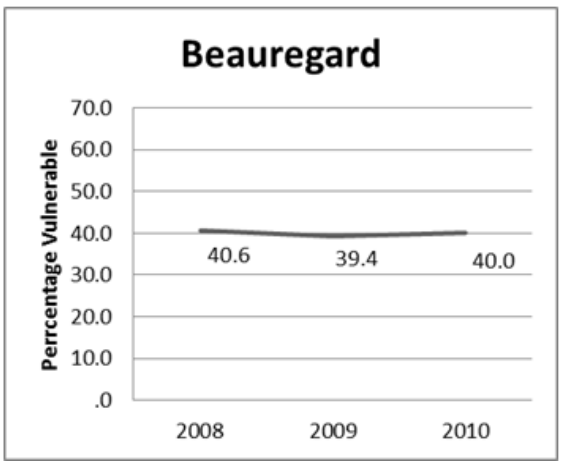
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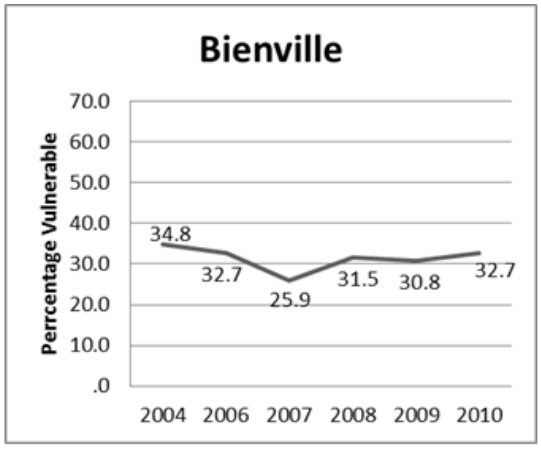
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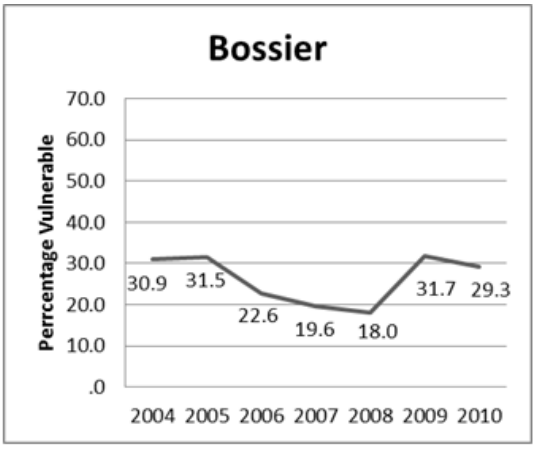
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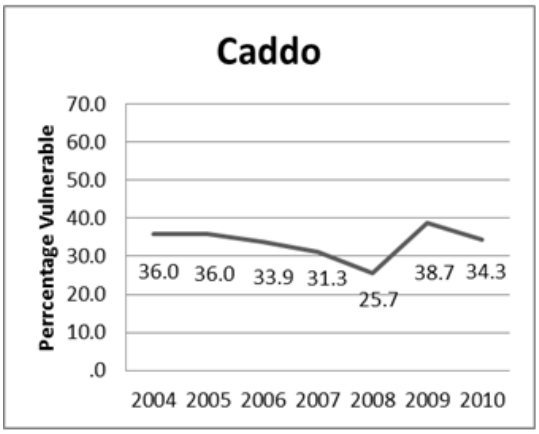
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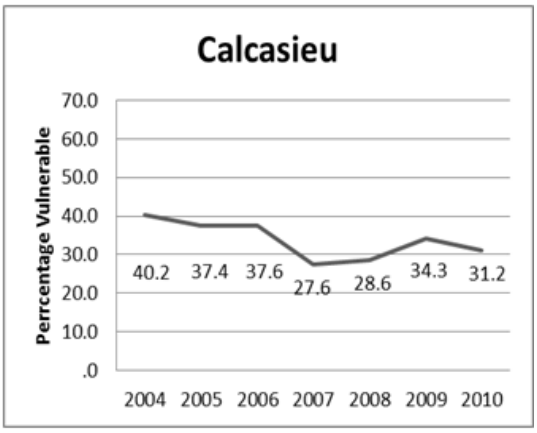
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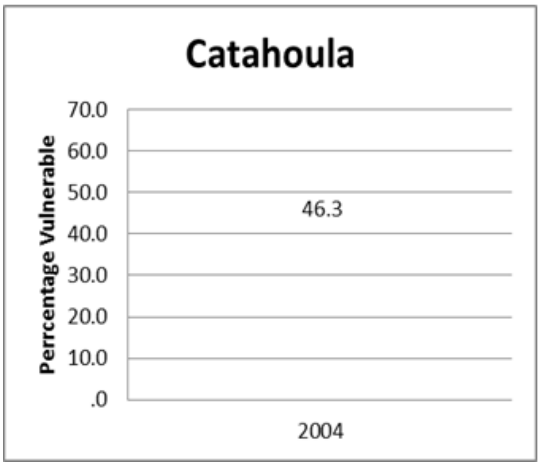
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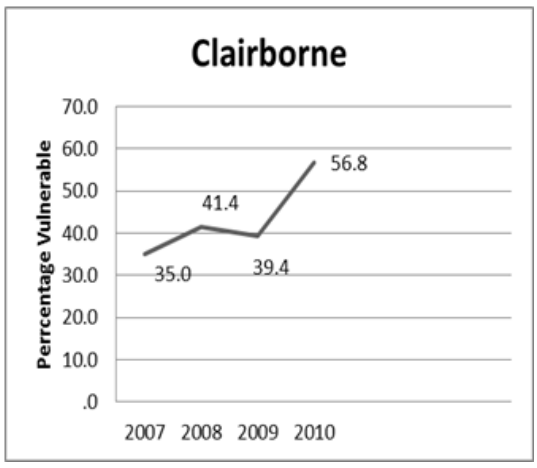
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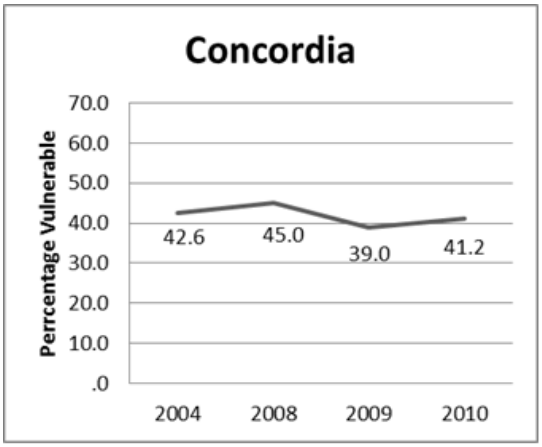
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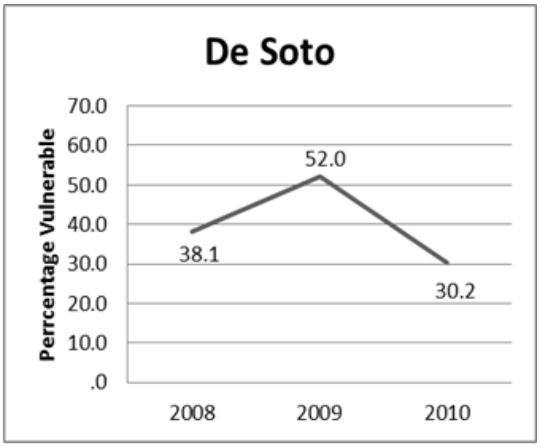
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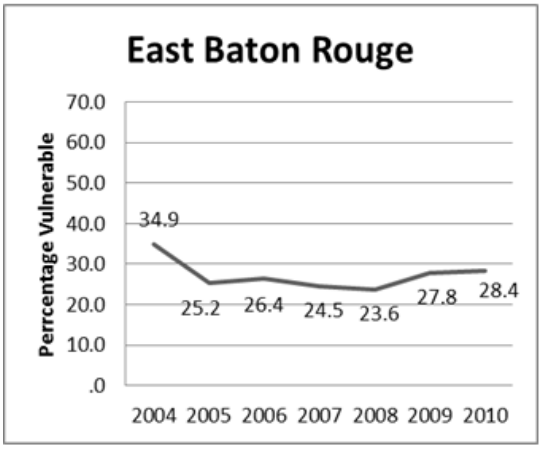
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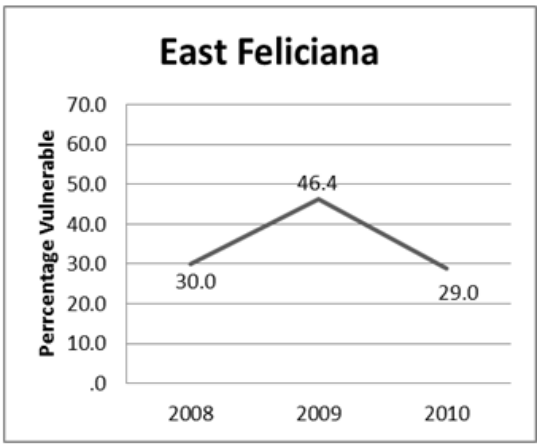
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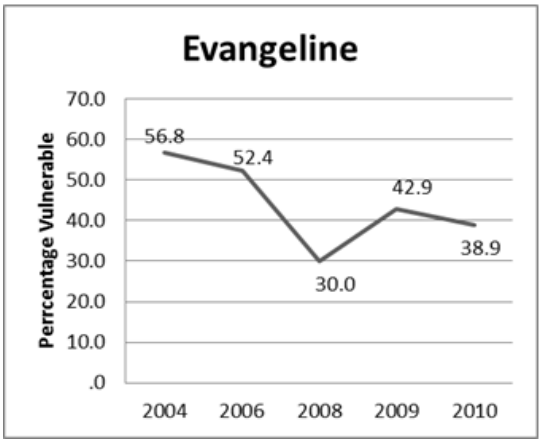
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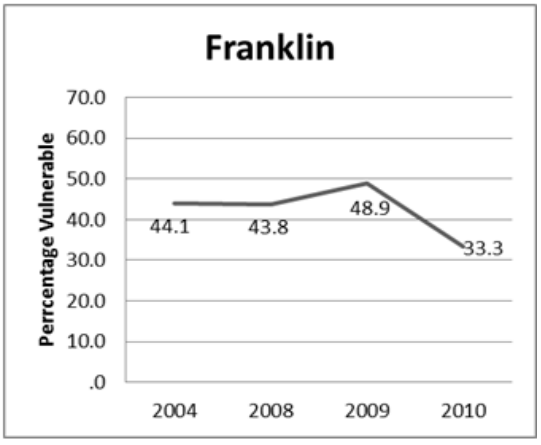
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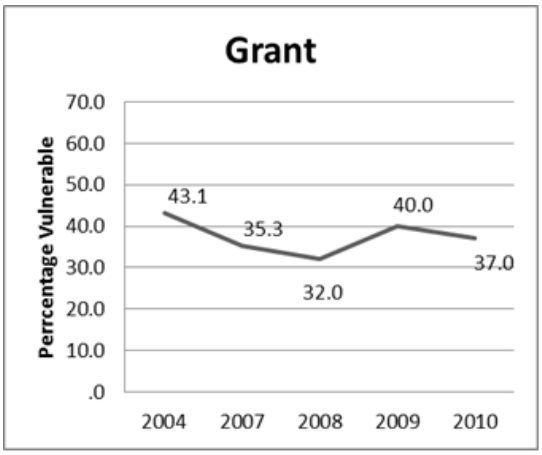
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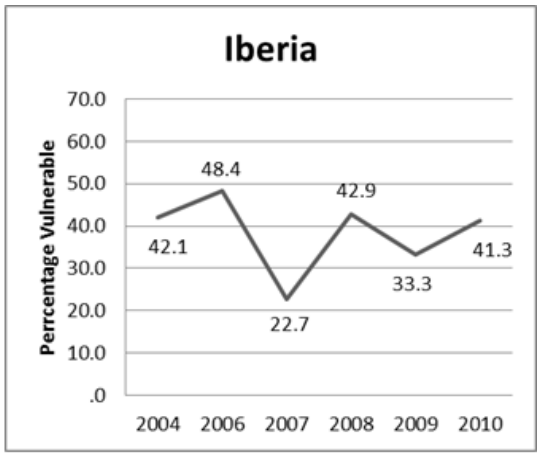
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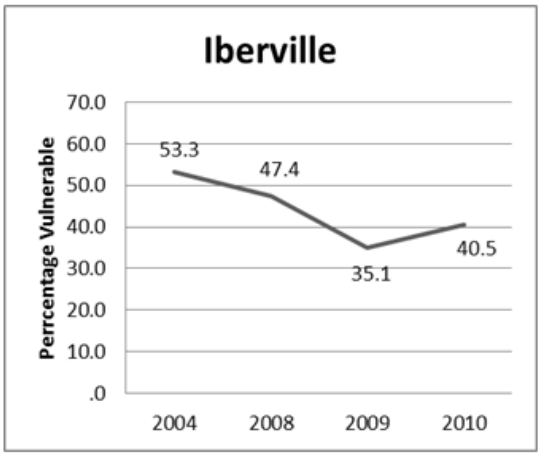
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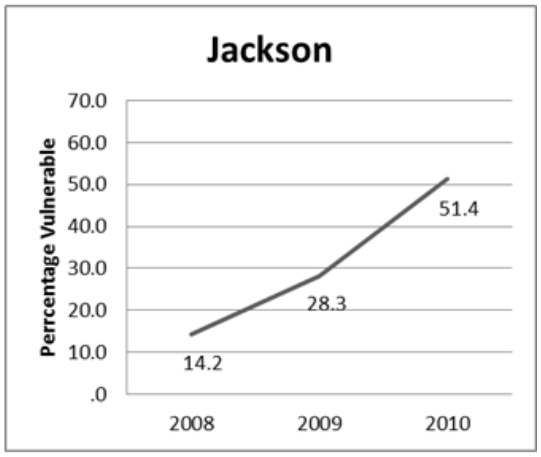
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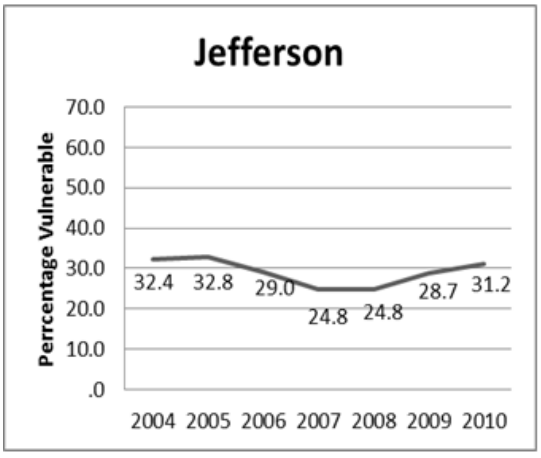
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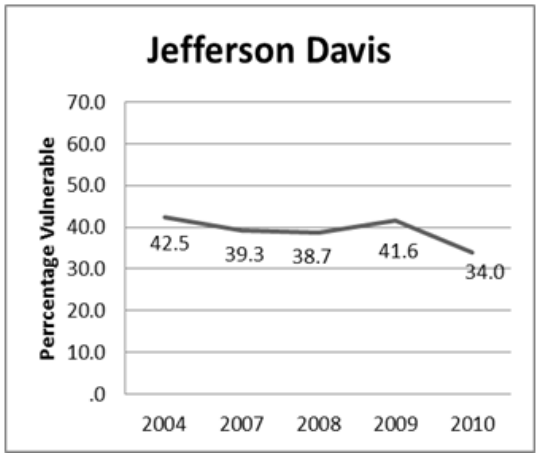
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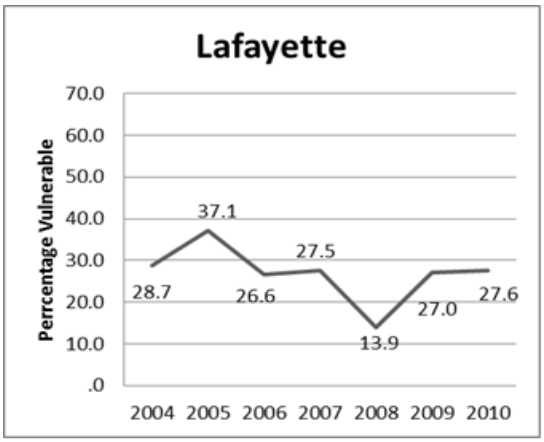
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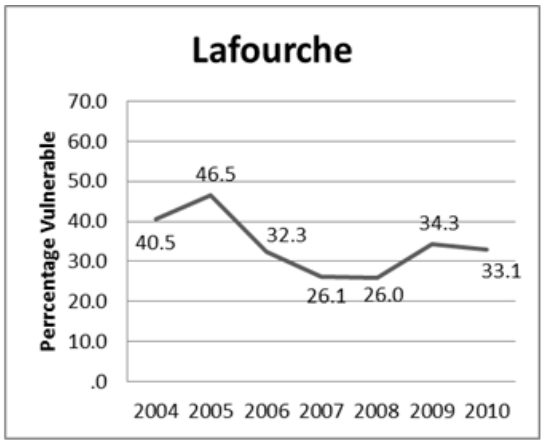
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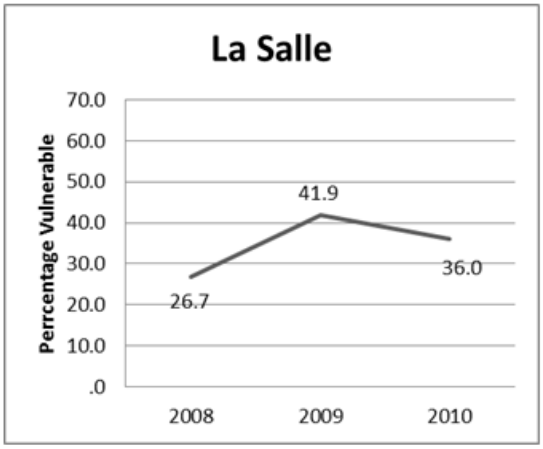
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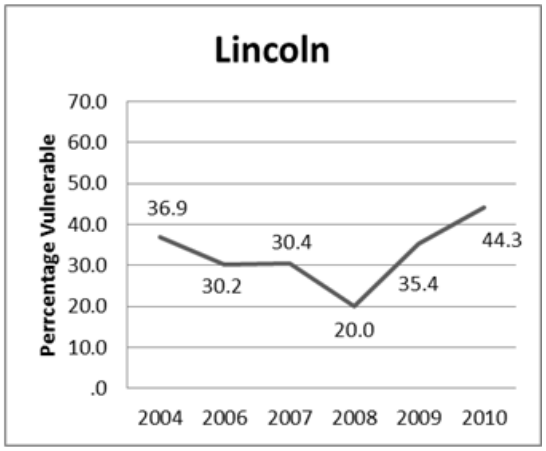
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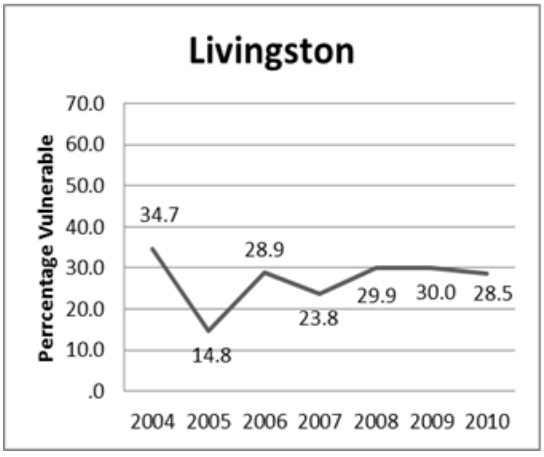
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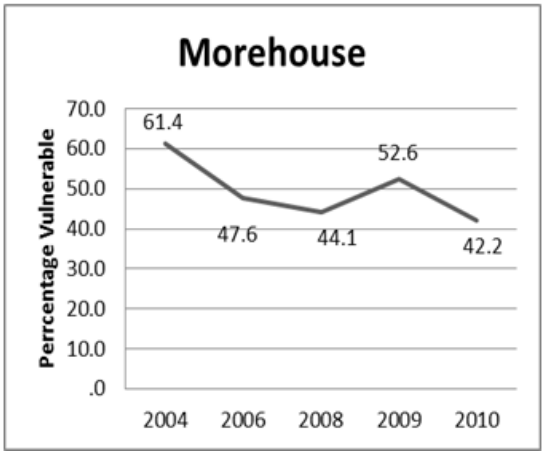
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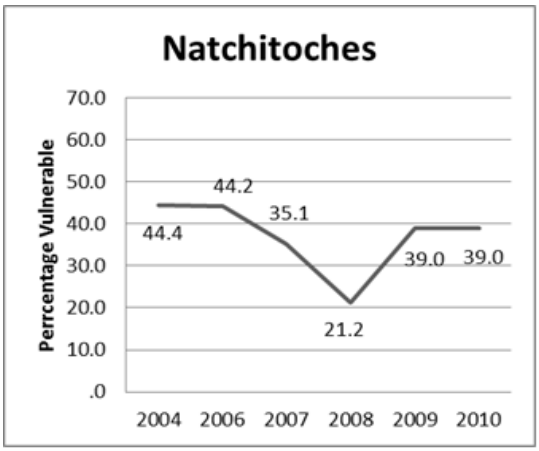
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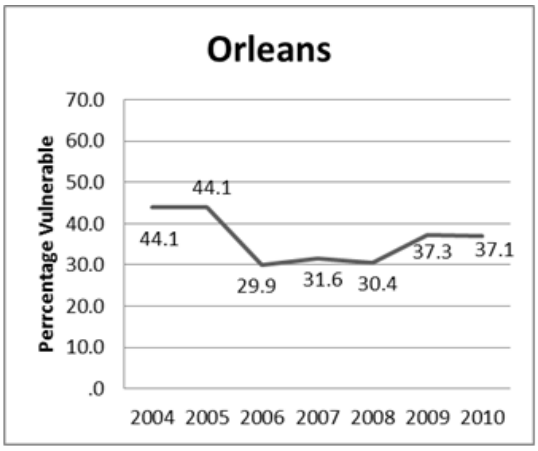
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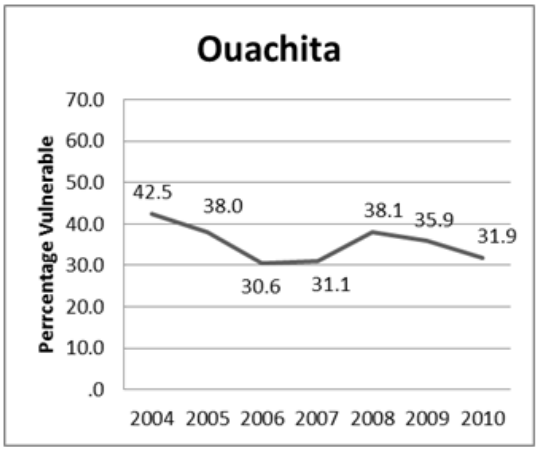
Ouachita
Perrcentage Vulnerable
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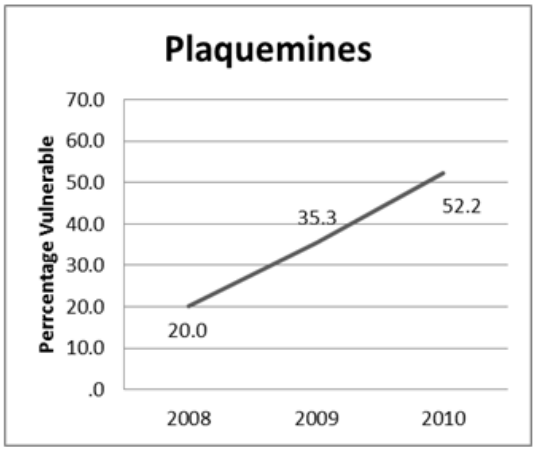
60.0
50.0
40.0
30.0
20.0
10.0
.0
42.5
38.0
30.6
31.1
38.1
35.9
31.9
2004 2005 2006 2007 2008 2009 2010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Perrcentage Vulnerable
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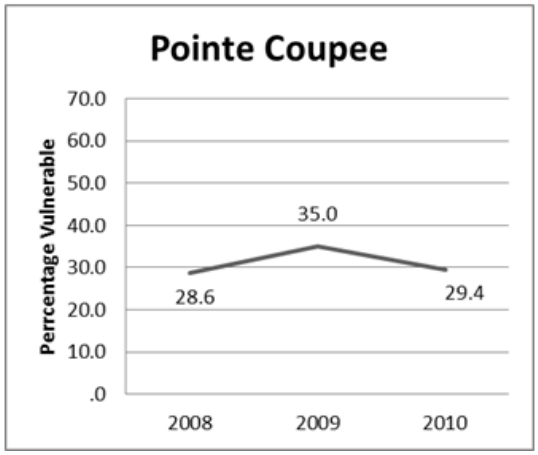
.0
20.0
35.3
52.2
2008 2009 2010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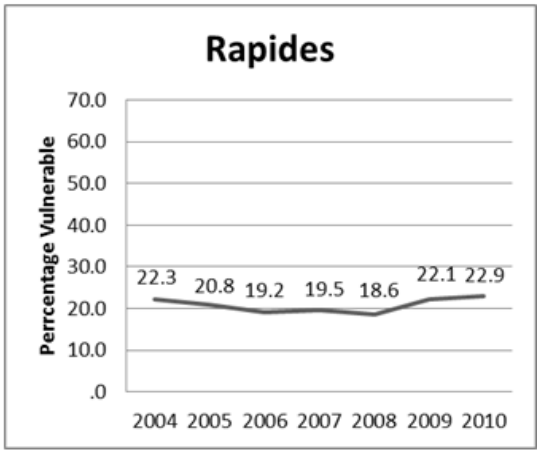
35.0
29.4
2008 2009 2010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18.6
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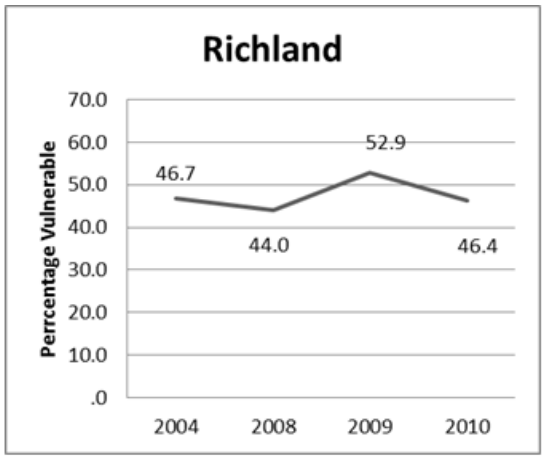
22.9
2004 2005 2006 2007 2008 2009 2010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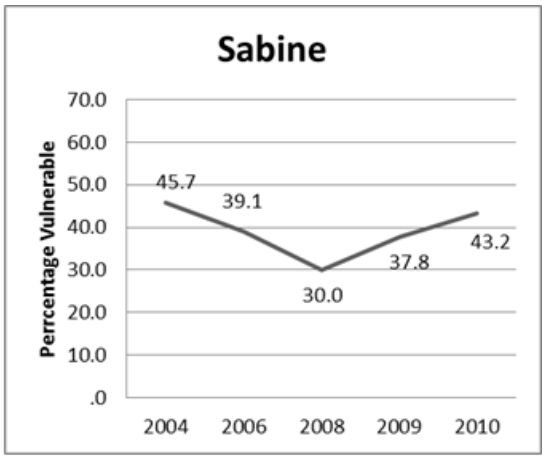
2004
2008
2009
2010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.0
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37.8
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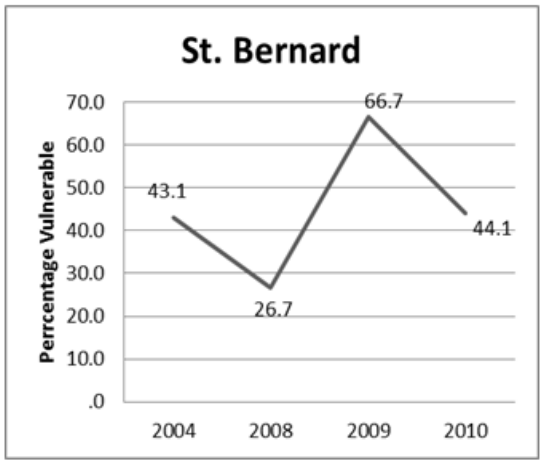
2004
2006
2008
2009
2010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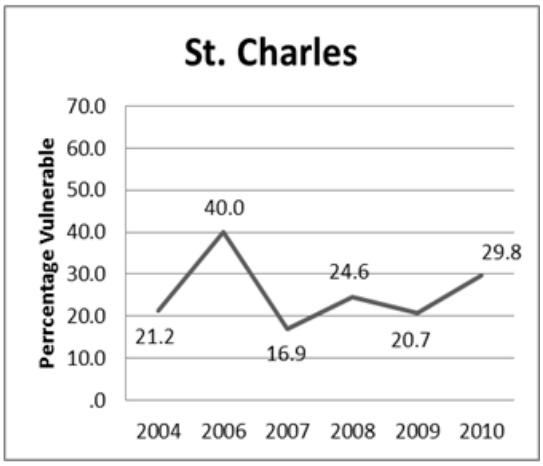
2004
2008
2009
2010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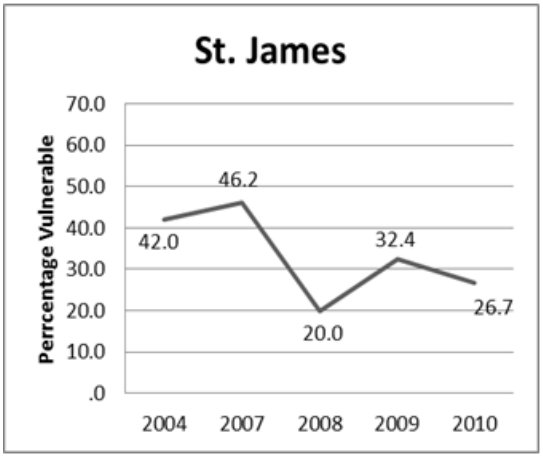
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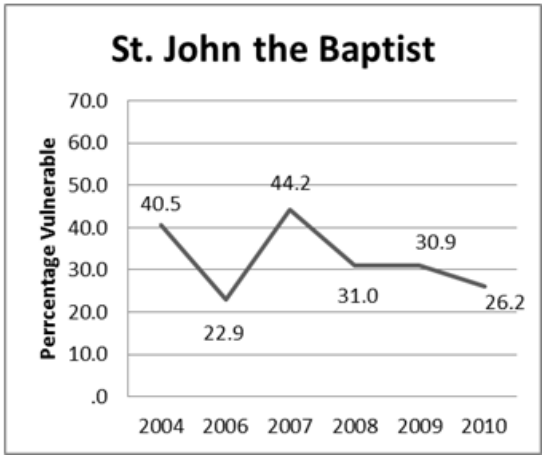
32.4
26.7
2004
2007
2008
2009
2010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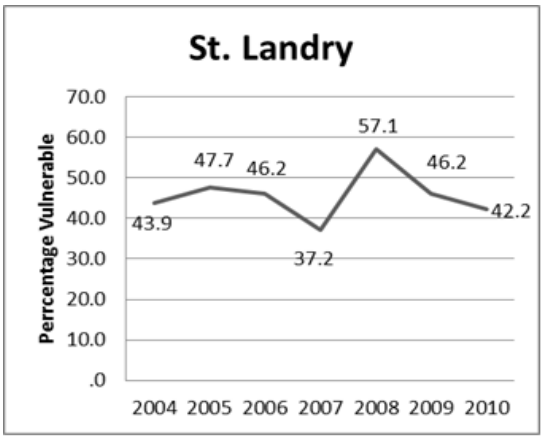
22.9
44.2
31.0
30.9
26.2
2004
2006
2007
2008
2009
2010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Perrcentage Vulnerable
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20.0
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.0
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47.7
46.2
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57.1
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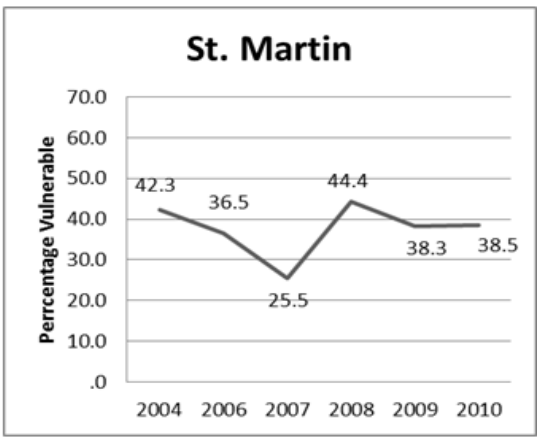
42.2
2004 2005 2006 2007 2008 2009 2010


St. Martin
Perrcentage Vulnerable
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44.4
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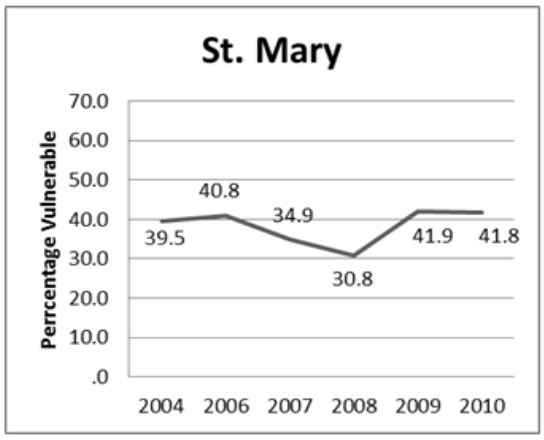
38.5
2004 2006 2007 2008 2009 2010


St. Mary
Perrcentage Vulnerable
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10.0
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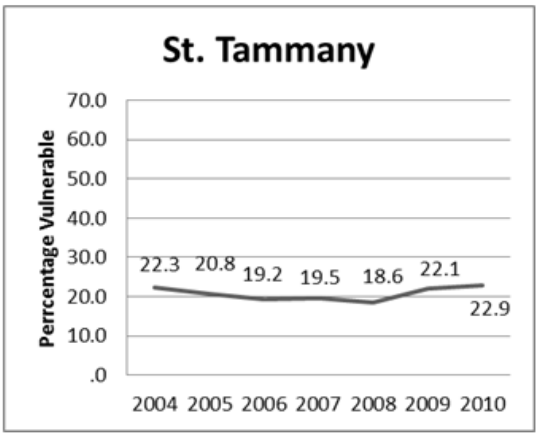
30.8
41.9
41.8
2004 2006 2007 2008 2009 2010


St. Tammany
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18.6
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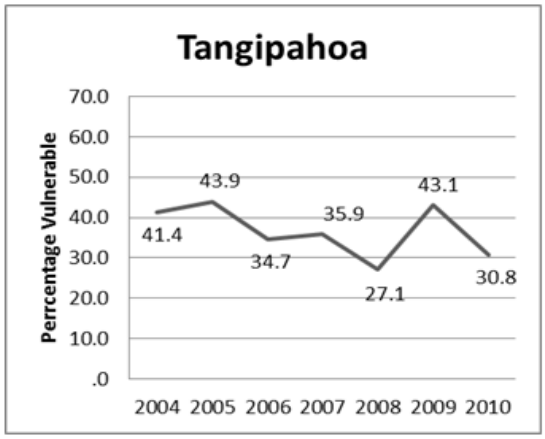
22.9
2004 2005 2006 2007 2008 2009 2010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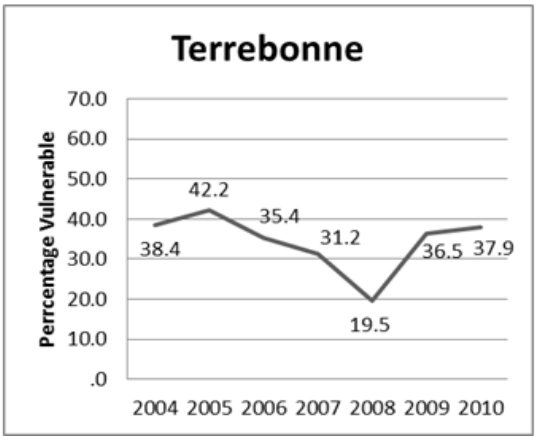
30.8
2004 2005 2006 2007 2008 2009 2010


Terrebonne
Perrcentage Vulnerable
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40.0
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.0
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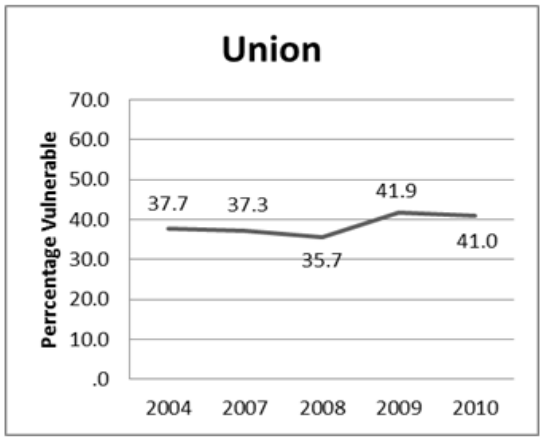
31.2
19.5
36.5
37.9
2004 2005 2006 2007 2008 2009 2010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Perrcentage Vulnerable
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60.0
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40.0
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10.0
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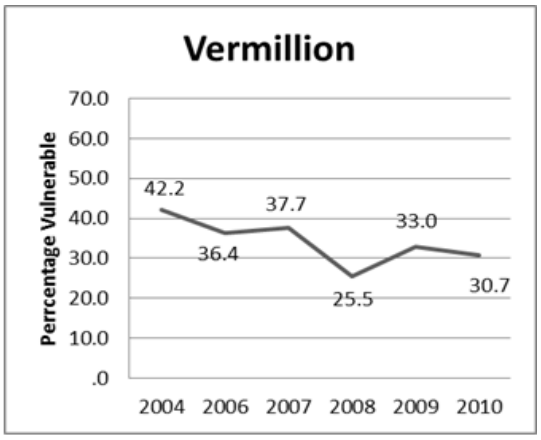
41.9
41.0
2004
2007
2008
2009
2010


Vermillion
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50.0
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30.7
2004
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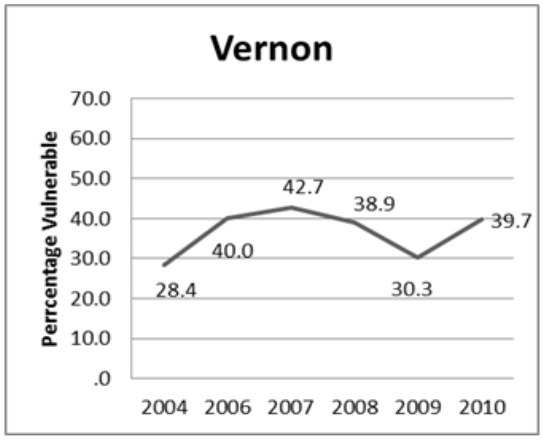
2010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Perrcentage Vulnerable
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39.7
2004
2006
2007
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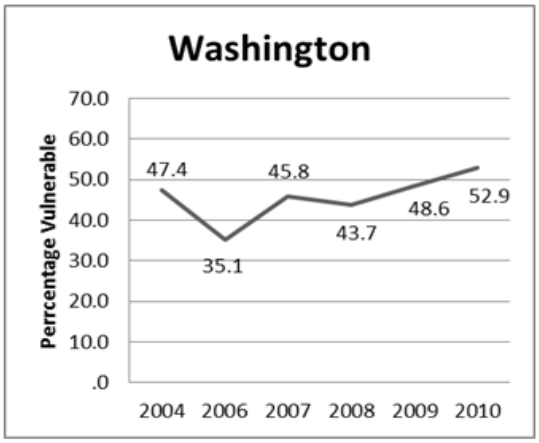
2009
2010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Perrcentage Vulnerable
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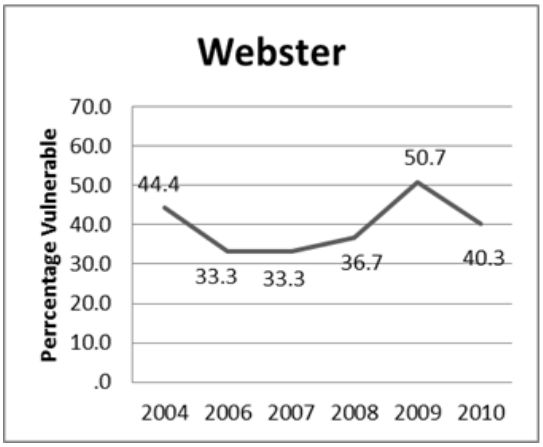
43.7
48.6
52.9
2004
2006
2007
2008
2009
2010


Webster
Perrcentage Vulnerable
70.0
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50.0
40.0
30.0
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44.4
33.3
33.3
36.7
50.7
40.3
2004
2006
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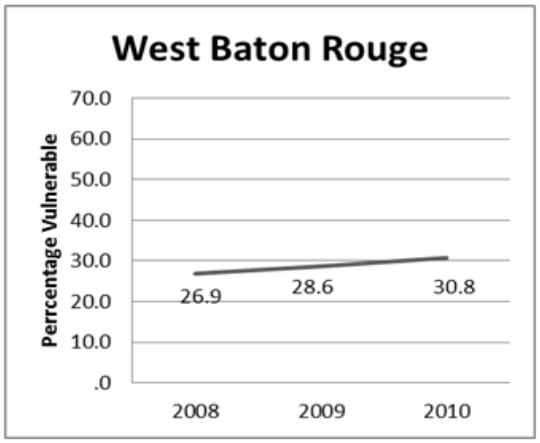
2010


West Baton Rouge
Perrcentage Vulnerable
70.0
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20.0
10.0
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26.9
28.6
30.8
2008
2009
2010

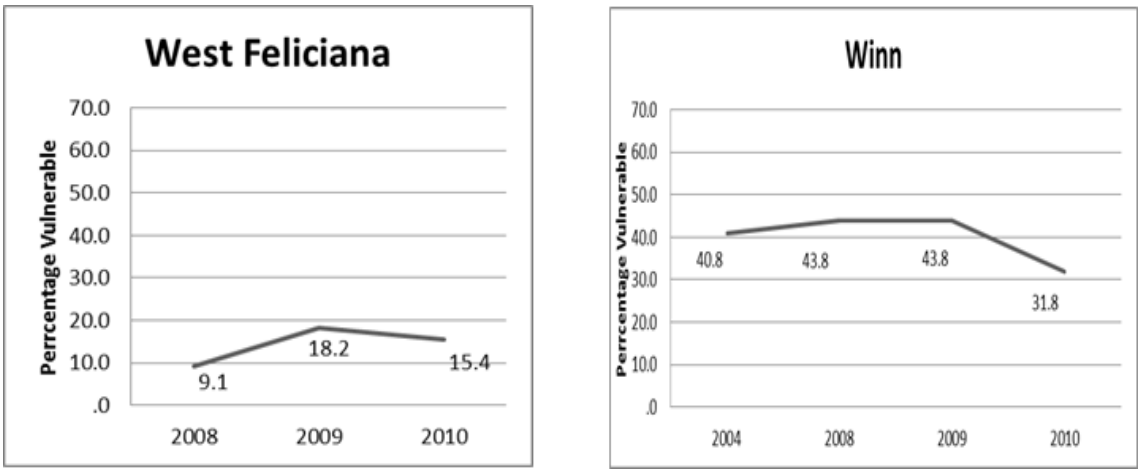

Figure 12. Empirical growth plots for parish vulnerability over time.

Unconditional Model

Fitting the unconditional (null) model which describes the probability of experiencing social vulnerability across individuals (Model A) was accomplished using the equation in Figure 13.

$\text{resp}_{ijkl} \sim \text{Ordered Multinomial } (\text{Constant}_{jkl}, \pi_{ijkl})$
$\gamma_{0jkl} = \pi_{0jkl};\ \gamma_{1jkl} = \pi_{0jkl} + \pi_{1jkl};\ \gamma_{2jkl} = 1$
$\text{logit}(\gamma_{0jkl}) = \beta_0 \text{Constant.}(<=\text{Not at all vulnerable})_{ijkl} + h_{jkl}$
$\text{logit}(\gamma_{1jkl}) = \beta_1 \text{Constant.}(<=\text{Some Vulnerability})_{ijkl} + h_{jkl}$
$h_{jkl} = v_{2kl} \text{Constant.01} + f_{2l}\ \text{Constant.01}$

$[f_{2l}] \sim \text{N}(0, \Omega_v) : \Omega_v = [\sigma_{f2}^2]$-*

$[v_{2kl}] \sim \text{N}(0, \Omega_v) : \Omega_v = [\sigma_{v2}^2]$

$\text{cov}(y_{sjkl}, y_{rjkl}) = y_{sjkl}(1 - y_{rjkl})/\text{Constant}_{jkl}\ \text{s} <= \text{r}$

Figure 13. Null model.

Table 24 provides details on the estimated intercept, variance components and model fit for the four level null model. As mentioned earlier, there were 34,685 individuals on level 1, 296 yearly parish cohorts on level 2 and 56 parishes on level 3. With a cumulative probability model, as the one used in this

study, an additional level is included with the analysis, represented by level 0. The level 0 is a response category level indicating the level of individual social vulnerability each individual had. This is in principle a dummy coded binary variable, indicating whether an individual was not vulnerable at all (yes or no), having some vulnerability (yes or no) with being vulnerable, the reference category. For this sample there were a total of 69,370 responses on level 0.

Table 24

Unconditional model (null model)

Parameter	Model A
Fixed effects	
0 Not at all vulnerable (γ_{0jkl})	-0.851*** (0.047)
<=1 Some vulnerability (γ_{1jkl})	0.569*** (0.047)
Random parameters	
Level: Individual	
Constant.01/Constant.01	0.083 *** (0.020)
CTYCODE	
Constant.01/Constant.01 YEAR	0.029 *** (0.006)
DIC:	75329.59
pD:	149.353

Note: Standard errors are in parentheses. DIC: Diagnostic Information Criterion; pD: estimated degrees of freedom; ***$p \leq 0.001$; **$p \leq 0.01$

With the null model (Model A, Table 24) the “success” being modeled is that of having a response at, or below each response level. Table 24 indicates the results of the first equation of the null model, without any predictors. The log-odds of not-at-all vulnerable is -0.851, corresponding to the probability of exp (-0.851)/ [1+exp (-0.851)] =0.30. The second equation, the log-odds of either having no vulnerability or having some vulnerability, is 0.569 that corresponds with a probability of exp (0.569)/ [1+exp (0.569)] = 0.64.

An important aspect that should receive attention with model building is the intraclass correlation (ICC). It measures the proportion of total variance that

is due to differences in groups (Steele, 2008). The ICC, an estimate of the amount of variability at a specified level (e.g., level-3, level-2), is calculated by using the specified level variance divided by the total variance present in the model. With the use of a logistic model, the level one residuals are expected to follow the standard logistic distribution with a mean of 0 and a variance of $\pi^2/3$ = 3.29 (O'Connell, 2010).

Table 24 shows that the variance at level 3 (parish level) was 0.083, and the variance at level 2 (parish cohort level) was 0.029. Therefore, about 2.4 percent of the total variance [(0.083/ (3.29+0.029+0.083) =0.024] was between parishes, indicating that there were indeed differences in individual social vulnerability levels. The variance between parish cohorts was minimal [(0.029/(3.29+0.029+0.083= 0.0085)], indicating that less than 1% (0.85%) change took place between 2004 and 2010 in the different parishes in relation to their levels of individual social vulnerability.

The Deviance Information Criterion (DIC) is used as an analytical method to assess the fit of models estimated with MCMC methods. DIC is utilized to determine the most parsimonious model based on both fit and complexity. Therefore, this is a comparative number where lower values are indicative of a more parsimonious model.

Since the DIC is already penalized for model complexity, it is not compared to a frequency distribution. Instead, the DIC values can be compared to one another. Lower values indicate a better and a more parsimonious model. For a DIC value to be considered a significant improvement, there needs to be a

decrease of at least 10 points (Jones, 2012). For the null model (Model A, Table 22) the DIC = 75329.59.

Figure 14 plots and ranks 56 parish-specific residuals along with their respective 95% confidence intervals. The parishes that ranked the lowest were the parishes where their residents had the lowest odds of not being vulnerable at all, or equivalently, the highest odds of being vulnerable. The parishes that ranked the highest were the parishes where their residents had the highest odds of not being vulnerable at all and therefore also the lowest odds of being vulnerable.

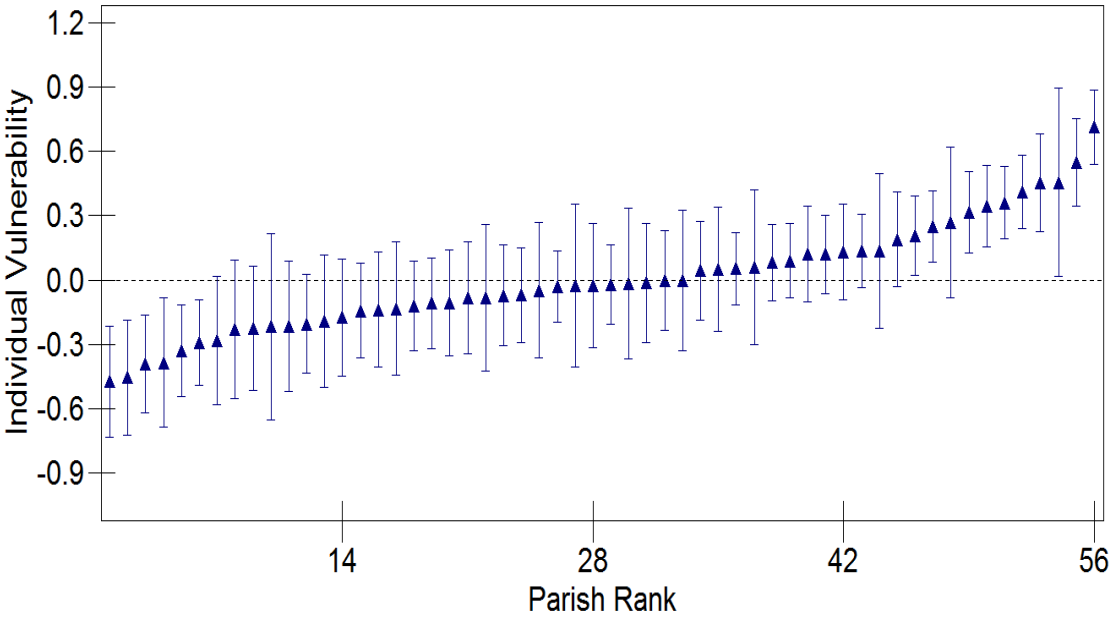

Figure 14. Ranked residuals for nested individuals in parishes.

The parishes that had worse than average odds of being vulnerable were Morehouse, Allen, Avoyelles, Richland, Washington and St. Landry parish. The parishes that had better than average odds of not being vulnerable were St. Tammany, East Baton Rouge, Ascension, Livingston, West Feliciana, Bossier, St. Charles, Jefferson, Lafayette and Lafourche parish.

Unconditional Growth Model

The unconditional growth model can be described as the unconditional model with the time variable added. Fitting the unconditional growth model, depicting the probability of experiencing individual social vulnerability over time, is shown in Model B, using the following expanded equation in which time was added. A Wald test showed that the effect of time did not vary across parishes or parish cohorts; therefore, time was only added as a fixed effect.

$$\text{resp}_{ijkl} \sim \text{Ordered Multinomial } (\text{Constant}_{jkl}, \pi_{ijkl})$$
$$\gamma_{0jkl} = \pi_{0jkl};\ \gamma_{1jkl} = \pi_{0jkl} + \pi_{1jkl};\ \gamma_{2jkl} = 1$$
$$\text{logit}(\gamma_{0jkl}) = \beta_0 \text{Constant.(<=Not at all vulnerable)}_{ijkl} + h_{jkl}$$
$$\text{logit}(\gamma_{1jkl}) = \beta_1 \text{Constant.(<=Some Vulnerability)}_{ijkl} + h_{jkl}$$
$$h_{jkl} = \beta_4 Time.01_{kl}\ v_{2kl}\text{Constant.01} + f_{2l}\text{Constant.01}$$

$$[f2l] \sim \text{N}(0, \Omega_v) : \Omega_v = \left[\sigma_{f2}^2\right]$$

$$[v\ 2kl] \sim N(0, \Omega_v) : \Omega_v = [\sigma_{v2}^2]$$

$$\text{cov}(y_{sjkl}, y_{rjkl}) = y_{sjkl}(1 - y_{rjkl})/\text{Constant}_{jkl}\ \text{s} <= \text{r}$$

Figure 15. Unconditional growth model

Table 25 shows both Model A and Model B, which includes the time variable.

Table 25

Comparison of Null Model to Growth Model

Parameter	Model A	Model B
Fixed effects		
0 Not at all vulnerable (γ_{0jkl})	-0.851*** (0.047)	-1.002*** (0.050)
<=1 Some vulnerability (γ_{1jkl})	0.569*** (0.047)	0.419*** (0.049)
TIME. $(\beta_4.01kl)$		0.045*** (0.007)
Random parameters		
Level: Individual		
Constant.01/Constant.01 CTYCODE	0.083*** (0.020)	0.086*** (0.020)
Constant.01/Constant.01 YEAR	0.029*** (0.006)	0.019*** (0.005)
DIC:	75329.59	75310.73
pD:	149.353	129.383

Note: Standard errors are in parentheses. DIC: Diagnostic Information Criterion; pD: estimated degrees of freedom; ***$p \leq 0.001$; **$p \leq 0.01$.

Comparing the equations of Model A to Model B, it is evident that for each response category, the log-odds of overall individual vulnerability went down. Adding the time variable to the model resulted in an improved model fit (DIC = 75329.59 for the null model versus DIC = 75310.73 for the growth model). As the case was with the null model, log-odds were transformed to cumulative probabilities using the customized predications function in MLwiN, in order to obtain unique probabilities. The unique probabilities for individual social vulnerability for the unconditional growth model are shown in Figure 16.

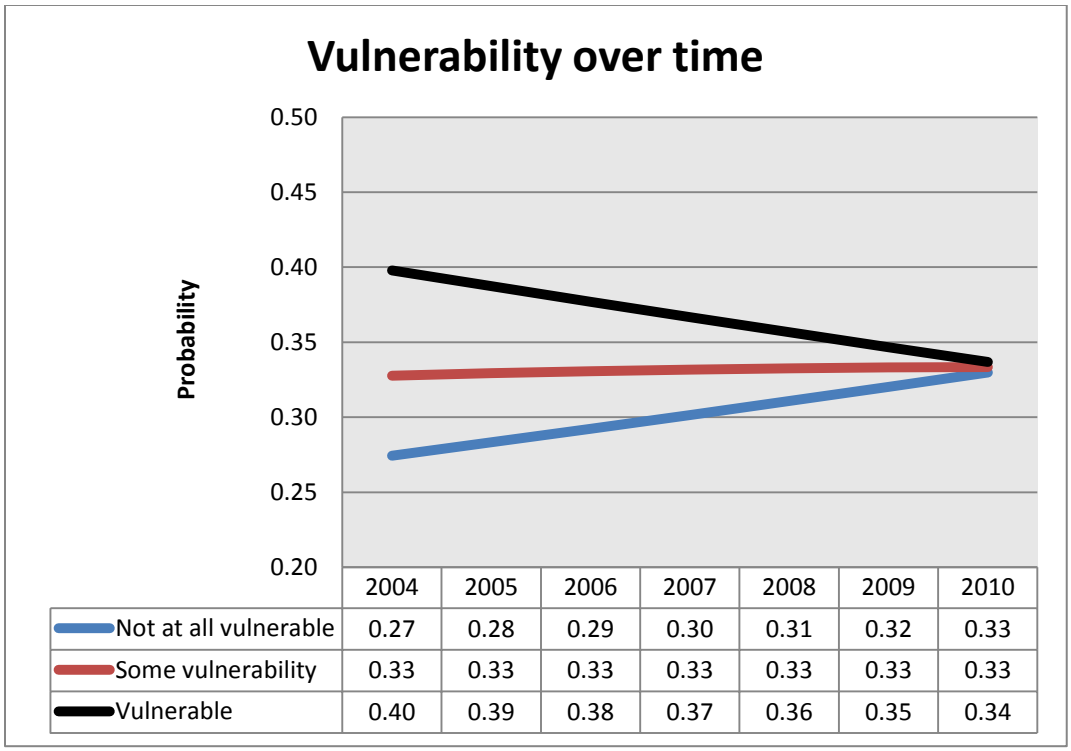

Figure 16. Individual social vulnerability of whole sample over time.

The sample had an overall decrease in the level of individual social vulnerability from 2004 to 2010. The probability of being not-at-all-vulnerable increased from 27 percent in 2004, to 33 percent in 2010. Being in a state of some vulnerability had a constant of 33 percent over the study period of seven years. Being in a state of vulnerability decreased from 40 percent in 2004 to 34 percent in 2010. Based on the probabilities presented with Figure 16 it can be concluded that conditions did improve for individuals with the overall level of individual social vulnerability decreasing from 2004 to 2010.

Conditional Growth Model

The conditional growth model was expanded by adding explanatory variables (Model C) to the equation:

$\text{resp}_{ijkl} \sim \text{Ordered Multinomial}\ (\text{Constant}_{jkl}, \pi_{ijkl})$
$\gamma_{0jkl} = \pi_{0jkl};\ \gamma_{1jkl} = \pi_{0jkl} + \pi_{1jkl};\ \gamma_{2jkl} = 1$
$\text{logit}(\gamma_{0jkl}) = \beta_0 \text{Constant.}(<=\text{Not at all vulnerable})_{ijkl} + h_{jkl}$
$\text{logit}(\gamma_{1jkl}) = \beta_1 \text{Constant.}(<=\text{Some Vulnerability})_{ijkl} + h_{jkl}$
$h_{jkl} = \beta_4 Time.01_{kl} + \beta_5(\text{RiskAssScore} - \text{gm}).01_{l} + \beta_6(\text{NumDisasters}).01_{kl} +$
$\beta_7\ \text{Fatalities}_{\text{gr}}\text{: Fatalities}.01_{kl} + \beta_8\ \text{Injuries}_{gr}\text{: Injuries}.01_{kl} +$
$\beta_9\ \text{PropDamGr: Property Damage}.01_{kl} + \beta_{10}\ \text{CropDamGr: Crop Damage}.01_{kl} +$
$\beta_{11}\ (\text{CitizenCorps} - \text{gm}).01_{l} +$
$\beta_{12}\text{Stormready: No Participation in Storm Ready Program}.01_{l} +$
$\beta_{13}\text{ComRatSys: No Participation in Community Rating System}.01_{l} +$
$\beta_{14}\ (\text{HMGrantPFunding} - \text{gm}).01_{l} + \beta_{15}\text{No Parish Capability Assessment}.01_{l} +$
$\beta_{16}\ (\text{HousingType} - \text{gm}).01_{l} + \beta_{17}\ (\text{HealthAccess} - \text{gm}).01_{l} +$
$\beta_{18}\ (\text{SchoolsSQRT} - \text{gm}).01_{l} + \beta_{19}\ (\text{TotalPopSQM} - \text{gm}).01_{kl} +$
$\beta_{20}\ (\text{EducAttainment} - \text{gm}).01_{l} + \beta_{21}\ (\text{Ageless65} - \text{gm}).01_{kl} +$
$\beta_{22}\ (\text{PercMajority} - \text{gm}).01_{kl} + \beta_{23}\ (\text{VehicleAccessTrim} - \text{gm}).01_{l} +$
$\beta_{24}\ (\text{HouseholdPhone} - \text{gm}).01_{l}$
$+\beta_{25}\ (\text{HealthCover} - \text{gm}).01_{l} + \beta_{26}\ (\text{SpecNeeds\_1} - \text{gm}).01_{l} + \beta_{27}\ (\text{HousingCap} -$
$\text{gm}).01_{l} + \beta_{28}\ (\text{Wealth} - \text{gm}).01_{l} + \beta_{29}\ EmploymentTrim.01_{l}$
$+\beta_{30}\ (\text{MultiSectorSQRT} - \text{gm}).01_{l}$
$+\beta_{31}\ (\text{FemaleEmploy} - \text{gm}).01_{l} + \beta_{32}\ (\text{Physicians} -$
$\text{gm}).01_{l} + \beta_{33}\ (\text{PlaceAttachment} - \text{gm}).01_{l} + \beta_{34}\ (\text{VoterParticipation} -$
$\text{gm}).01_{l} + \beta_{35}\ (\text{ReligiousBel} - \text{gm}).01_{l} + \beta_{36}\ (\text{VolunteerOrg} -$
$\text{gm}).01_{l} + \beta_{37}\ (\text{Innovation} - \text{gm}).01_{l} + v_{2kl}\text{Constant}.01 + f_{2l}\text{Constant}.01$

$[f2l] \sim \text{N}(0, \Omega_v) : \Omega_v = \left[\sigma_{f2}^2\right]$
$[v\ 2kl] \sim N(0, \Omega_v) : \Omega_v = [\sigma_{v2}^2]$
$\text{cov}(y_{sjkl}, y_{rjkl}) = y_{sjkl}(1 - y_{rjkl})/\text{Constant}_{jkl}\ \text{s} <= \text{r}$

Figure 17. Growth model with main effects.

Variables that were either not significant or did not contribute to overall model fit were deleted from Model C to create a parsimonious model, resulting in the removal of 26 variables from the final model C. Table 26 compares the unconditional model (null model) with the unconditional growth model and the conditional growth model, with only relevant variables included.

Table 26

Comparison of Null Model, Growth Model and Growth Model with Main effects

Parameter	Model A	Model B	Model C
	Fixed effects		
0 Not at all vulnerable $\left(\gamma_{0jkl}\right)$	-0.8513*** (0.0471)	-1.0020*** (0.050)	-0.865*** (0.026)
<=1 Some vulnerability $\left(\gamma_{1jkl}\right)$	0.5690*** (0.0471)	0.4190*** (0.0495)	0.552*** (0.103)
TIME.01($\boldsymbol{\beta_4}.\boldsymbol{kl}$)		0.0451*** (0.0070)	0.0495*** (0.007)
Number of Disasters ($\boldsymbol{\beta_5}.\boldsymbol{kl}$)			-0.0021 (0.0015)
Educational Attainment ($\boldsymbol{\beta_6}.\boldsymbol{l}$)			0.0294*** (0.0036)
Age Below 65 Years ($\boldsymbol{\beta_7}.\boldsymbol{kl}$)			0.0238** (0.0110)
Total Population per Square Mile ($\boldsymbol{\beta_8}.\boldsymbol{kl}$)			0.00008 (0.00005)
Household Phone ($\boldsymbol{\beta_9}.\boldsymbol{l}$)			0.0155*** (0.0030)
Wealth ($\boldsymbol{\beta_{10}}.\boldsymbol{l}$)			0.0160** (0.0050)
Employment ($\boldsymbol{\beta_{11}}.\boldsymbol{l}$)			-0.0364 (0.011)
Physicians ($\boldsymbol{\beta_{12}}.\boldsymbol{l}$)			0.0002 (0.0002)
	Random parameters		
Level: Individual			
Constant.01/Constant.01 CTYCODE	0.0834*** (0.020)	0.0860*** (0.020)	0.0015 (0.0013)
Constant.01/Constant.01 YEAR	0.0290***(0.006)	0.0190*** (0.005)	0.0150*** (0.0040)
DIC:	75329.59	75310.73	75282.02
pD:	149.353	129.383	95.020

*Note: Standard errors are in parentheses; DIC: Diagnostic Information Criterion; pD: estimated degrees of freedom; ***p ≤ 0.001; **p ≤ 0.01*

Adding predictor variables to the model resulted in a significantly improved fit (DIC = 75329.59 for the null model versus DIC = 75310.73 for the unconditional growth model versus DIC = 75282.02 for the conditional growth model).

As with the null model and the unconditional growth model, log-odds were transformed into cumulative probabilities to calculate unique probabilities.

In Figure 18, the unique probabilities of individual social vulnerability for the whole sample controlling for main effects were modeled.

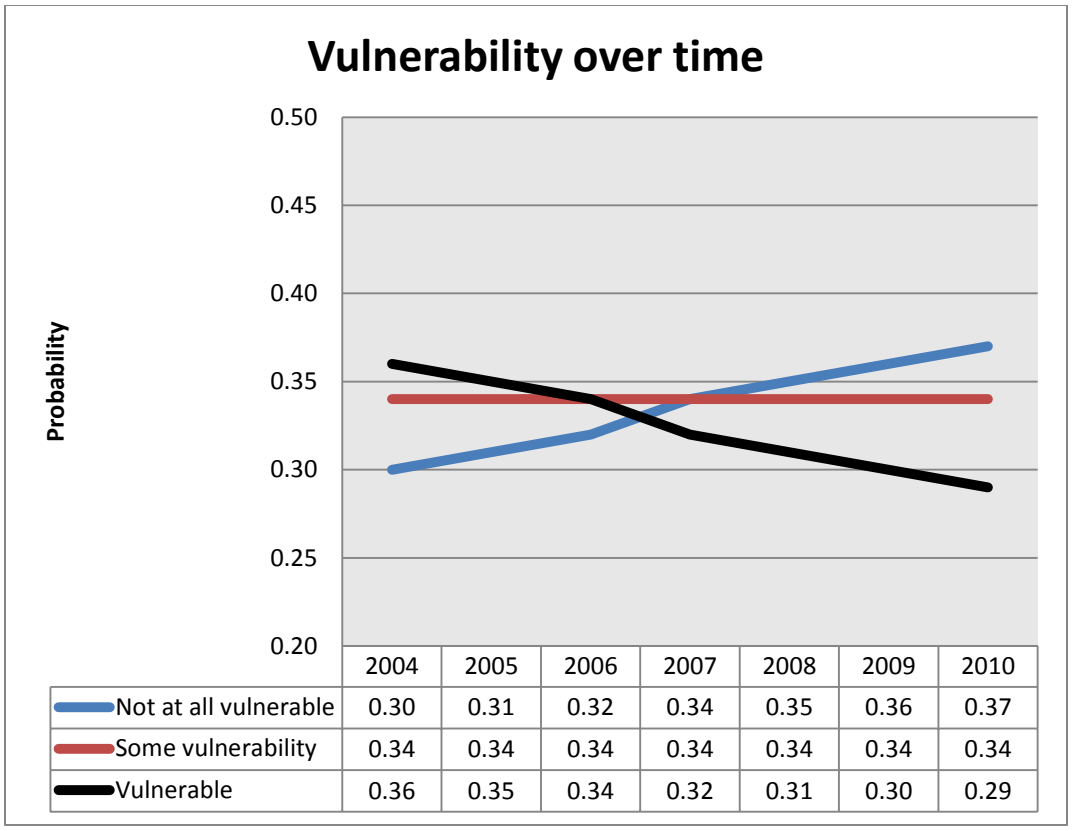

Figure 18. Individual social vulnerability of the whole sample over time controlling for main effects.

Based on the probabilities for vulnerability over time with the main effects added, it is evident that the probability of an individual being in a state of vulnerability decreased for the vulnerable group. The probability of not being vulnerable increased by seven percent from 2004 to 2010. The some-vulnerability group did not experience any change in their level of vulnerability with a constant probability of 34 percent over the seven year study period.

Conditional Growth Model with Interaction Effects

The conditional growth model was expanded by adding interaction effects of social vulnerability with the main effects (Model D) in the equation in Figure 19:

$\text{resp}_{ijkl} \sim \text{Ordered Multinomial}\ (\text{Constant}_{jkl}, \pi_{ijkl})$
$\gamma_{0jkl} = \pi_{0jkl};\ \gamma_{1jkl} = \pi_{0jkl} + \pi_{1jkl};\ \gamma_{2jkl} = 1$
$\text{logit}(\gamma_{0jkl}) = \beta_0 \text{Constant.}(<=\text{Not at all vulnerable})_{ijkl} + h_{jkl}$
$\text{logit}(\gamma_{1jkl}) = \beta_1 \text{Constant.}(<=\text{Some Vulnerability})_{ijkl} + h_{jkl}$
$h_{jkl} = \beta_4 Time.01 + \beta_5(\text{NumDisasters}).01_{\ kl} + \beta_6\ (\text{EducAttainment} - \text{gm}).01_{\ l} + \beta_7\ (\text{Ageless65} - \text{gm}).01_{\ kl} + \beta_8\ (\text{TotalPopSQM} - \text{gm}).01_{\ kl} + \beta_9\ (\text{HouseholdPhone} - \text{gm}).01_{\ l} + \beta_{10}\ (\text{Wealth} - \text{gm}).01_{\ l} + \beta_{11}\ EmploymentTrim.01_{\ l} + \beta_{12}\ (\text{Physicians} - \text{gm}).01_{\ l} + \beta_{13}\ (\text{Ageless65} - \text{gm}) * (\text{HouseholdPhone} - \text{gm}).01_{\ kl} + \beta_{14}(\text{NumDisasters}) * (\text{TotalPopSQM} - \text{gm}).01_{\ kl} + \beta_{15}(\text{NumDisasters}) * (\text{Physicians} - \text{gm}).01_{\ kl} + v_{2kl}\text{Constant.}01 + f_{2l}\ \text{Constant.}01$

$[f_{2l}] \sim \text{N}(0, \Omega_v) : \Omega_v = \left[\sigma_{f2}^2\right]$

$[v\ 2kl] \sim \text{N}(0, \Omega_\text{v})\ : \Omega_v = [\sigma_{v2}^2]$

$\text{cov}(y_{sjkl}, y_{rjkl}) = y_{sjkl}(1 - y_{rjkl})/\text{Constant}_{jkl}\ \text{s} <= \text{r}$

Figure 19. Growth model with main effects and interaction effects.

Table 27 compares all four models. In adding the interaction effects of community disaster resilience with the main effects to the model resulted in a slightly improved fit (DIC = 75329.59 for the null model versus DIC = 75310.73 for the unconditional growth model versus DIC =75282.02 for the conditional growth model versus DIC = 75280.26 for the conditional growth model with main and interaction effects). In order for the model fit to be significant a reduction of 10 points was needed. Reduction in DIC for Model D was therefore not different from the conditional growth model, but there was a reduction in the random effect on the cohort level. The examination of DIC diagnostics in MLwiN with the final stage of the model-building showed that with 50,000 iterations, the effective sample size requirement of 250 was met.

Table 27

Comparison of All Models

Parameter	Model A	Model B	Model C	Model D
	Fixed effects			
0 Not at all vulnerable (γ_{0jkl})	-0.8513***(0.0471)	-1.0020*** (0.050)	-0.8650*** (0.026)	-0.8430*** (0.027)
<=1 Some vulnerability (γ_{1jkl})	0.5690*** (0.0471)	0.4190*** (0.0495)	0.5520*** (0.103)	0.5770*** (0.027)
TIME.01($\beta_4.kl$)		0.0451*** (0.0070)	0.0495*** (0.007)	0.0520*** (0.006)
Number of Disasters ($\beta_5.kl$)			-0.0021 (0.0015)	0.0025 (0.002)
Educational Attainment ($\beta_6.l$)			0.0294*** (0.0036)	0.0280*** (0.003)
Age Below 65 Years ($\beta_7.kl$)			0.0238** (0.0110)	0.0220˜(0.012)
Total Population per Square Mile ($\beta_8.kl$)			0.00008 (0.00005)	0.000015 (0.000059)
Household Phone ($\beta_9.l$)			0.0155*** (0.0030)	0.0147***(0.0033)
Wealth ($\beta_{10}.l$)			0.0160** (0.0050)	0.0134* (0.005)
Employment ($\beta_{11}.l$)			-0.0364** (0.0110)	0.0360** (0.011)
Physicians ($\beta_{12}.l$)			0.0002 (0.0002)	0.00025 (0.0012)
Age Below 65 Years*Household Phone($\beta_{13}.kl$)				0.0020˜ (0.0012)
Number of Disasters*Physicians($\beta_{14}.kl$)				-0.000016* (0.00008)
Number of Disasters*Total Population per Square Mile($\beta_{15}.kl$)				0.000017* (0.000007)
	Random parameters			
Level: Individual				
Constant.01/Constant.01 CTYCODE	0.0834*** (0.020)	0.0860*** (0.020)	0.0015 (0.0013)	0.0015 (0.0011)
Constant.01/Constant.01 YEAR	0.0290***(0.006)	0.0190*** (0.005)	0.015*** (0.0040)	0.0135*** (0.0036)
DIC:	75329.59	75310.73	75282.02	75280.26
pD:	149.353	129.383	95.020	91.563

*Note: Standard errors are in parentheses; DIC: Diagnostic Information Criterion; pD: estimated degrees of freedom; ***p ≤ 0.001; **p ≤ 0.01*

The final model (Model D) included two-way interaction effects. Interaction effects modeled were number of disasters in a parish and total population per square mile; number of disasters and number of physicians per 100 000 population, as well as having a household phone and people in parish below 65 years.

ICC was calculated with the final model using the same formula as used with the null model. Table 27 shows that the variance at level 3 (parish level) was 0.001556, and the variance at level 2 (parish cohort level) was 0.013509. Therefore, a very small amount (0.05%) of the total variance [(0.001556/ (3.29+0.013509+0.001556)] was left unexplained between parishes, indicating that most of the variance between parishes was explained by the main and interaction effects in the model. The variance between parish cohorts was 0.41 percent [(0.013509/ (3.29+0.001556+0.013509)], indicating that less than a half percent of variance remained on the parish cohort level that was not explained.

As with Models A, B, C, log-odds were transformed into cumulative probabilities using the customized predictions function in MLwiN, to calculate the unique probabilities. Figure 20 displays the unique probabilities modeled for individual social vulnerability for the whole sample after controlling for main and interaction effects.

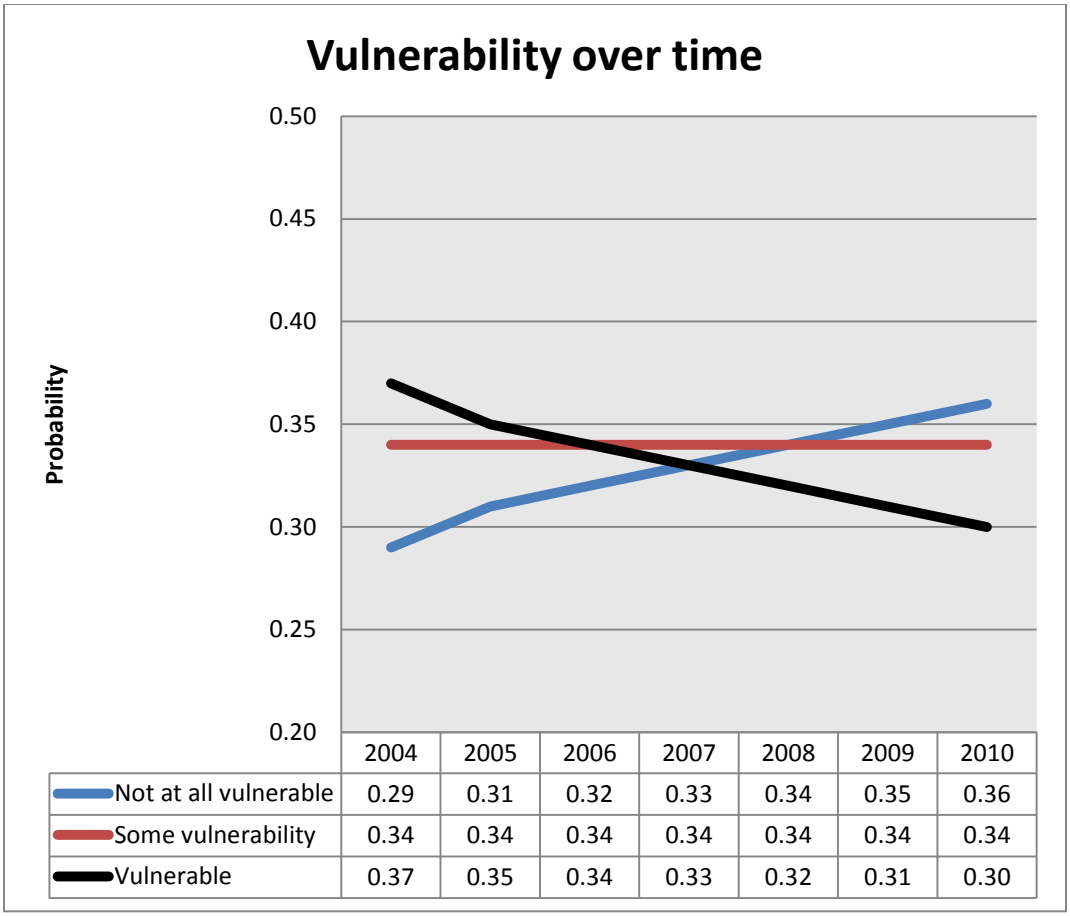

Figure 20. Individual social vulnerability of the whole sample overtime controlling for all main effects and interaction effects in Model D.

The caterpillar plot in Figure 21 highlights the differences between parishes that were left after all main effects and interaction effects were added to model D. The figure clearly shows that there were no differences left between parishes that were not explained.

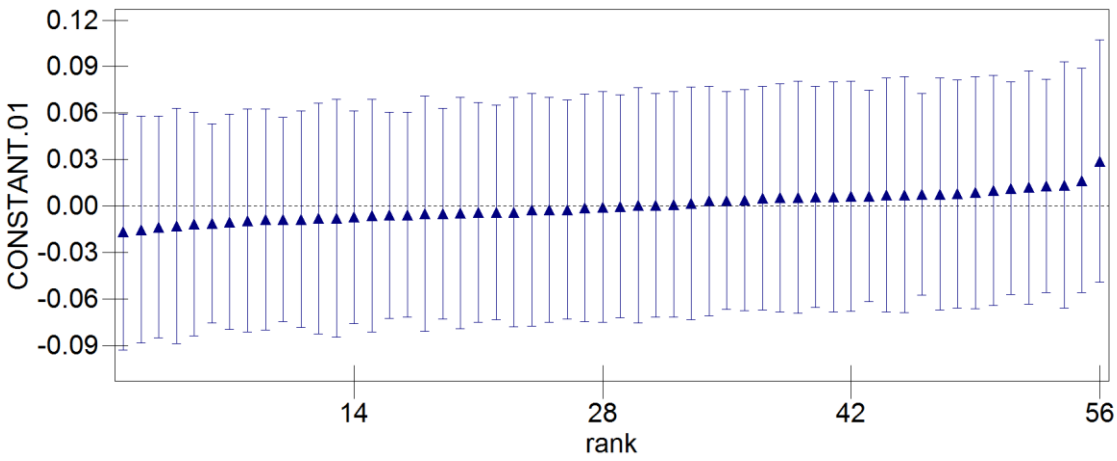

Figure 21. Caterpillar plot for final model indicating differences between the 56 parishes.

This next section details the unique probabilities of individual social vulnerability as modeled for each of the significant main effects.

Socio-Economic Resilience. Social resilience predictors that were statistically significant predictors of individual social vulnerability included educational attainment, household phone, wealth, employment and age as a trend. Figures 22, 23, 24, 25 and 26 represents the unique predicted probabilities for the significant predictors. Figure 22 below shows the main effect of **educational attainment** on individual social vulnerability, and highlights the unique predicted probabilities of no vulnerability, some vulnerability and vulnerability by educational attainment.

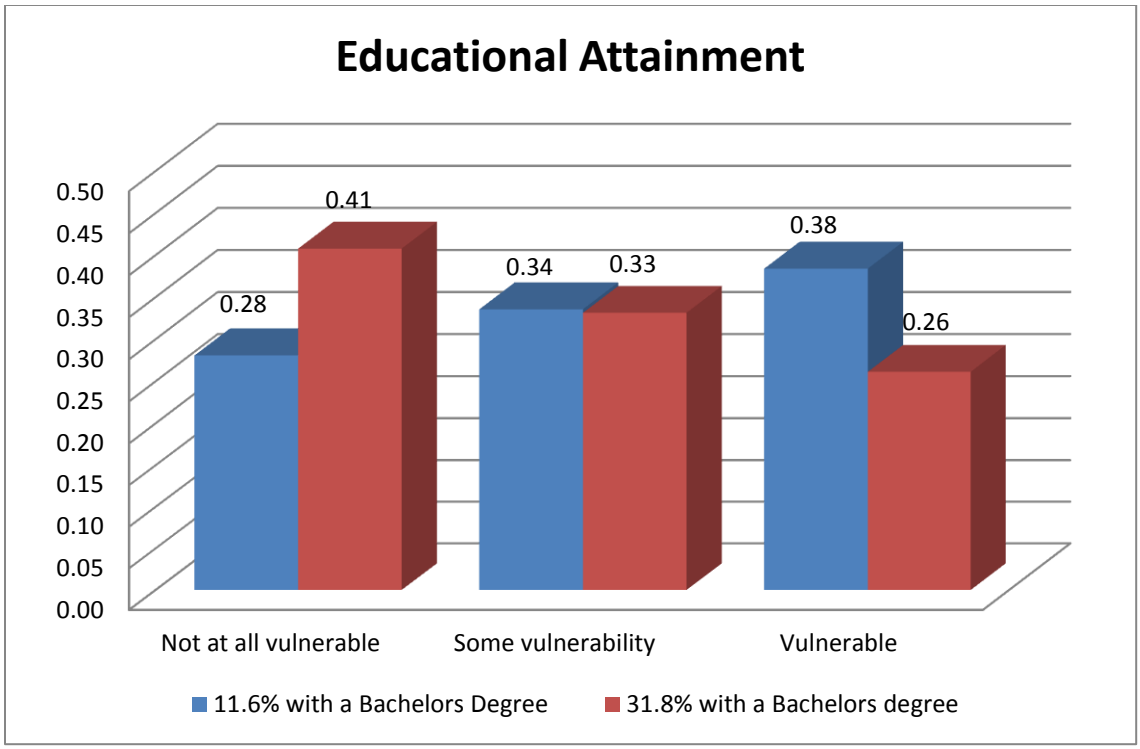

Figure 22. Unique predicted probabilities for educational attainment by individual social vulnerability level.

Based on the unique probabilities for educational attainment in Figure 22, it is evident that in parishes where more people had a bachelors degree, the vulnerability was the lowest. Parishes that had a lower percentage of residents possessing a bachelors degree were the most vulnerable.

Figure 23 highlights the unique probabilities, based on the main effect of having access to a **household phone,** on individual social vulnerability.

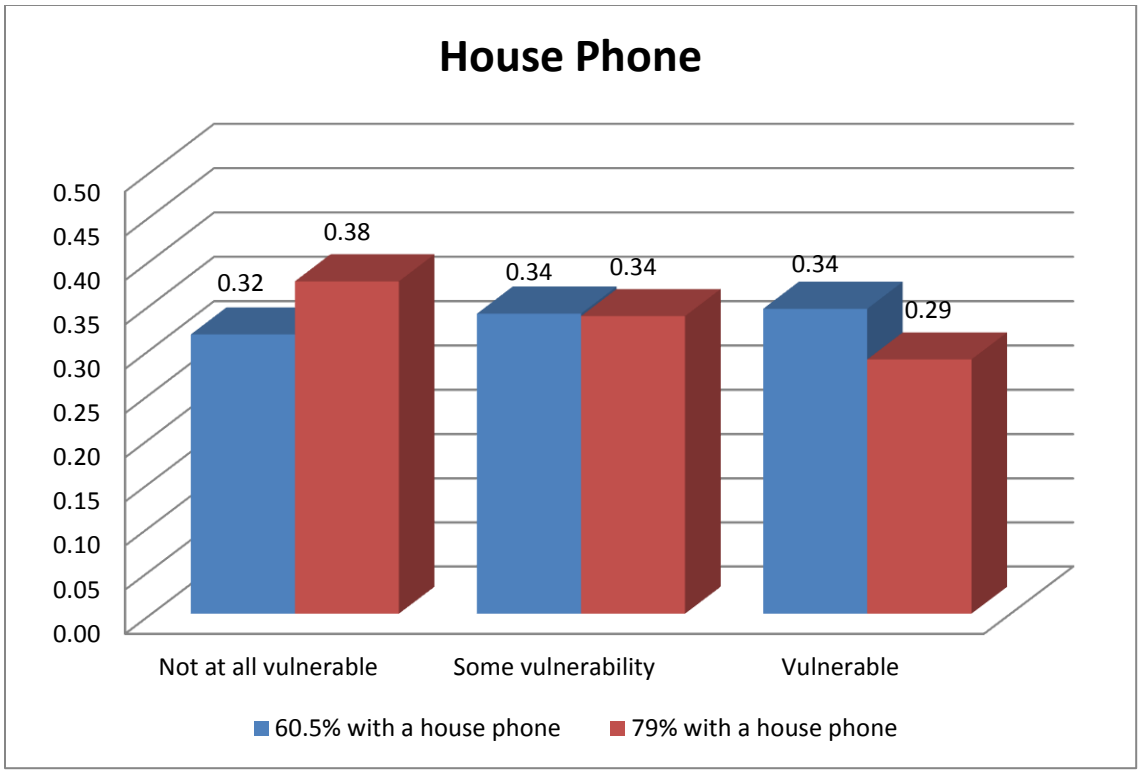

Figure 23. Unique predicted probabilities of having access to a household phone on individual social vulnerability.

The unique probabilities in Figure 23 confirm that in parishes where more people had access to a household phone, the vulnerability of the residents were the lowest. Parishes where people with lower levels of access to a household phone resided had the highest probability of being vulnerable.

Figure 24 models the unique probabilities based on the main effect of **wealth** on individual social vulnerability.

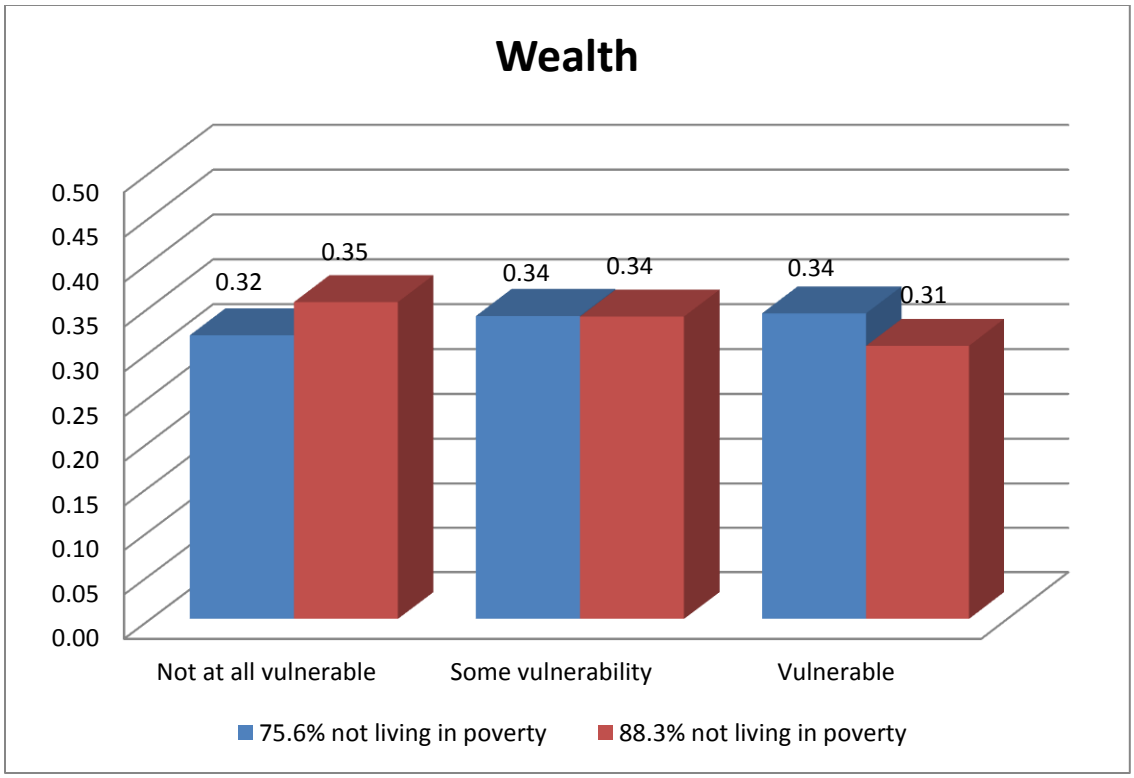

Figure 24. Unique predicted probabilities of not living in poverty on individual social vulnerability.

As can be seen in Figure 24, in parishes where more people were not living in poverty, the level of vulnerability was the lowest. Parishes that had a lower percentage of people not living in poverty experienced the highest level of vulnerability.

Figure 25, models the unique probabilities of the main effect of **employment** on individual social vulnerability.

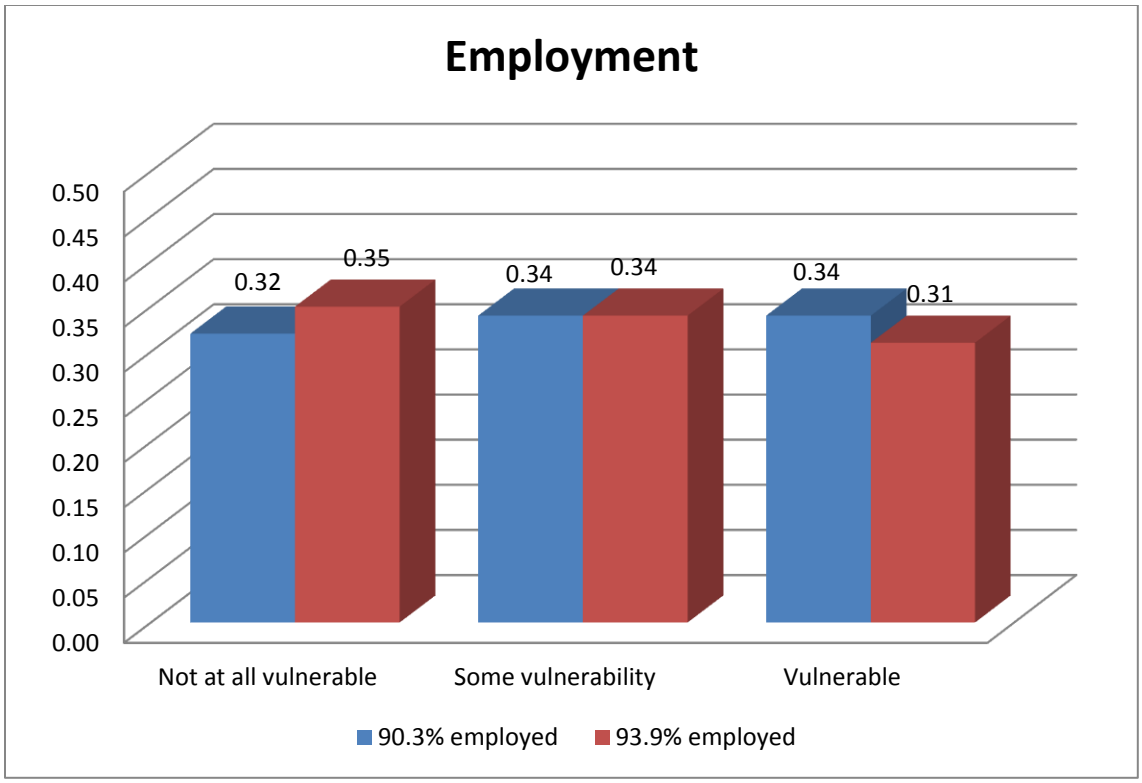

Figure 25. Unique predicted probabilities of employment on individual social vulnerability.

Based on the unique probabilities presented in Figure 25, a significant effect for employment was detected. It was evident that in parishes where more people were employed, the vulnerability was the lowest. Parishes that had lower levels of employment had the highest vulnerability.

Figure 26, models the unique probabilities of the main effect of **age** on individual social vulnerability.

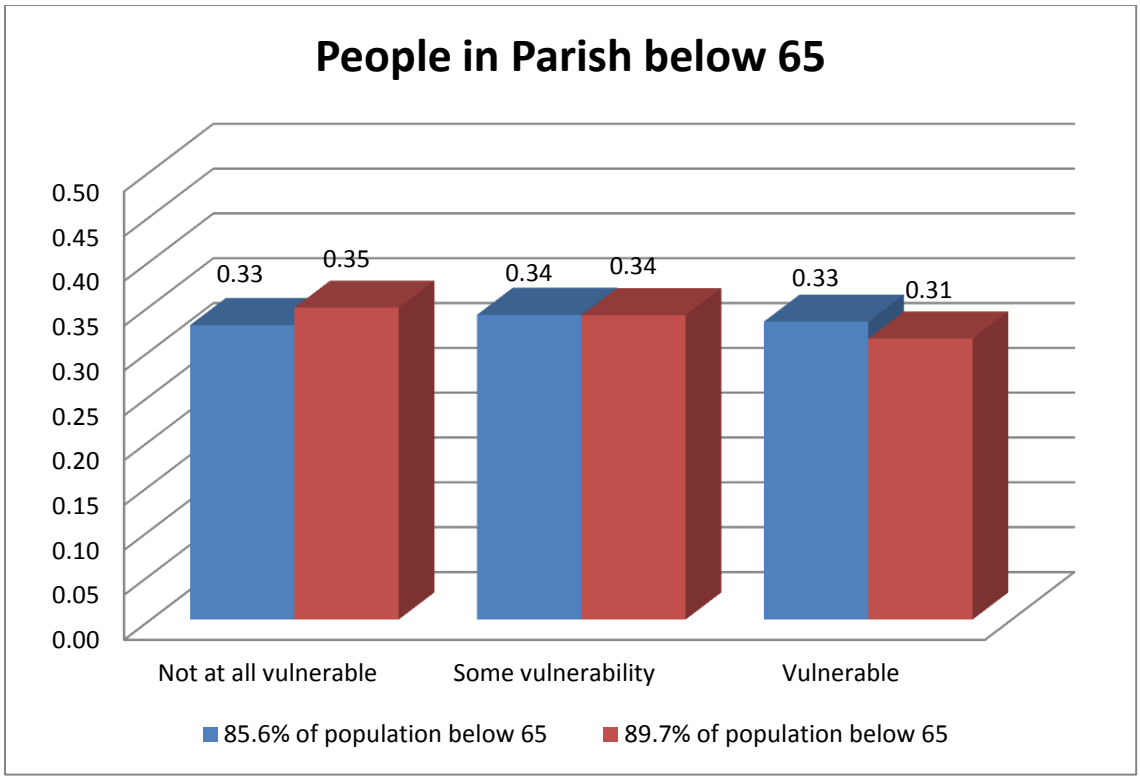

Figure 26. Unique predicted probabilities of age on individual social vulnerability.

As is evident from Figure 26, in parishes that had more people below 65 years, vulnerability showed a lower trend. Parishes with less people below 65 years had a higher trend of vulnerability.

Interaction effects: There were three interaction effects of importance, with two significant interactions and one trend. Figure 27 captures the unique probabilities of the interaction effect of age and household phone access.

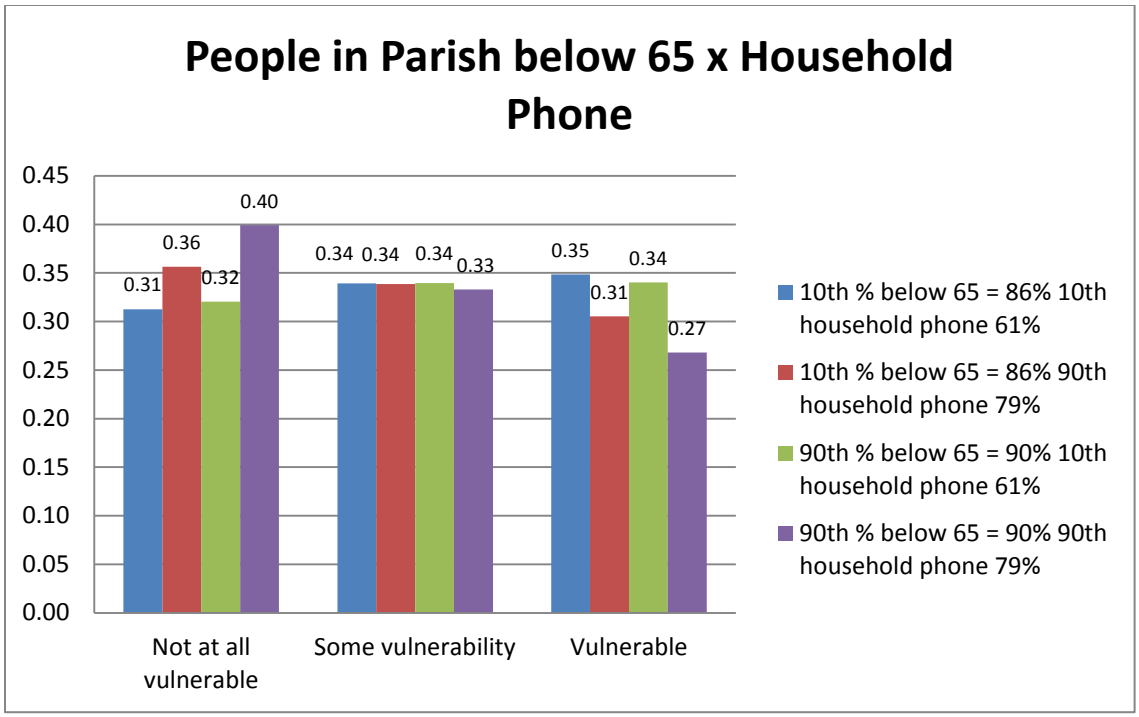

Figure 27. Unique predicted probabilities for the interaction effect of age and household phone access on individual social vulnerability.

Figure 27, showed an interaction effect for **age** and **household phone**.

Based on the probabilities in Figure 27, it is evident that the most vulnerable parishes were those where less people have access to a household phone, irrespective of the differences in the amount of people living in the parish who were below 65. In parishes with the same high number of people living in the parish who were below 65, vulnerability was the lowest where people had access to a household phone.

Figure 28, highlights a significant interaction effect for **number of disasters** and **total population per square mile**. Based on the probabilities in Figure 28, it is evident that the least vulnerable parishes were those with higher population density, irrespective of the differences in the amount of disasters in

the parish. In parishes with the same high numbers of disasters, vulnerability was the highest in parishes with lower population density.

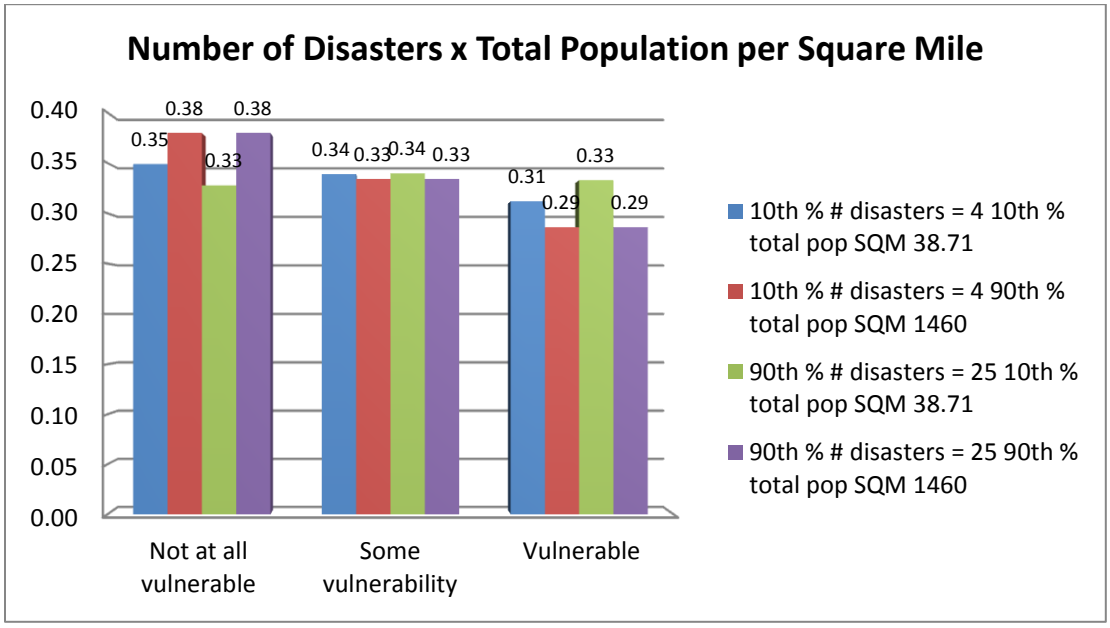

Figure 28. Unique predicted probabilities for the interaction effect of number of disasters and total population per square mile on individual social vulnerability.

Figure 29, shows a significant interaction effect for number of disasters and number of physicians per 100,000. Based on the probabilities in Figure 29, it is evident that the least vulnerable parishes were those where there were more physicians per 100,000, irrespective of the differences in the amount of disasters. In parishes with the same low number of disasters, vulnerability was the highest where people had less access to physicians.

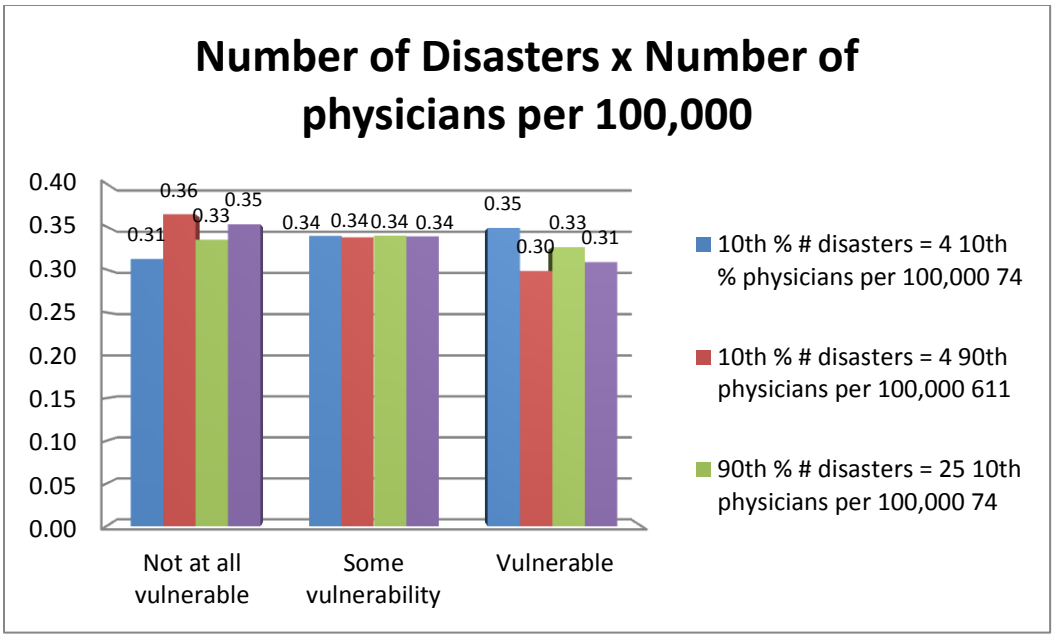

Figure 29. Unique predicted probabilities for the interaction effect of number of disasters and number of physicians on individual social vulnerability.

Summary and Conclusion

In each step, the model fit improved using the DIC statistic. Overall, the probability for individuals experiencing individual social vulnerability decreased from 2004 to 2010.

In the overall sample the following significant main effects were found: Statistically significant community level predictors of individual social vulnerability were lack of educational attainment, communities with less access to a household phone, community poverty, and community unemployment. More people in a parish above 65 years showed a trend. Parish disaster history and operational resilience had no significant predictors present.

Based on the results of two-way interaction effects, two significant results were detected. The interaction effect of number of disaster and total population

per square mile, and the interaction effect of number of disasters and number of physicians per 100,000, had significant interaction effects. There was one interaction effect that displayed a trend, namely the interaction effect between age and household phone.

In the next chapter the relevance of these findings will be discussed, specifically addressing the implications for future research, social work practice, education and policy.

CHAPTER V: DISCUSSION

This chapter will discuss the implications of the results presented in the previous chapter. First, the findings of the analyses as they relate to the three research questions will be discussed, along with their convergence with or divergence from the literature presented in chapter 2. Secondly, the research, practice, education and policy implications will be presented. Finally, strengths, limitations, and the implications for future research will be outlined.

Using representative trend data for Louisiana from 2004 to 2010 and multilevel modeling methodology, this study responded to the following three research questions: (1) Do parishes in Louisiana have different levels of individual social vulnerability? (2) Do parishes in Louisiana experience change, and have different levels of individual social vulnerability over a seven-year period? (3) What are the most important parish disaster history events and community disaster resilience factors that predict individual social vulnerability within and between Louisiana parishes over a seven-year period?

Discussion of the Research Questions

This section will discuss the findings of the three research questions associated with the study. The findings will be discussed as they relate to the specific aims and hypotheses:

Specific Aim 1: To determine if the parishes in Louisiana have different levels of individual social vulnerability.

H_1= Parishes in Louisiana have different levels of individual social vulnerability, with some parishes having more individual social vulnerability than others.

Findings from the study supported this research hypothesis. Significant differences were observed among the 56 parishes regarding their levels of social vulnerability. The caterpillar plot presented as Figure 14 (Chapter 4) highlights the differences between the 56 parishes. Parishes that were deemed to be the most vulnerable and differed significantly from the least vulnerable parishes, were Morehouse, Allen, Avoyelles, Richland, Washington and St. Landry. The least vulnerable parishes were St. Tammany, Ascension, West Feliciana, St. Charles, Lafayette, East Baton Rouge, Livingston, Bossier, Jefferson and Lafourche. Empirical findings from Hurricane Katrina highlighted the impact of disasters on socially vulnerable individuals. Hurricane Katrina took the lives of 1,836 individuals (Louisiana Department of Health and Hospitals, 2006). Of the 1,836 individuals that lost their lives 40 percent was 65 years and older; 33 percent were unemployed; 57 percent lived in a household with less than $20,000 per year and 77 percent had a high school education or less (Heldman,

2011). Table 28 highlights differences between the most vulnerable parish, Morehouse, and the least vulnerable parish, St. Tammany.

Table 28 Morehouse and St. Tammany Parish differences for Individual Social Vulnerability

	Morehouse (N=267)		St. Tammany (N=1997)	
Characteristic	***F***	**Percentage**	***F***	**Percentage**
Demographics				
Female	174	65.2	1257	62.9
Minority	105	39.3	277	13.9
Having Children	93	34.8	810	40.6
Less than High School Education	38	14.2	124	6.2
Older than 65 years	73	27.3	369	18.5
Livelihood				
Income of less than $50,000 annually	204	76.4	899	45.0
Social Support				
Not married or living without a partner	137	51.3	656	32.8
Societal Protection				
No health coverage	76	28.5	250	12.5
Not having a primary care physician	40	15.0	313	15.7
Well-Being				
Self-rated health as poor or fair	81	30.3	320	16.0
Depressed more than 0 days a month	73	27.3	590	29.5

Based on the descriptive statistics in Table 28, there are significant differences between the most vulnerable parish (Morehouse) and the least vulnerable parish (St. Tammany). Morehouse is an agriculturally dependent

community. Nearly 30 percent of the parish residents lived below the poverty line, with a median household income of $31,000. St. Tammany parish had only 10 percent of its residents living below the poverty line, and a median household income of $61,000. Empirical findings from this study align with statements made in Chapter 1 regarding the disparities in Louisiana. Louisiana as a state ranks in the bottom five states nationally for health, education, quality of life indicators and poverty (Gordon et al., 2011; Social Science Research Council, 2011). When communities with higher levels of disparity and individual social vulnerability are faced with disaster, the impact is long lasting and long- term on all aspects of an ecological system. This statement is supported by Cannon et al. (2000) and Cutter et al. (2003), with the most vulnerable taking longer to recover when faced with disaster. From a theoretical standpoint, the conservation-of-resources theory points out that those with the least amount of resources will find it harder to maintain and obtain resources when faced with adversity.

From a social work perspective it is important to know what the differences are among individuals nested within communities. Identification of the differences in individual social vulnerability levels can ensure that comparisons are made across communities, that vulnerabilities are identified and that strengths are built upon. Building upon strengths and improving weaknesses can increase response and recovery capacity. The first hypothesis of the study was supported by the findings and allowed for the identification of differences in individual social vulnerability between the 56 parishes of the study.

Specific Aim 2: To determine if the parishes change differently in their individual social vulnerability over a period of seven-years.

H_2= Louisiana parishes change differently over a period of seven-years in their levels of individual social vulnerability, with some parishes where individual social vulnerability improve and other parishes where individual social vulnerability decrease or not change at all.

Results of this study support the hypothesis. All three individual social vulnerability groups of the sample did improve in their level of individual social vulnerability from 2004 to 2010. The not-at-all-vulnerable group showed an improvement and experienced an increase of 6 percent in being not-at-all-vulnerable. The some-vulnerability group remained constant from 2004 to 2010, and the vulnerable group decreased from 40 percent to 34 percent in their probability of experiencing vulnerability. A number of factors attributed to the change in individual vulnerability over the seven-year period. For this sample, two main factors that contributed to the change in vulnerability over time, were Hurricane Katrina that occurred in 2005, and the state of the economy from 2004-2010. The severity, impact and extent of Hurricane Katrina resulted in a number of federal grant programs conferred upon the state of Louisiana post-Katrina. The Road Home program supports this statement. The program disbursed about $8.6 billion to roughly 127,000 families whose homes were destroyed or damaged by hurricanes Katrina and Rita in August and September 2005. Families received up to $150,000 for rebuilding purposes (Johnson & Chawla, 2010). This program is just one of the numerous programs that

stimulated the local economy in Louisiana post Hurricane Katrina. The economy experienced substantial growth from 2004 to 2009 and was at its peak post Katrina. The impact of the economic recession is not fully captured within this study since the extent of the recession was only felt from 2009 onwards.

From a theoretical standpoint, structural functionalism and the risk-and-resiliency theory are relevant to change and improvement of individual social vulnerability over time. Federal agencies provided structure and reorganizing opportunities for individuals, families and communities post Hurricane Katrina. With federal funding being channeled into Louisiana post 2005, there was an opportunity to increase capacity and decrease vulnerability. Kreps (1989), indicated that communities that receive assistance in a structured manner are able to reorganize and improve their capacity. Katrina challenged capacity, and provided an opportunity for the identification of problem areas. The levee breaches in Orleans and Jefferson parishes are examples where vulnerability was turned into an opportunity to become more resilient. This structural improvement is a sign of resilience that will lessen the impact of future disasters for individuals.

It is noted that not every parish showed an improvement in their levels of individual social vulnerability. If the parishes are to be dissected over the seven-year study period, then some parishes actually experienced an increase in their level of vulnerability. Change in vulnerability levels are captured by Figure 12 (Chapter 4).

The second hypothesis was supported by the findings, indicating that parishes did change differently in their individual social vulnerability over the seven-year period of the study. The findings related to the final hypothesis of the study will now be discussed.

Specific Aim 3: To determine what the most important parish disaster history events and community disaster resilience factors are that predict individual social vulnerability within and between Louisiana parishes over a seven-year period.

H_3= Some parish disaster history events and community disaster resilience factors will be more important than others in predicting individual social vulnerability in Louisiana parishes over a seven-year period.

Based on empirical findings made with this study, the third hypothesis was supported. The strong theoretical approach used for this dissertation provided the guidance in answering the third hypothesis. Structural functionalism, the risk-and-resiliency theory, social capital theory and the conservation of resources theory provided guidance for selecting the appropriate predictors that had an influence on individual social vulnerability in Louisiana parishes.

Based on the multilevel analysis, socio-economic resilience had the only significant predictors. Statistically significant socio-economic community level predictors of individual social vulnerability were lack of educational attainment, communities with less access to a household phone, poverty and unemployment. A trend was observed for age. Accordingly, the significant predictors will be

discussed in depth with current research literature supporting the statistically significant findings.

Educational attainment. Past research results confirm the importance of educational attainment (Cutter et al., 2010; Morrow, 2008; Norris, 2009; Norris et al., 2008; Simpson and Katirai, 2006; Twigg, 2007; Wisner et al., 2004). Parishes that had a lower level of educational attainment had higher levels of social vulnerability. Having a bachelors degree results in a higher level of income. Higher income allows for better living conditions and individual well-being. Having a higher income base in a community provides better access to resources. When faced with adversity individuals, families and communities have to rely on resources to either mitigate or reorganize. Higher presence of educational attainment further increases community competence (Norris et al., 2008).

Household phone. Having access to communication sources is very important when faced with disaster. Household phones are the perfect dissemination tool for disaster-related information. Empirical findings and literature underlines this statement (Norris et al., 2008; Colten et al., 2008). Communities not having sufficient access to household phones, according to the results of this study, indicate a higher level of social vulnerability. Emergency management authorities are able to send out automated messages. Norris et al. (2008), point out that access to communication during disaster, decreases the likelihood of being severely affected, and is an indicator of resilience.

Wealth. Disasters cause a financial burden on communities. Communities in a state of poverty are more vulnerable and likely to take longer to re-organize

after disasters. Recovery is likely to take longer due to a lack of resources. The wealth predictor used in this study indicated that parishes in a state of poverty were more vulnerable. Within disaster research literature there is a plethora of evidence supporting the statement (Dwyer et al., 2004; Twigg, 2007; Wisner et al., 2004).

Employment. Communities with higher levels of employment have greater access to a broader base of resources. Normally these resources are put under pressure when there is a disaster. Higher levels of employment can ensure that communities are not within a state of vulnerability when faced with disaster (Tierney, 2009; Wisner et al., 2004). The indicator shows that higher levels of community unemployment result in higher levels of community social vulnerability.

Percentage of population below 65 years. Communities having a higher percentage of older adults present, are at a higher risk of experiencing harm when faced with disasters. Communities with a higher percentage of older adults are at a higher risk for illness or even death when faced with disaster. The age predictor had a moderate trend and is supported by literature, indicating that communities with a higher level of 65 years and older are more vulnerable towards the impact of disasters (Cutter et al., 2003; Cannon et al. 2000).

Interaction effects were modeled for with the study. Based on the results there were two significant interactions and one moderate trend. The first significant interaction effect modeled were the **number of disasters** interacting with the **number of people per square mile**. It is evident that the least

vulnerable parishes were those with higher population density, irrespective of the differences in the amount of disasters in the parish. In parishes with the same high numbers of disasters, vulnerability was the highest in parishes with lower population density. This particular finding is supported by Mileti (1999), who found that higher levels of vulnerability are present in rural areas with lower population numbers. This, in part, can be attributed to a lack of resources available to individuals and families in these areas.

The second significant interaction effect was the **number of disasters** and **physicians**. This particular result indicated that the least vulnerable parishes were those where there were more physicians per 100,000, irrespective of the differences in the amount of disasters. In parishes with the same low number of disasters, vulnerability was the highest where people had less access to physicians. Findings made by Krol et al. (2009) indicate that a lack of health services post Hurricane Katrina resulted in higher levels of vulnerability among individuals. Access to health services post-disaster is essential, since it provides a safety net on a psychosocial level for those affected.

The final interaction effect found to be of relevance to the study were **age below 65 years** and **household phone**. It is evident that the most vulnerable parishes were those where less people have access to a household phone, irrespective of the differences in the amount of people living in the parish who were below 65. In parishes with the same high number of people living in the parish who were below 65, vulnerability was the lowest where people had access to a household phone. Communication is essential for dissemination of disaster

related information. Not having access to a household phone results in limited access to communication. It can be stated that, for disaster information, the use of other communication means, such as social media and mobile phones is not as high for the 65 years and older age group. The age group associated with the highest number of fatalities as a result of disasters is the 65 years and older age group. Findings from Hurricane Katrina and Superstorm Sandy support this statement. Half of the people that died as a result of Superstorm Sandy was 65 years and older (Heldman, 2011; Keller, 2012; Serna, 2012).

Implications of the study

The findings from this dissertation present many informative implications for research, practice, education and policy. From a systemic approach the implications are intended to focus on both a micro and a macro level. Micro implications are those that are directly related to the individual and his overall well-being while macro implications are those related to the community level on the local, state and federal policy. This section will discuss research, practice, education and policy implications**.**

Research Implications

The study presents a number of significant research implications. The first implication, and contribution to research, is that it addresses the need for multilevel modeling in disaster research. Ronan and Johnston (2005) have identified the need for multilevel modeling studies within the field of disaster research. Studies in disaster research utilizing multilevel modeling are few, and

mainly focused on disaster mental health impacts (Kawachi & Subramanian, 2006; Wind & Komproe, 2012).

Secondly, the study provides a baseline for future disaster studies as to analyzing individual and community factors within the same context. Very few studies have incorporated the vulnerability and resiliency paradigm, as done in this study, on both a micro and macro level. The conceptual framework used to guide this study is replicable across different settings, if the relevant data are available.

The study made use of an underutilized approach in disaster research, by focusing on the objective and subjective aspects needed to dissect a problem statement. The approach of utilizing the objective and subjective approach allowed for a better conceptualization of the problem statement. It is hoped that fellow and future disaster researchers investigating social problems will foster this under-utilized approach in disaster research.

Practice Implications

The impact of disasters on individuals, families and communities is inevitable. The impact can be lessened if safer and more resilient environments are created for individuals, families and communities. The findings from this study provide important initiatives for social work practitioners to work proactively in strengthening individuals, families and communities pre- and post-disaster.

Based on the findings made from this study it is important that attention is given to the following aspects that can decrease the level of vulnerability for

individuals. Findings from this study indicate that individuals in poverty are more vulnerable, in part due to unemployment and lack of proper education. It is accepted that poverty alleviation won't happen overnight, but better education opportunities can lead to better employment. With better employment, poverty can be reduced. It is therefore important that communities work towards creating employment opportunities for individuals.

A starting point for creating access to education would be to create work-study programs were individuals could receive a subsidized education stipend, associated with a possible job placement. This will ensure that individuals also receive practical experience, and be ready for the job market upon completion of their studies.

Access to basic health services is imperative. Community decision-makers should ensure that all individuals have access to basic health services. Health services need to be made available to all in need, irrespective of background. Healthy citizens increase community well- being and lessen the financial burden on other resources within the community.

Creating support systems for individuals that are living alone is important. Support systems are very important during times of disaster. Social work practitioners can provide the guidance and tools for individuals to connect with faith-based-, social- and community groups. Receiving emotional and physical support during a time of disaster is important for all, but especially for individuals in a state of vulnerability. Older adults tend to be more isolated during times of

disaster. By implementing outreach programs the needs of isolated groups, such as the older population, are attended to, post-disaster.

In practice, implications on a macro level are just as important as on a micro level. Macro practice implications are intended to increase community competence, communication, social capital and economic growth. If practitioners were to build on these suggestions, vulnerability can be decreased in communities. With a decrease in vulnerability, communities will be able to re-organize and recover from the impact of disaster in a shorter time.

Community competence can only be improved if there is an emphasis on the level of education in the community. Access to tertiary education should be a priority on a macro level. With higher levels of access to tertiary education, a greater sense of community competence and structure is created.

It is not always feasible to improve education from grass roots level in a community. Instead, communities should make it more rewarding for higher-level educated individuals to move to, and live in a particular community with lower educated individuals. Providing housing incentives and tax relief are possible solutions for attracting such individuals. By “recruiting” higher-level educated residents to areas with lower levels of education, pockets of low-income areas can be prevented. The concept of promoting mixed income areas should be fostered on a macro level. Ensuring that communities focus on diversified employment opportunities is very important. When disaster strikes it tends to have a cyclical effect on employment. Communities that rely on only one source

of employment are more susceptible to the impact of a disaster. This vulnerability can have a ripple effect on the community.

Promoting intergenerational living within communities will decrease vulnerability on a micro and macro level. This would be especially beneficial in areas where there are limited resources available. Intergenerational living provides support networks for people who live alone, improving access to resources for individuals and families.

Access to communication resources is essential during time of disaster. Having access to communication resources improves disaster awareness and preparedness. Tax incentives and breaks should be provided to communications companies, to ensure that everybody has access to either a landline or to mobile communication.

It is imperative that practitioners build on past experiences of disaster events. Familiarity with past experiences creates an opportunity for communities to capture the success and weaknesses thereof. If knowledge of prior experiences is applied to later situations a “disaster subculture” is created in the community (Wenger & Weller, 1973). Community competence starts with building upon past experiences. Knowing what its strengths and weaknesses are, will increase community competence.

Education Implications

Education is the greatest mitigation tool available for reducing the risk and impact of disasters. With the significant increase of disasters, it is

inevitable that individuals, families and communities will be impacted on a more frequent basis. Findings from this study can inform educators as to which predictors can increase and decrease vulnerability for individuals, families and communities. Greater emphasis should be put on social work theory that relates to systems. This approach will allow future practitioners to not only identify predictors of social vulnerability but also mitigate the effects of social vulnerability.

Social work educators can play a leading role in advocating for disaster awareness and preparedness in communities. It is hoped that findings of this research study can be incorporated into future social work curriculum. Social workers are exposed to all types of people on a daily basis. In particular they work with the most vulnerable. By educating social work practitioners on disaster practices we empower them to create a “disaster subculture” in our communities. Disaster education should start at grass roots level with preschoolers and should reach as far as older adults in long-term care facilities. By following this approach we will not only make our communities more resilient, but also ensure the well-being of those in need.

Policy Implications

Findings from this study can inform policy-makers on a local, state and national level as to what measures should be taken to reduce the vulnerability of individuals exposed to disasters. In particular, findings from this study can inform the National Disaster Recovery Framework (NDRF). The purpose of the NDRF is to provide guidance to communities to

recover from disaster impacts. The NDRF consists of six recovery support functions. The six areas are Community Planning and Capacity Building, Economic Recovery, Health and Social Services Recovery, Housing Recovery, Infrastructure Systems Recovery, and Natural and Cultural Resources Recovery. Predictors that had an influence on individual social vulnerability should be brought under the attention of the six recovery support functions mentioned. The findings can ensure that the six relevant role-players working on disaster recovery operations improve their decision-making capacity. Better decision-making will result in better resource allocation for those in a state of vulnerability.

Policy-makers working within the field of disaster risk reduction need to put a greater emphasis on improving access to general education. One of the significant results from this study indicates that communities with higher levels of tertiary education experienced a lower level of vulnerability. Putting greater emphasis on education will increase competence and create safer environments for individuals, families and communities.

Access to tertiary education is not always feasible or possible in certain remote areas. By building a trust-relationship with communities, policy-makers can lessen the impact of disasters by fostering basic disaster education practices in communities.

Providing resources to those in a state of vulnerability can also lessen the impact of future disaster events. This study provided a baseline of basic resources needed to decrease vulnerability among individuals. Resource needs will differ from individual to individual, but access should not be denied on the basis of social background, thus the need for open access to resources.

Social workers have a duty to work closely with members of the community and inform policy-makers about the needs at grass roots level. The profession of social work, in many instances, is the last line of defense for individuals in a state of vulnerability. By advocating for the immediate needs of vulnerable individuals and groups we can lessen social vulnerability and make our communities safer from disaster impacts.

Strengths of the study

The study has provided a number of strengths that ensure value is added to the knowledge base of social work and disaster research. The identification of basic predictors of individual social vulnerability will inform research, practice, education and policy. A main strength of the study is that it addresses the need for multilevel modeling in disaster research. Very few disaster research studies in the past have utilized multilevel modeling as a method of analysis. It is hoped that this study will create a foundation for current and future disaster researchers in dissecting complex problems. Empirical findings of the study align with past findings.

The findings of this study also contribute to the knowledge-base of disaster research by making use of multilevel modeling.

The strong theoretical foundation of this study provided for the holistic approach in dissecting the problem statement. Theory allowed for an approach that ensured the conceptual framework used, captured all the relevant components of predictors causing individual social vulnerability. The ecological approach taken with the study placed micro and macro aspects within a context that allowed for multilevel modeling.

Limitations of the study

Threats and limitations related to the design of the existing data should be acknowledged. The choice and measurement of variables for the study was limited to those secondary data sources available for each level. Primary data sources would have allowed for a broader and holistic approach to the study, specifically for the community disaster resilience variables. The fact that there were no significant predictors present in the analysis for operational resilience and community capital, supports this statement. Greater availability of operational resilience data can provide a better understanding of the effectiveness of emergency management operations and activities in communities. It is acknowledged that data related to operational resilience, in most cases, are restricted due to the security risks associated with public access of security data. Better data capturing measures on a local level for community capital aspects could have solved the associated problem of no significant predictors.

Another limitation related to data for the study was the lack of disaster event data from the Federal Emergency Management Agency website. Data used to represent disaster events and losses for parish disaster history, was only for natural disaster events and not technological or natural-technological disasters. Local, State and Federal Agencies in some instances do have records available for some technological and natural technological events, but these were limited due to access, availability and/or lack of quality reporting in some jurisdictions. Quality of reporting was evident for some parish disaster history events. In many instances only estimates were provided for disaster injuries and loss of life, and not the actual death and injury totals.

The availability of longitudinal data for individual social vulnerability on the individual level could have allowed for a more precise measurement and interpretation of individual social vulnerability. Another impediment of individual social vulnerability data was the extensive cleaning and transformation of variables needed.

Another important limitation of this study is racial representation. Minorities made up only 28.7 percent of the study sample. From empirical evidence it is suggested that minorities in many instances are affected more severely by disasters (Cutter et al., 2003). This is attributed to political and economic factors present (Bates & Swan, 2007). A greater representation of minorities in the study sample would have provided for a more holistic picture on individual social vulnerability of minorities.

It is acknowledged that the “true voice” of individuals affected by disasters in Louisiana from 2004 to 2010, is not fully captured within this study. In many instances the subjective interpretation of a disaster event can provide for a better understanding of the impact associated with the event. Even though probabilities indicated that individual social vulnerability decreased, it is fully acknowledged that not everyone had a decrease in their social vulnerability. This is evident in some parishes where vulnerability did increase based on the empirical growth plots done for social vulnerability.

The impact of the “economic recession” on the results is not fully known, since most variables on the community level were once-off measurements and not repeated measures. A logical deduction may be that the affected areas did receive Federal dollars that could possibly have averted a full-scale economic recession for Louisiana.

Future Research

The field of social work is unique, since it provides an ecological underpinning in most instances. Disasters impact all aspects of an ecological system. Multilevel modeling provides a basis for analyzing ecological systems. This study provides a foundation for similar studies in the future. Future research should make use of primary data sources if possible. It is recommended that, with future research, the emphasis should be on the role of operational resilience and community capital aspects that predict individual social vulnerability. A cross comparative study of all 50 states in the United States will add value to the field

of disaster research, and allow for generalizable results that can inform research, practice, education and policy. A study on a different country, and in particular a developing country is an approach that can add immense value to the field of social work and disaster research. Future research should focus in particular on minorities, children and older adults within a disaster context. More knowledge is needed on how the impact of disasters on these three particularly vulnerable groups can be diminished.

Summary and Conclusion

It is understood that there are no “quick fix solutions” for preventing disasters and in many instances disasters are inevitable. With a proactive approach in strengthening individuals and communities, the impact of disasters can be lessened. The outright objective of this study was to identify the factors that cause individuals and communities to be less vulnerable and more disaster resilient when faced with disaster. The expectation is findings from this study will be carried forward in creating safer environments for citizens around the world.

REFERENCES

Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography, 24*, 347-363.

Adger, W. N., Hughes, T. P., Folke, C., Carpenter S.R., & Rockström. (2005). Social-Ecological resilience to coastal disasters. *Science, 309*, 1036-1039.

Advocates for Environmental Human Rights (2007). "Protecting the Human Right to Return with Dignity and Justice After Hurricane Katrina".

Anderskov, C. (2004). Anthropology and disaster - An analysis of current trends within anthropological disaster research, and an attempt to construct an approach that facilitates theory building and applied practices - analysed with vantage point in a case-study from the flood-prone Mutarara District in Mozambique. Retrieved from http://www.anthrobase.com/Txt/A/Anderskov_C_03.htm#21_Research%20Framework

Arbuckle, J. L. (2011). *AMOS™20 user's guide*. Chicago: SPSS.

Auf der Heide, E., & Scanlon., J. (2007). Health and medical preparedness and response, " In emergency management: Principles and practice for local government, edited by Waugh, W.L. and Tierney, K. *International City Managers Association*, 183-206.

Baker, L. F. (2011). Louisiana purchase. *The Encyclopedia of Arkansas and Culture.* Little Rock, AR.

Barnshaw, J., & Trainor, J. (2007). Race, class, and capital amidst the Hurricane Katrina diaspora. In D. L. Brunsma, D. Overfelt & J. S. Picou (Eds.), *The Sociology of Katrina: Perspectives on a Modern Catastrophe*. Lanham: MD: Rowman and Littlefield

Bates, K. A., & Swan, R. S. (2007). *Through the eye of Katrina: Social justice in the United States.* Carolina Academic Press.

Beitler, S. (Producer). (2007). The ninth Mississippi River disaster in three weeks. Retrieved from http://www3.gendisasters.com/louisiana/52/hermitage%2C-la-steamer-paris-c.-brown-wreck%2C-jan-1889?page=0%2C0

Berke, P. R., & Campanella, T. J. (2006). Planning for postdisaster resiliency. *Annals of the American Academy of Political and Social Science 604:* 192-207.

Birkland, T. A. (2006). Lessons of Disaster: Policy Change after Catastrophic Events. Washington D.C.: Georgetown University Press.

Birkmann, J. (2005). Measuring vulnerability*:* Expert workshop in Kobe, Japan. United Nationas University: Institute for Environment and Human Security. Bonn, Germany.

Birkmann, J. (Ed.). (2006). Measuring vulnerability to natural hazards: Towards disaster resilient societies. New York, NY: United Nations University Press.

Bodin, G. B. (2003). Without restoration, coastal land loss to continue. Lafayette, LA: U.S. Geological Survey, National Wetlands Research Center.

Bolin, R. (1986). Disaster characteristics and psychosocial impacts. In B. J. Sowder & M. Lystad (Eds.), *Diasers and mental health: Contemporary perspectives and innovations in services to disaster victims.* Washington D.C.: American Psychiatric Press.

Britannica (Cartographer). (2011). Deepwater Horizon oil spill of 2010: Coastal waters affected by the oil spill. Retrieved from www.britannica.com

Bronfenbrenner, U. (1990). Discovering what families do. In rebuilding the nest: A new commitment to the American family. Retrieved from http://www.montana.edu/www4h/process.html

Brown, T. A. (2006). Confirmatory factor analysis for applied research. New York: Guilford Press.

Browning, W. (2011). Gulf oil spill timeline. Retrieved from http://news.yahoo.com/s/ac/20110419/us_ac/8322745_gulf_oil_spill_timeline

Byrne, B. M. (2010). Structural equation modeling with AMOS: Basic concepts, applications, and programming. New York: Routledge.

Cannon, T. (2000). Vulnerability Analysis in Disasters. In D. Parker (Ed.), *Floods* (pp. 43-55). London: Routledge.

Cannon, T., Rowell, J., & Twigg, J. (2000). Social vulnerability, sustainable livelihoods and disasters. Report to conflict and humanitarian assistance Cape Town: University of Cape Town.

Carter-Pokras, O., Zambrana, R. E., Mora, S. E., & Aaby, K. A. (2009). Emergency Preparedness: Knowledge and perceptions of Latina American immigrants. In V. M. Brennan (Ed.), *Natural Disasters and Public Health: Hurricane Katrina, Rita, and Wilma*. Baltimore: MD: The John Hopkins University Press.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). Applied multiple regression/correlation analysis for the behavioral sciences (3 ed.). Mahwah, N.J.: Lawrence Erlbaum Associates.

Collogan, L. K., Tuma, F., Dolan-Sewell, R., Borja, S., & Fleischmann, A. R. (2004). Ethical issues pertaining to research in the aftermath of a disaster. *Journal of Traumatic Stress, 17*(5), 363-372.

Colten, C. E., Kates, R. W., & Laska, S. B., 2008. " (2008). Community Resilience: Lessons from New Orleans and Hurricane Katrina."CARRI Research Report 3. *Community and Regional Resilience Institute.*

Couch, S. R. (1996). Environmental contamination, community transformation and the Centrulia Mine Fire,. *United Nations University*.

Crossley, D. (2005). 10 ‘Worst’ Natural Disasters. The Department of Earth and Atmospheric Sciences, hazards and disasters. Retrieved from http://www.eas.slu.edu/hazards.html

Crowards, T. (2000). Comparative vulnerability to natural disasters in the Caribbean. Paper presented at the Vulnerability Assessment Technicques, Charleston, South Carolina.

Curtis, A., Warren Mills, J., & Leitner, M. (2009). Katrina and vulnerability: The geography of stress. In V. M. Brennan (Ed.), *Natural Disasters and Public Health: Hurricanes Katrina, Rita, and Wilma*. Baltimore, MD.: The Johns Hopkins University Press.

Cutter, S. L., Boruff, B. J., & Shirley, W. L. (2003). Social Vulnerability to Environmental Hazards. *Social Science Quarterly 84* (1), 242–261.

Cutter, S. L., Barnes, L., Berry, M., Burton, C. G., Evans, E., Tate, E. C., & Webb, J. (2008). Community and regional resilience: Perspectives from hazards, disasters, and emergency management. CARRI Research Report 1. *Community and Regional Resilience Institute.*

Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010). Disaster resilience indicators for benchmarking baseline conditions. *Journal of Homeland Security and Emergency Management, 7*(51), 1-22.

Doerfel, M. L., Lai, C.-H., & Chewning, L. V. (2010). The evolutionary role of interorganizational communication: Modeling social capital in disaster contexts. *Human Communication Research, 36,* 125-162.

Dwyer, A., Zoppou, C., Nielsen, O., Day, S., & Roberts, S. (2004). Quantifying social vulnerability: A methodology for identifying those at risk to natural hazards.

Dwyer, T., Salmon, J. L., & Eggen, D. (2005). Katrina takes environmental toll, *The Washington Post*. Retrieved from http://www.washingtonpost.com/wp-dyn/content/article/2005/09/06/AR2005090600498.html

Dynes, R. R. (2002). The importance of social capital in disaster response: Preliminary. Newark, DE: University of Delaware Disaster Research Center.

Dynes, R. R., & Rodriguez, H. (2007). Finding and framing Katrina: The social construction of disaster. In D. L. Brunsma, D. Overfelt & J. S. Picou (Eds.), *The Sociology of Katrina: Perspectives on a Modern Catastrophe*. New York:NY: Rowman & Littlefield Publishers, Inc.

Ehrenreich, J. H., & McQuaide, S. (2001). Coping with disasters: A guidebook to psychosocial intervention.

Ehrlich, M., Harville, E., Xiong, X., Buekens, P., Pridjian, G., & Elkind-Hirsch, K. (2010). Loss of resources and hurricane experience as predictors of postpartum depression among women in Southern Louisiana. *Journal of Women's Health, 19*(5), 877-884.

EM-DAT: The OFDA/CRED International Disaster Database. (2011). Natural disaster trends.

Ersing, R. L., & Kost, K. (2011). *Surviving Disaster: The Role of Social Networks*. Chicago:IL: Lyceum.

Evans, G. W., Wells, N. M., & Moch, A. (2003). Housing and mental health: A review of the evidence and a methodological conceptual critique. *Journal of Social Issues, 59*(25).

Federal Emergency Management Agency. (2011). *Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288) as amended*. Washington D.C.: Retrieved from http://www.fema.gov/about/stafact.shtm

Federal Emergency Management Association. (2010). Disaster totals.

Ferreira, R. J. (2008). *Determining the social vulnerability of students at the University of the Free Stateafter the events of social unrest in 2008.* Masters Degree in Disaster Management, University fo the Free State, Bloemfontein, South Africa.

Fischer, H. (1998). *Response to disaster: Fact versus fiction & its perpetuation: The sociology of disaster.* Lanham, MD: University Presses of America.

Fortier, A., & McLoughlin, J. J. (1913). "Louisiana". *Catholic Encyclopedia,* New York, NY: Robert Appleton Company.

Freedy, J. R., Saladin, M. E., Kilpatrick, D. G., Resnick, H. S., & Saunders, B. E. (1994). Understanding acute psychological distress following natural disaster. *Journal of Traumatic Stress, 7*(2), 257-273.

Genzmer, H., Kershner, S., & Schutz, C. (2007). *Great Disasters in History*. New York, NY.: Parragon.

Gillespie, D. F. (2010). Vulnerability: The central concept of disaster curriculum. In D. F. Gillespie & K. Danso (Eds.), *Disaster Concepts and Issues*. Alexandria, VA.: CSWE Press.

Gillespie, D. F., & Danso, K. (2010). *Disaster Concepts and Issues: A Guide for Social Work Education and Practice*. Alexandria, Virginia: Council on Social Work Education Press.

Godschalk, D. R. (2003). Urban hazard mitigation: Creating resilient cities. *Natural Hazards Review 4*, 136-143.

Gordon, K., Buchanan, J., Singerman, P., Madrid, J., & Busch, S. (2011). Beyond recovery: Moving the Gulf Coast toward a sustainable future. In Center for American Progress & Oxfam America (Eds.).

Goss, K. C. (2000). *Remarks at the 5th Annual "Technology partnerships for emergency management.* Retrieved from http://fema.gov/pte/gosspch100.html

Governor's Office of Homeland Security & Emergency Preparedness. (2006). *The Louisiana Homeland Security and Emergency Assistance and Disaster Act* Baton Rouge, LA.

Governor's Office of Homeland Security & Emergency Preparedness Louisiana. (2008). *State of Louisiana Hazard Mitigation Plan Update*. Baton Rouge, LA.

Greene, R. R. (2007). *Social work practice, A risk and resilience perspective.* Belmont, CA: Thomson Higher Education.

Guha-Sapir, D., Vos, F., Below, R., & Ponserre, S. (2011). Annual Disaster Statistical Review 2010: The numbers and trends. CRED (Ed.).

H. John Heinz III Center for Science Economics. (2002). Human links to coastal disasters. *H. John Heinz Center.*

Hazards and Vulnerability Research Instititute. (2011). Social vulnerability index for the United States - 2005-2009.

Heitmuller, P. T., & Perez, B. C. (2006). Environmental impact of Hurricane Katrina on Lake Pontchartrain. In U. S. G. Survey (Ed.).

Heldman, C. (2011). Hurricane Katrina and the demographics of death. Retrieved from http://thesocietypages.org/socimages/2011/08/29/hurricane-katrina-and-the-demographics-of-death/

Henghuber, G. (2010). Two months to Cancun climate summit: Large number of weather extremes as strong indication of climate change.: Munich RE.

Hobfoll, S. E. (2002). Social and psychological resources and adaptation. *Review of General Psychology, 6*(4), 307-324.

Huffingtonpost. (2010). Louisiana Oil Spill 2010 Photos: Gulf of Mexico Disaster Unfolds, *Huffingtonpost*. Retrieved from http://www.huffingtonpost.com/2010/04/30/louisiana-oil-spill-2010_n_558287.html#s172644&title=Gulf_Oil_Spill

Independent Levee Investigation Team. (2006). Investigation of the performance of the New Orleans flood protection systems in Hurricane Katrina on August 29, 2005.

International Strategy for Disaster Reduction. (2004). *Living with risk*. Geneva, Switzerland.

International Strategy for Disaster Reduction. (2005). Hyogo framework for action. Geneva, Switzerland.

International Strategy for Disaster Risk Reduction. (2008). Indigenous knowledge for disaster risk reduction: Good practices and lessons learned from experiences in the Asia-Pacific region. Geneva, Switzerland.

Johnson, A., & Chawla, K. (Producer). (2010). Hundereds of millions in Katrina funds remain unspent. Retrieved from http://www.nbcnews.com/id/38788131/ns/us_news-katrina_five_years_later/#.UTzrOhz3B8F

Johnston Flood Museum. (2011). Johnston Flood Museum: The compelling story of the 1889 disaster, from http://www.jaha.org/FloodMuseum/history.html

Jones, K. (2012). *MCMC training manual.* Bristol, UK: Center of Multilevel Modeling.

Kammerer, J. C. (1990). Largest rivers in the United States. In U. S. G. Survey (Ed.). Reston Virginia.

Kanel, K. (2007). *A Guide to Crisis Intervention*. Belmont, CA Brooks/Cole.

Kawachi, I., & Berkman, L. (2001). Social ties and mental health. *Journal of Urban Health: Bulletin of the New York Academy of Medicine, 78*(3), 458-467.

Kawachi, I., & Subramanian, S. V. (2006). Measuring and modeling the social and geographic context of trauma: A multilevel modeling approach. *Journal of Traumatic Stress, 19*(2), 195-203.

Keel, R. (2011). Structural Functionalism, from http://www.umsl.edu/~keelr/3210/3210_lectures/structural_functionalism.html

Keller, J. (2012). Mapping Hurricane Sandy's death toll, *The New York Times*. Retrieved from http://www.nytimes.com/interactive/2012/11/17/nyregion/hurricane-sandy-map.html

Kelman, A. (2006). *A River and Its City: The Nature of Landscape in New Orleans*. Berkley, CA: University of California Press.

Kentucky Division of Emergency Management. (2010). Kentucky state hazard and mitigation plan, (Vol. 2010 edition).

Kingdon, J. W. (1995). Agendas, alternatives, and public policies (2nd ed.). New York: Longman.

Klein, R. J. T., Nicholls, R. J., & Thomalla., F. (2003). Resilience to natural hazards:How useful is this concept? . *Environmental Hazards 5* (1–2), 35–45.

Kreft, I., & De Leeuw, J. (1998). *Introducing multilevel modeling.* . Thousand Oaks, CA.: Sage Publications.

Kreps, G. A. (1989). *Social Structure and Disaster*. New Ark, Deleware: University of Deleware Press.

Krol, M. D., Redlener, M., Shapiro, A., & Wajnberg, A. (2009). A mobile medical care approach targeting underserved populations in Post-Hurricane Katrina Mississippi. In V. M. Brennan (Ed.), *Natural Disasters and Public Health*. Baltimore, MD.: The Johns Hopkins University Press.

Lafayette Cemetery Research Project New Orleans (Producer). (2012). The Yellow Fever Epidemic in New Orleans - 1853. Retrieved from

http://www.lafayettecemetery.org/yellowfever1853_page1/the-yellow-fever-epidemic-in-new-orleans---1853-page-2

Lindell, M. K., & Perry, R. W. (2000). Household adjustment to earthquake hazard: A review of research. *Environment & Behavior, 32*, 461-501.

Lindell, M. K., & Prater, C. S. (2000). Household adoption of seismic hazard adjustment: A comparison in two states. *International Journal of Mass Emergencies and Disasters. Natural Hazards Review, 4*, 176-185.

Lindell, M. K., & Whitney, D. J. (2000). Correlates of household seismic hazard adjustment adoption. . *Risk Analysis, 20*, 13-25.

Louisiana Department of Health and Hospitals. (2006). Deceased reports.

Louisiana. (2012). *About Louisiana*. Baton Rouge: Retrieved from http://louisiana.gov/Explore/About_Louisiana/

Luke, D. A. (2004). *Multilevel modeling.* Thousand Oaks, CA.: Sage Publications.

Mathbor, G. M. (2007). Enhancement of community preparedness for natural disasters: The role of social work in building social capital for sustainable disaster relief and management. . *International Social Work, 50*(3), 357-369.

Mattock, J. L. (2005). *Resource Loss and Psychosocial Distress: An Application of the Conservation of Resources (COR) Model to the 2004 Asian Tsunami in Sri Lanka.* Masters of Science, University of Northumbria at Newcastle, Newcastle.

McCulley, R. (2007). Saving Pets from Another Katrina. *TIME*.

Medical News Today (Producer). (2008). 3,000 Evacuated After Train Chemical Spill, Louisiana, USA. Retrieved from http://www.medicalnewstoday.com/articles/107842.php

Meyers, L. S., Gamst, G., & Guarino, A. J. (2006). *Applied multivariate research: Design and interpretation.* . Thousand Oaks, CA: Sage.

Mileti, D. S. (1999). *Disasters by design: A Reassessment of natural hazards in the United States*. Washington, D.C.: Joseph Henry Press.

Miller, J. (2003). “Critical Incident Debriefing and Social Work: Expanding the Frame.” *Journal of Social Service Research 30* (2), 7-25.

Morrow, B. (2008). "Community resilience: A social justice perspective." *CARRI Research Report 4.* Oak Ridge, TN: Community and Regional Resilience Institute.

Movassaghi, K. (2012). 2012 Report card for Louisiana's infrastrucutre. In A.S.C. Engineers (Ed.).

Murphy, B., & Dolan, H. (2003). Social capital and disaster management: Building community capacity. Interm report University of Victoria, Canada.

Myer, R. A. (2001). *Assessment for Crisis Intervention, a Traige Assessment Model.* Stamford: CT.: Wadsworth/Thomson Learning.

Myers, D., & Wee, D. F. (2005). *Disaster Mental Health Services*. New York: Routhledge.

National Research Council (NRC). (2006). Facing Hazards and Disasters: Understanding Human Dimensions. Washington, DC: National Academy Press.

National Wildlife Federation. (2011). How Does the BP Oil Spill Impact Wildlife and Habitat? Retrieved from http://www.nwf.org/Oil-Spill/Effects-on-Wildlife.aspx

Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, P. J., Diaz, C. M., & Kaniasty, K. (2002). 60 000 disaster victims speak: Part I. An empirical review of the empirical literature. 1981-2001. *Psychiatry, 65*(207-239).

Norris, F. H., Galea, S., Friedman, M. J., & Watson, P. J. (2006). *Methods for Disaster Mental Health Research* (Vol. 1). New York: The Guilford Press.

Norris, F. H., Stevens, S. P., B. Pfefferbaum, Wyche, K. F., & Pfefferbaum, R. L. (2008). Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. *American Journal of Community Psychology, 41*, 127-150.

Norris, F. H. (2009). Proceedings from Natural Hazard Conference:*Defining Resilience for Communities and Organizations*. Boulder: Colorado.

NPR. (2005). An American history of disaster and response, from http://www.npr.org/templates/story/story.php?storyId=4839530

O'Connell, A. A. (2010). Proceedings from at the 8th International Conference on Teaching Statistics. *An illustration of multilevel models for ordinal response data.* Ljubljana, Slovenia. http://www.stat.auckland.ac.nz/~iase/publications/icots8/ICOTS8_4C3_OCONNELL.pdf

Pagnamenta, R. (2010). "BP oil spill could cost tourism and fishing $5.5bn, say analysts", *The Sunday Times*. Retrieved from http://www.timesonline.co.uk/tol/news/environment/article7113425.ece

Pampel, F. C. (2008). *Library in a Book: Disaster Response*. New York, NY: Infobase Publishing.

Paquette, D., & Ryan, J. (2001). *Bronfenbrenner's Ecological Systems Theory*.

Payne, M. (2005). *Modern Social Work Theory.* . Chicago, Il,: Lyceum Books, Inc.

Pazar, J. (2003). Proceedings from the 27th Annual Convening of Crisis Intervention Personnel. *Triage Assessment: The Triage Assessment System*. Chicago: IL.

Phongsavan, P., Chey, T., Bauman, A., Brooks, R., & Silove, D. (2006). Social capital, socio-economic status and psychological distress among Australian adults. *Social Science & Medicine, 63*(10), 2546-2561.

Picou, J. S., & Marshall, B. K. (2007). Katrina as paradigm shift: Reflections on disaster research in the Twenty-First century. In D. L. Brunsma, Overfelt, D., Picou, J.S. (Ed.), *The Sociology of Katrina: Perspectives on a Modern Catastrophe*. Lanham:MD: Rowman & Littlefield Publishers, INC.

Picou, J. S., Marshall, B. K., & Gill, D. A. (2004). Disaster, litigation, and the corrosive community. *Social Forces, 82*(4), 1493-1522.

Picou, J. S., & Martin, C. G. (2007). Long-term community impacts of the Exxon Valdez Oil Spill: Patterns of social disruption and psychological stress seventeen years after the disaster. In N. S. Foundation (Ed.). Washington D.C.: University of South Alabama.

Popular Mechanics. (2010). The 10 Worst Disasters of the Last Century from http://www.popularmechanics.com/outdoors/survival/stories/10-disasters

Quarantelli, E. L. (1986). What is a disaster? The need for clarification in definition and conceptualization in research. In B. J. Sowder & M. Lystad (Eds.), *Disasters and mental health: Contemporary perspectives and innovations in services to disaster victims.* Washington D.C.: American Psychatric Press.

Quarantelli, E. L. (2002). *The protection of cultural properties: The neglected social science perspective and other questions and issues that ought to be considered.* (Preliminary paper no. 325.). Newark, DE: University of Delaware, Disaster Research Center.

Quarantelli, E. L., Lagadec, P., & Boin, A. (2006). A heuristic approach to future disasters and crises: New, old, and in-between types. In H. Rodrigues, E. Quarantelli, L., & R. R. Dynes (Eds.), *Handbook of Disaster Research* Springer.

Rainer, J., & Brown, F. (2007). *Crisis counseling and therapy.* . Binghamton, NY: The Haworth Press, Inc.

Rapoport, L. (1970). Crisis intervention as a mode of brief Treatment. In R. W. Roberts & R. H. Nee (Eds.), *Theories of Social Casework*. Chicago:IL: The University of Chicago Press.

Rich, H. E., & Winters, L. E. (2002). Disasters. In C. F. Hohm & J. A. Glynn (Eds.), *California's Social Problems* (2 ed.). Thousand Oaks: CA: Sage.

Richardson, G. E. (2002). The metatheory of resilience and resiliency. *Journal of Clinical Psychology., 58* (3), 307-321.

Ride, A., & Bretherton, D. (2011). *Community Resilience in Natural Disasters*. New York: NY: Palgrave Macmillan.

Ritchie, L., & Gill, D. (2006). The Selendang Ayu Oil Spill: A study of the renewable resource community of Dutch Harbor/Unalaska. In N. H. C. U. o. Colorado (Ed.), *Quick Response Report* (Vol. 181). Boulder: CO: University of Colorado at Boulder.

Ritzer, G., & Goodman. (2004). *Modern sociological theory*. New York: McGraw Hill Co.

Roberts, R. W., & Nee, R. H. (1970). *Theories of Social Casework*. Chicago:IL: The University of Chicago Press.

Roberts, A. R. (2005). *Crisis intervention handbook, Assessment , treatment, and research* (3 ed.). New York, NY: Oxford University Press.

Roberts, P., Ward, R., & Wamsley, G. (2012). The Evolving Federal Role in Emergency Management: Policies and Processes. In C. B. Rubin (Ed.), *Emergency Management: The American Experience 1900-2010*. Boca Raton, FL.: CRC Press.

Robertson, C. (2010). Search continues after oil rig blast, *The New York Times*. Retrieved from http://www.nytimes.com/2010/04/22/us/22rig.html

Robinson, C. A. (1996). Health Care Relationships Revisited. *Journal of Family Nursing, vol. 2* (no. 2), 152-173.

Ronan, K. R., & Johnston, D. M. (2005). *Promoting community resilience in disasters: The role for schools, youth and families.* . New York, NY: Springer.

Rubin, A., & Babbie, E. R. (2011). *Research methods for social work* (7 ed.). Belmont, CA: Wadsworth.

Rubin, C. B. (Producer). (2012). Disaster Timeline Series. Retrieved from http://disaster-timeline.com/

Scanlon, T. J. (1988). Disaster's Little Known Pioneer: Canada's Samuel Henry rince. *International Journal of Mass Emergencies and Disasters. , 6 (3) 213-232*.

Schoeman, H. P., & Ferreira, S. B. (2002). Justification for an Ecological approach to Violence against Women in Cohabitational and Marital Relationships. *MDB 452 notes – Loss and Trauma.* Bloemfontein, South Africa: University of the Free State.

Serna, J. (2012). Hurricane Sandy death toll climbs above 110, N.Y. hardest hit., *Los Angeles Times*. Retrieved from http://articles.latimes.com/2012/nov/03/nation/la-na-nn-hurricane-sandy-deaths-climb-20121103

Simpson, D. M., & Katirai, M. (2006). Indicator issues and proposed framework for a disaster preparedness index. *University of Louisville: Center for Hazards Research. Working Paper # 06-03*.

Singer, J., & Willett, J. B. (2003). *Applied longitudinal data analysis. Modeling change and event occurrence.* Oxford, NY: Oxford University Press.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1981). Perceived risk: Psychological factors and social implications. *Royal Society of London* (A376), 17-34.

Smith, A. (2011). Disaster costs triple to $218 billion, from http://money.cnn.com/2011/03/29/news/economy/swiss_re_disaster/index.htm

Snijders, T. A. B. (2005). *Power and Sample Size in Multilevel Linear Models* (Vol. 3). Chicester: Wiley.

Social Science Research Council. (2011). Mapping the Measure of America. In Social Science Research Council (Ed.).

Songer, T. (1999). Epidemiology of disasters. Retrieved from http://www.pitt.edu/~epi2170/lecture15/index.htm

Soper, D. S. (2011). "The Statistics Knowledge Base Website", Retrieved from http://www.danielsoper.com/statkb/

Spybrook, J., Raudenbush, S. W., Liu, X., Congdon, R., & Martínez, A. (2008). *Optimal design for longitudinal and multilevel research: Documentation for the "Optimal Design" software.*

Stallings, R. A. (1997). Proceedings from the inaugural distinguished lecture on disaster and disaster risk. *Sociological theories and disaster studies.* New Ark, DE.: United States if America.

Steele, F. (2008). Introduction to multilevel modelling concepts.

Stewart, J. (2008). *Space and Survival: The Aftermath of a fire disaster in a Cape Town Infromal Settlement.* Doctoral Degree, Stellenbosch University, Stellenbosch, Western Cape Province, South Africa.

Subcommittee on Disaster Reduction. (2005). Grand Challenges for disaster reduction. In S. o. D. Reduction (Ed.), *National Science and Technology Council Committee on Environment and Natural Resources: A Report of the Subcommittee on Disaster Reduction.*

Substance Abuse and Mental Health Services Administration. (2012). Drought. *Disaster Distress Helpline*. Retrieved from http://www.disasterdistress.samhsa.gov/disasters/drought.aspx

The Times-Picayune (Producer). (2010). Chemical spill in Norco closes schools, forces residents out. Retrieved from http://www.nola.com/politics/index.ssf/2010/04/st-charles.html

Tierney, K. (2009). Disaster response: Research findings and their implications for resilience measures. *CARRI Research Report 6.* Oak Ridge: Community and Regional Resilience Institute.

Tierney, K., & Bevc, C. (2007). Disaster as War: Militarism and the Social Construction of Disaster in New Orleans. In D. L. Brunsma, D. Overfelt & J. S. Picou (Eds.), *The Sociology of Katrina: Perspectives on a Modern Catastrophe*. New York:NY: Rowman & Littlefield Publishers, Inc.

Tierney, K., Bevc, C., & Kuligowski, E. (2006). Metaphors matter: Disaster myths, media frames, and their consequences in Hurricane Katrina. *The ANNALS of the American Academy of Political and Social Science, 604:57*.

Twigg, J. (2007). Characteristics of a disaster-resilient community: A guidance note. In D. D. R. R. I. C. Group (Ed.).

U.S. Census Bureau. (2011). Gulf States.

U.S. Fish & Wildlife Service. (2004). Effects of oil spills on wildlife and habitat from http://alaska.fws.gov/media/unalaska/Oil%20Spill%20Fact%20Sheet.pdf

U.S. Office of Personnel Management. (2011). List of cost-of-living adjustments (COLA), from http://www.opm.gov/retire/annuity/cola/colalist.asp

University of North Carolina. (2011). Structural functionalism theory.

Vale, L. J., & Campanella, T. J. (2005). *The Resilient City: How Modern Cities Recover from Disaster.* New York Oxford University Press.

Van Heerden, I., & Bryan, M. (2007). *The Storm: What Went Wrong and Why During Hurricane Katrina - The Inside Story From One Louisiana Scientist*. New York, NY: Penguin Group (USA) Inc.

Wade, & Schneberger. (2006). Social capital theory, from http://www.fsc.yorku.ca/york/istheory/wiki/index.php/Social_capital_theory

Warfa, N., Curtis, S., Watters, C., Carswell, K., Ingleby, D., & Bhui, K. (2012). Migration experiences, employment status and psychological distress among Somali immigrants: a mixed-method international study. *BioMEd Central, 12*.

Webb, G. R. (2006). The popular culture of disaster: Exploring a new dimension of disaster research. *Handbook of Disaster Research.* New York, NY Springer.

Wenger, D. E., & Weller, J. M. (1973). Disaster Subcultures: The Cultural Residues of Community Disasters. In U. f. D. D. R. Center (Ed.), *Preliminary Paper #9* (Vol. 6/73): University fo Delaware: Disaster Research Center.

Werner, E., & Smith, R. (1992). *Overcoming the odds: High risk children from birth to adulthood.* . Ithaca, NY: Cornell University Press. .

Westermann, C. (1994). *Genesis 1-11: A Continental commentary*. Minneapolis, MN: Augsburg Fortress.

Wind, T. R., & Komproe, I. H. (2012). The mechanisms that associate community social capital with post-disaster mental health: a multilevel model. *Social Science and Medicine 75* (9).

Wisner, B., Blaike, P., Cannon, T., & Davis, I. (2004). *At risk, natural hazards, people's vulnerability and disasters.* (2nd). New York: Routledge.

Wyman, B. (1911). *The Special Law Governing Public Service Corporations and all others Engaged in Public Employment*. Washington D.C.: Beard Books.

Yamamura, E. (2008). Learning effect and social capital: A case study of natural disasters from Japan. : Munich Personal RePEc Archive.

Zakour, M. J. (2005). Social Work and Disasters. In F. E. M. Association (Ed.).

Zakour, M. J. (2010). Vulnerability and Risk Assessment: Building Community Resilience. In D. F. Gillespie & K. Danso (Eds.), *Disaster Concepts and Issues*. Alexandria, VA: CSWE Press.

Zastrow, C., & Kirst-Ashman, K. K. (2008). *Understanding Human Behavior and the Social Environment*. Belmont, CA: Brooks/Cole.

CURRICULUM VITAE

Reggie J. Ferreira

RESEARCH INTERESTS

Community Disaster Resilience; Disaster Mental Health; Gerontology; Vulnerability; Special Needs Populations; Systems; International Social Work; Humanitarian Relief; Evidence Based Practice; Pet Evacuation and Pet Loss.

EDUCATION

Doctor of Philosophy in Social Work
2009– April 2013
University of Louisville, Kent School of Social Work
Dissertation: Predictors of Social Vulnerability: A Multilevel Analysis

Pre-Doctoral UNU PhD Block Course Scholar
March-April 2009
United Nations University, Institute for Environment and Human Security Bonn, Germany

Master in Disaster Management *(Cum Laude)*
Mental Health Specialization
2007-2008
Department of Social Work and Agricultural Economics, University of the Free State, Bloemfontein, South Africa
Dissertation: Determining the Social Vulnerability of Students at The University of the Free State after the events of social unrest in 2008.

Bachelors in Social Work – Minor Psychology and Criminology
2003-2006 University of the Free State, Bloemfontein South Africa
Mini-Dissertation: Adaptation Process of the Adolescent in Youth Reform Centers.

TRAINING AND CERTIFICATION

Community Emergency Response Team

University of Louisville, Louisville, KY. June 2012.

Intermediate Community Rating System

FEMA, Cumberland Falls, KY, USA, October 2011.

Master Trainer - Chronic Disease Self-Management Program (CDSMP), Stanford University.

Stanford University, Palo Alto, CA, USA, July 2011.

Master Trainer - Diabetes Self-Management Program (DSMP), Stanford University.

Stanford University, Palo Alto, CA, USA, July 2011.

Incident Command System Training – FEMA 300 and 400

Working on Fire, Vaalriver, South Africa, March 2009.

Fire Wise Communities – Fire Risk Assessment for Communities

Fire Logistics Inc. USA – Bloemfontein, South Africa, December 2009.

Response and Evacuation

South African Defense Force/ DiMTEC University of the Free State, May 2008.

Mass Evacuation (FIFA World Cup 2010)

Free State Rugby Union, Bloemfontein, South Africa, May 2008.

Sphere Minimum Standards in Humanitarian Relief (Trainer Course)

University of the Free State, Bloemfontein, South Africa, May 2008.

Child Loss and Trauma

Jigsaw 4U (United Kingdom), Bloemfontein, South Africa, August 2007.

Photo Box Therapy – Gestalt perspective

University of the Free State, Bloemfontein, South Africa, June 2007.

UDRAW – Graduate Academic Reasoning and Writing

University of the Free State, Bloemfontein, South Africa, February 2007.

Health and Safety Training

Marks and Spencer, London, United Kingdom, July 2002.

PROFESSIONAL EXPERIENCE

7/2009– present
Center for Hazards Research and Policy Development, University of Louisville

- Practical application and evaluation of practice and research projects in communities across the state of Kentucky (please see RESEARCH and SCHOLARSHIP).
- University of Louisville student representative for Hazard Mitigation related projects.

1/2009-7/2009
University of the Free State, Disaster Management Training and Education Centre for Africa (DiMTEC)

- Practical application and evaluation of practice and research projects in communities across Southern Africa (please see RESEARCH and SCHOLARSHIP)

7/2003-12/2008 (concurrent with education)
Free State Rugby Union, Bloemfontein South Africa
Event Manager

- Personnel management of 80-100 personnel involved with game day activities.
- Involved with stadium emergency management planning meetings.
- Involved with FIFA 2010 stadium exercises.

5/2007– 7/2007
Ons Kinderhuis, Bloemfontein, South Africa
Clinical Social Worker

- Performed Clinical Social Work duties; case work, group work and community work with about 25 children, who have been bereaved and traumatized because of various reasons (sexual molestation and abuse, physical abuse and neglect, etc. staying at Our Children Home-therapeutic center).
- Responsible for daily report writing on child development and progression within the center, as required by Social Work Policy and Services in South Africa. Reported to supervisor and provincial manager on child safety and progression.
- Steered fundraising committee to successful fundraising events.
- Supervised fourth year clinical social work students at *Ons Kinderhuis*.

2/2006– 11/2006
Ons Kinderhuis, Bloemfontein, South Africa
Intern Social Worker

- Performed Clinical Social Work duties; case work, group work and community work with 8 children, who have been bereaved and traumatized because of various reasons (sexual molestation and

abuse, physical abuse and neglect, etc. staying at *Ons Kinderhuis* (therapeutic center).
- Collaborated with physicians, nursing staff and educators.
- Co-facilitated adult support groups for children and families.
- Participated in the creation of community fund raising projects.

RESEARCH AND SCHOLARSHIP

ACADEMIC APPOINTMENTS

May 2010 to present
University of Louisville, *Kent School of Social Work*

Adjunct Faculty (See Teaching)

1/2009-7/2009

University of the Free State, *Disaster Management Training and Education Centre for Africa (DiMTEC)*

Junior Lecturer (full-time)

- Grant writing
- Implementation of funded studies
- Field visit coordinator
- Program evaluation
- Data collection and analysis for funded studies
- Lecturing short-courses with Disaster Risk Reduction promotion in mind, supervision of groups of up to 40 delegates during short-course training, involved with assessment procedures of delegates during short-course
- Research supervisor for master degree students

RESEARCH ASSISTANTSHIPS

7/2009– present
Center for Hazards Research and Policy Development, University of Louisville
Graduate Research Assistant

- Grant writing
- Program development
- Implementation of funded studies
- Data collection and analysis for funded studies
- Project leader for Kentucky Community Resiliency Initiative – Community Resiliency Planning Guide and Resiliency Assessment

- Professional writing and preparation of abstracts, manuscripts, posters and presentations related to completed projects
- Research mentor for master degree students in Urban and Public Affairs

8/2010–3/2012 Kentuckiana Regional Planning & Development Agency (KIPDA)
Grant Manager

- Grant Manager for Chronic Disease Self-Management Program
- Survey development and data collection
- Training of lay-leaders
- Development of structured independent study for Kent School students
- Monitoring of community leaders

1/2008–12/2008 Disaster Management Training and Education Centre for Africa, University of the Free State
Graduate Research Assistant

- Project leader for Contingency Planning at the University of the Free State
- Training of municipal and provincial Disaster/Emergency Management officials and community developers with specialized training programs to improve their skills in all disaster related program needs
- Literature reviews
- Data collection
- Table top exercise development for emergency response

RESEARCH AND PROJECT EXPERIENCE

2012 – Commonwealth Hazard and Mitigation Portal
Duties: Development of a disaster resilience community planning guide and resilience assessment scale for Commonwealth of Kentucky.

2012 – Commonwealth Hazard and Mitigation Portal
Duties: Assisting with the development of community recovery planning guide and for Commonwealth of Kentucky.

2010- Chronic Disease Self-Management Program (Department of Aging).

2012- Duties: Management of research inputs – survey development and data collection.

2011 – Hazard Mitigation Plan Development Kentucky State University

2011 – Kentucky Emergency Management Education Program Development

2010 – Disaster Preparedness Index (National Science Foundation).
Duties: Overseeing of final data collection, final management of project, responsible for delivering final NSF Report.

2010 – Quick Response Grant (University of Colorado at Boulder).
Duties: Management of grant and responsible for data collection.

2010 – Chronic Disease Self-Management Program (Department of Aging).
Duties: Management of research inputs on the grant – creation of survey, distribution and data collection tasks related to grant.

2010 – Kentucky Long-Term Care Facilities Disaster Preparedness Program (Kent School of Social Work) Development of table top exercises for Long-Term Care Facilities.

2009 - Disaster Risk Management Framework Development for Northern Cape Province, South Africa. Duties: Coordination and data collection management of the project.

2009 - Agricultural Impact Assessment, Mpumalanga Province, South Africa.
Duties: Responsible for baseline data collection and final report to client.

2009 – Disaster Risk Assessment conducted for the University of the Free State.
Duties: Project manager, management and overseeing of project.

2008 – Master Degree Dissertation: Determining the Social Vulnerability of Students at The University of the Free State after the events of social unrest in 2008

2008 – Disaster Risk Assessment conducted at for the University of the Free State. Duties: Project manager, management and overseeing of project.

2007 – Disaster contingency plan developed for University of the Free State.
Duties: Project manager, management and overseeing of project.

2006 – BSW 4th year research project: Adaptation tasks of the adolescent in youth reform centers.

HONORS AND AWARDS

FELLOWSHIPS AND SCHOLARSHIPS

7/2011 to present University of Louisville, *Center for Hazards Research and Policy Development Doctoral Assistantship*

7/2009-6/2011 University of Louisville, *Graduate School Doctoral Assistantship*

1/2008-12/2008 University of the Free State, *Graduate Research Assistantship*.

ACADEMIC AND SERVICE AWARDS

University of Louisville, ***Faculty Favorite 2011-2012 Award***. *Recognition to faculty that makes a significant difference in student learning and intellectual growth.*

Kentucky Association for Gerontology, **Lois E Layne *Student Achievement and Contribution*** in the field of gerontology. (April, 2012). $300 award.

University of the Free State, ***Graduate Student Funding Award***. *$1500 award to pursue graduate studies,* (2009).

GRANTS AWARDED

National Science Foundation: Quick Response Research Program, University of Colorado at Boulder. $2000 research award. *Developing a Social Vulnerability Assessment Tool for Special Needs Populations*, (2010).

GRANTS RECOMMENDED FOR FUNDING

National Science Foundation, Infrastructure Management and Extreme Events Program: Understanding Disaster Resilience through Multi-Level Modeling, $305, 063 (June, 2012).

GRANT APPLICATION REVIEW ACTIVITIES

Kentuckiana Regional Planning & Development Agency (KIPDA): 2011 Agency external grant application reviewer.

Kentucky Cabinet for Health and Family Services: *Department for Aging and Independent Living* 2012 external grant application reviewer.

TEACHING

TEACHING EXPERIENCE - Ph.D. Level Courses

University of Louisville,

Title	Section	Semester
Doctoral Preparation course for the incoming 2010 Cohort to the Ph.D. Program in Social Work	SW-766	Summer, 2010

TEACHING EXPERIENCE - **Graduate Level Courses**

University of the Free State,

Title	Section	Semester
Hazards and Disaster Management	DIM 602	2009

TEACHING EXPERIENCE - **Graduate Level**

University of Louisville, Kent School of Social Work

Title	Section	Semester
Advanced Research Practice I	SW-668	Fall, 2010
	SW-668	Fall, 2011
	SW-668	Fall, 2012
	SW-668	Fall, 2012
Advanced Research Practice I	SW-669	Spring, 2011
	SW-669	Spring, 2012
	SW-669	Spring, 2013
Chronic Disease Self-Manage	SW-697	Fall, 2011
Social Work and Disaster Management	SW-698	Summer, 2012

TEACHING EXPERIENCE - Undergraduate Level Courses

University of Louisville, Kent School of Social Work

Title	Section	Semester
Chronic Disease Self-Manage	SW-397	Fall, 2011
Social Work and Disaster Management	SW-398	Summer, 2012

TEACHING EXPERIENCE – Invited Guest Lectures

University of Louisville, Kent School of Social Work

Title	Section	Semester
International Social Work	SW 697	Fall, 2010
International Social Work	SW 697	Fall, 2011
International Social Work	SW 697	Fall, 2012

University of Louisville, Urban and Public Affairs

Title	Section	Semester
Hazards and Planning	Plan-623	Fall, 2011

TEACHING EXPEREINCE – Teaching Assistant

University of the Free State,

Title	Section	Semester
Research Methodology	DIM 601	2008
Public Health	DIM 607	2008

SERVICE

ACADEMIC AND PROFESSIONAL COMMITTEES

University of Louisville, Hazard Mitigation Steering Committee. University Student Representative. (2012-present).

University of Louisville Community Emergency Response Team. Charter Member (2012-present).

Kentucky Emergency Management: Commonwealth Hazard and Mitigation Portal System (2/2012-present).

Kentucky Association for Mitigation Managers: Region Two Strategic Committee. (10/2011- present).

Kent School Doctoral Faculty Committee Representative for 34 PhD students at Kent School for Social Work (2010-2011).

Kent School Faculty Committee: Representative for 34 PhD students at Kent School for Social Work (2010-2011).

Advanced Research Practice Curriculum Committee: Forum for instructors teaching in the advanced research practice sequence (2010- present).

Free State Provincial Disaster Management Advisory Forum: Served on multi-disciplinary advisory committee for the Free State Provincial government, providing advice and feedback on Disaster Management related practices in the province (2007-2009).

PROFESSIONAL SOCIETIES

Society for Social Work and Research (SSWR), 2012 – present

Council on Social Work Education (CSWE), 2011-present

Kentucky Association of Mitigation Managers (KAMM), 2011-present

International Association of Emergency Managers (IAEM), 2008-present

Disaster Management Institute of South Africa – 2008-present

PROFESSIONAL SOCIETIES INVITED

Golden Key Honor Society, United States of America, University of Louisville Chapter, 2012

Golden Key Honor Society, South Africa, University of the Free State Chapter, 2009

LICENSURES AND CERTIFICATIONS

Licensed Social Worker
South African Council for Social Services –Registered Social Worker

CONFERENCE PRESENTATIONS (Refereed Papers and Posters)

Ferreira, R.J. (2009, March). *Development of a Social Vulnerability Assessment Tool for Special Needs Populations* Poster presented at the United Nations University PhD Block Course, Bonn, Germany.

Ferreira, R.J. (2009, May). *Determining the Social Vulnerability of Students at The University of the Free State after the events of social unrest in 2008*. Paper presented at the 2nd Annual International Conference on Disaster Risk Reduction, Bloemfontein, South Africa.

Gordon, B. **Ferreira, R.J.,** & Johnson, S. (2012, July). *The Good, the Bad and the Ugly: An Integrative Evidence Based Approach to Practice and Student Education.* Paper presented at the 37th Annual National Conference for the National Association on Area Agencies on Aging, Denver, Colorado.

Ferreira, R.J. (2012, August). *A Comprehensive approach to Community Disaster Resilience Planning.* Incorporating Water into the Community Planning Process Workshop hosted by the Center for Environmental Policy and Management Studies. Louisville, Kentucky.

Ferreira, R.J., Bucher, J.W., & Human R.J. (2012, September). *Building a Disaster Resilient Commonwealth of Kentucky.* Paper presented at the 2012 Annual Conference for Kentucky Association of Mitigation Managers, Kentucky Dam Village, Kentucky.

Ferreira, R.J., & Faul, A.C. (2012, November). *Measuring Individual Disaster Resilience in Louisiana: A Multilevel Trend Study.* Paper presented at the 58th Council on Social Work Education Annual Program Meeting, Washington D.C.

Ferreira, R.J. (2012, December). *A Comprehensive approach to Community Disaster Resilience Planning*. Paper presented at the Governor's Conference on Emergency Management, Louisville, KY.

Human R.J, & **Ferreira, R.J.** (2013, January). *Building a Disaster Resilient Community in Kentucky*. Paper presented at the International Disaster Conference and Expo, New Orleans, LA.

Ferreira, R.J., & Faul, A.C. (2013, January). *Measuring Individual Disaster Resilience in Louisiana: A Multilevel Trend Study.* Paper presented at the 17th Annual Conference for Society for Social Work and Research, San Diego, CA.

Ferreira, R.J., & Bucher, J. (2013, February*). Community Resiliency and Recovery Planning: Strengthening our Communities.* Environmental Protection Agency National Webinar Series, Louisville, KY.

BIBLIOGRAPHY

Peer-reviewed Publications

Ferreira, R.J. (Ready for submission). *Recommendations for conducting disaster research with vulnerable populations.*

Ferreira, R.J., Faul, A.C. & McCord, L. (In preparation). *Assessing the Social Vulnerability of Older Adults in North Central Kentucky region.*

Ferreira, R.J., and Bucher J.W. (In preparation). Exploring Rural Community Recovery: A Case Study of Three Rural Communities.

Technical reports

Simpson, D.M., & **Ferreira, R.J**., (2010). Final Report to National Science Foundation: Measuring Cross-Community Disaster Preparedness and Resiliency: Theoretical and Practical Application Development.

Ferreira, R.J., & Jordaan, A.J., (2009). Report to the Office of the Premier Northern Cape Province: Agricultural Disaster Risk Assessment.

Ferreira, R.J. & Jordaan, A.J., (2009). Report to the Office of the Premier Mpumalanga Province: Environmental Impact Assessment.

Ferreira, R.J. (2008). Development of an Emergency Contingency Plan: Submitted to the University of the Free State, Directorate of Finance.