THESIS

OPTIMISTIC BIAS IN RELATION TO HURRICANE RISK

Submitted by

Bridget Morrissey

Department of Journalism and Technical Communication

In partial fulfillment of the requirements

For the Degree of Master of Science

Colorado State University

Fort Collins, Colorado

Summer 2010

COLORADO STATE UNIVERSITY

May 7, 2010

WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY BRIDGET MORRISSEY ENTITLED OPTIMISTIC BIAS IN RELATION TO HURRICANE RISK BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

Committee on Graduate Work

_____
Garrett O'Keefe

_____
Lori Peek

_____
Advisor: Craig Trumbo

_____
Department Chair: Greg Luft

ABSTRACT OF THESIS

OPTIMISTIC BIAS IN RELATION TO HURRICANE RISK

Public officials in the natural disaster field benefit from knowing whether individuals tend to underestimate or overestimate the dangers they could face from future hurricanes. Correcting hurricane risk misperceptions can encourage individuals living in coastal regions to take action and prepare themselves for the next hurricane season. One of the first steps in this process is to understand social perceptions of risk. In order to so, this quantitative study explored optimistic bias in relation to hurricane risk. Optimistic bias is defined as the tendency of people to be unrealistically optimistic about life events (Weinstein, 1980). Weinstein explains this belief through the idea that individuals expect others to suffer hardship, but not themselves. After conducting a secondary analysis on 824 surveys collected from Gulf Coast residents, results show implications on the effects that dispositional optimism, age and tenure have on optimistic bias pertaining to hurricane risk. This data provides important information for future research and has implications for hurricane risk education.

Bridget Morrissey
Journalism and Technical Communication
Colorado State University
Fort Collins, CO 80523
Summer 2010

ACKNOWLEDGMENTS

A special thanks to my graduate committee for their support during the completion of my thesis. This project could not have been completed without their advice, expertise and time. A special thanks to my advisor, Craig Trumbo, who not only provided the data for this secondary analysis, but who also spent countless hours making sure this thesis was completed successfully.

I would also like to thank my parents and siblings for their moral support. I could not have reached my goals without their constant motivation, especially during the stressful days.

I must also acknowledge those living on the Gulf Coast who support research efforts such as Craig Trumbo's 2006 Gulf Coast Hurricane Outlook Survey used for this thesis. The original data collection for this project was supported by a grant from the National Science Foundation (PI: Trumbo CW, SES-0554921, 10/01/05-09/30/06).

TABLE OF CONTENTS

Chapter 1: Introduction

The goal of this research was to study the theory of optimistic bias or also referred to as "unrealistic optimism" and to examine how this theory can help public officials understand individuals' perceptions of hurricane risk. Public officials in the natural disaster field who can use this information include those who work for the Federal Emergency Management Agency (FEMA), local governments, the Red Cross and other relief agencies, disaster preparedness communicators, and emergency resource managers. Although optimistic bias is defined differently throughout existing studies, this research used Neil Weinstein's definition. Weinstein explains optimistic bias as the tendency of people to be unrealistically optimistic about life events (Weinstein, 1980). Weinstein explains this belief through the idea that individuals expect others to suffer misfortune, but not themselves.

1.1. Overview

To explore optimistic bias in the context of hurricane risk, this study conducted a secondary analysis using an existing data set (Trumbo, 2007). This data focused on optimistic bias, hurricane risk perception and evacuation intention among Gulf Coast residents from western Florida, eastern Alabama and in Texas, from Galveston west. Details on the data collection are provided in chapter five.

This area is important to study for hurricane risk perception because the Gulf Coast region is the fourth most populated region in the United States (Crossett, Culliton,

Wiley and Goodspeed, 2004). Of the 673 coastal counties in the United States, 144 are on the Gulf Coast (Crossett et al., 2004). In 2003 the population in this region was just over 19 million making up 13 percent of the nation's coastal population (Crossett et al., 2004). It is predicted that by 2015 the population will increase in the Gulf Coast by one-third (Crossett et al., 2004).

This study considered how certain demographic factors, such as age, income, education and number of children in the household can affect an individual's optimistic bias level. Besides demographic factors, other covariates were analyzed such as housing type, homeownership, length of time an individual has resided within 50 miles of their current home (tenure) and past hurricane experience. These covariates were analyzed through a bi-variate and a multi-variate analysis. Results were organized using eight research questions followed by a detailed discussion.

1.2. Rationale

Through analyzing these covariates, this study extends literature on optimistic bias in the natural disaster field. This is important to disaster management officials because understanding public perception of risk is recognized as an important attribute for natural hazards policy, management response and planning initiatives (Peacock, Brody and Highfield, 2005). As seen in optimistic bias studies, "if people do not perceive themselves as vulnerable to a disease or condition, they are less likely to adopt recommended behaviors" (Avis, Smith and McKinlay, 1989, p. 1608). As Chapin and Coleman (2009) state in their study on optimistic bias, people use many factors to assess

their personal risk, such as personal experience or education. These risk evaluations affect the level of precautions individuals take before engaging in risky behavior. Information from this study will help public officials understand which individuals may need more education on hurricane risk. If these individuals understand that they are at risk during hurricanes, they can better prepare themselves to help eliminate physical and economic problems common during and after a hurricane. For example, if mobile home owners prove to have high levels of optimistic bias, this sheds light that this group of people may need more education regarding the greater dangers they face during hurricane season. Public officials can create information packets targeting this group of people explaining to them mobile home risk and vulnerability. Once individuals have correct information regarding their hurricane risk, it is hoped that they will put this knowledge into action, such as having an evacuation plan and knowing hurricane shelter locations. It is important to correct risk misperceptions through targeted education and this research can help to identify possible target groups. By "risk misperception" this research refers to what Weinstein (1980) described as an error in judgment. A risk misperception is an understanding that is not correct because this understanding depends on faulty reasoning and belief.

Understanding how individuals perceive risks of hurricanes using optimistic bias is important. From June through November the Gulf Coast population must be ready to face the potential dangers of a hurricane. Hurricanes disrupt the lives of those who live in this region through the destruction of homes and businesses as well as through fatalities. When a hurricane advances on land, colossal damage can occur in that

territory. Hurricanes can be the source of major power outages, destroy homes and cause intense flooding. In addition, hurricanes cause long-term displacement and death as well as catastrophic economic damage.

In the United States, the six storms during hurricane seasons 2004 and 2005 were extremely destructive (Smith and McCarty, 1996). It was during this time when the nation watched as Hurricane Katrina devastated multiple states on the Gulf Coast. Strong category hurricanes will continue to threaten the United States in the future. Not only will hurricanes be expected, but researchers also warn that global warming and climate change may increase the strength of future storms (Inman, 2010).

As global warming continues to increase so will the United States' coastal population. More than half of the U.S. population lives within 50 miles of a coast and this number continues to grow (United States Geological Survey, 2006). In the United States, ten of the 15 cities that have the highest populations are in coastal regions and according to a 2004 report by the National Oceanic and Atmospheric Administration (NOAA), there are 300 persons per square mile in coastal counties, compared to 98 persons per square mile for the rest of the U.S. (Donner and Rodriguez, 2008).

As coastal populations increase, public officials and those working in disaster management must adequately prepare hurricane prone regions. We know that hurricanes will continue to make landfall in the future, therefore, it is important for these officials to educate the public about hurricane risk so that individuals can take the proper actions to protect themselves. One of the first steps in this process is to understand how publics perceive their risks of hurricanes. "It is well known that the nature and effectiveness of

risk preparedness, management and mitigation activities in human settlements is affected by individual and social perceptions of risk" (Li, 2009, p. 366). Public officials must know if individuals tend to underestimate or overestimate the dangers they could face from future storms. Correcting hurricane risk misperceptions may encourage individuals living in coastal regions to take action and prepare themselves.

Chapter 2: Literature Review

The following review examines the theory of optimistic bias. Included are studies on the existence and nature of this concept in several fields, an explanation of how scientists measure optimistic bias and a review of optimistic bias covariates. Literature on hurricane risk perception is also explored. Although research on optimistic bias in the context of natural disasters is scarce, this literature explains what scientists have discovered about risk perceptions of these hazards.

This research used Neil Weinstein's definition as its formal explanation of optimistic bias; how individuals exaggerate the likelihood that a positive event will happen while underestimating the likelihood of a negative event occurring (Weinstein, 1980). Past research showed that optimistic bias has been measured in two ways, directly and indirectly. The direct measurement has individuals rate their likelihood of experiencing an event compared to that of their peers' likelihood of experiencing that same event. For example, some may feel that they do not have to wear a seatbelt because they are better drivers than others and are less likely to have a car accident. The indirect measurement of optimistic bias compares the difference between two questions. Individuals are asked about their own chances of experiencing an event and in a separate question individuals are then asked to rate the likelihood of an average other's chance of experiencing that same event. This study used the indirect measurement.

As used when studying optimistic bias, a car accident is an example of a future negative event. An example of a positive future or past event refers to statements such as "not catching the flu" or "no nights spent in the hospital" (Weinstein, 1980, p. 810). In hurricane research, a positive future or past event can refer to statements such as "a home not damaged by winds" or "no flooding during and after the storm." Examples of a negative event include, "having a drinking problem" or "developing cancer" (Weinstein, 1980, p. 810). In relation to hurricanes, a negative event can be "damaged house," "home looted" or "experiencing a serious injury during a hurricane."

It is important to understand how this concept has been studied in past research. The following literature on optimistic bias explores what it means to have an optimistic bias, how scientists measure this bias and what variables moderate levels of it.

2.1. Existence of Optimistic Bias

Optimistic bias has been studied within a diverse field of topics and events. Weinstein (1980) measured levels of optimistic bias by testing college students and their tendencies to focus on their chances of achieving positive outcomes while failing to realize that other students may have the same chance of obtaining those same positive outcomes. In this study, students rated their likelihood versus the likelihood of fellow classmates of experiencing a positive future event from phrases such as "owning your own home" or "having a mentally-gifted child" (Weinstein, 1980, p.810). Students rated their likelihood versus the likelihood of fellow classmates of experiencing a negative future event from phrases such as, "having a drinking problem" or "divorced after a few years of marriage" (Weinstein, 1980, p. 810). Through his measurements, Weinstein

found evidence of optimistic bias for both positive and negative events. Weinstein also found that the range of bias differed depending on the particular described event.

Important results from this study revealed specific attributes that contributed to how students assessed their likelihood versus classmates' likelihood of experiencing a particular event. Weinstein (1980) found students thought about personal actions and perceived controllability when rating the likelihood that positive events would happen over negative events. A second important finding was that when students compared themselves to their classmates, they tended to consider unrealistic stereotypes of others. Students used these stereotypes to explain why others were more likely to experience negative events than themselves (Weinstein, 1980). Weinstein suggested future research using different age groups, different event characteristics and the need to study methods of assessing optimism.

When assessing optimism, it is important to note the difference between unrealistic and realistic optimism. Many studies on optimistic bias find that individuals see themselves at less risk than others (Dillard, McCaul and Klein, 2006). These individuals may in fact be realistically judging their risk. This is referred to as "realistically optimistic" or as Dillard et al. (2006) referred to as "accurate" (p. 93). On the other hand, there are individuals who are "unrealistic optimists" who believe they are at less risk than others, but in fact are at a greater or at just as much risk. There are important implications for those who are unrealistic optimists. When these individuals misperceive their risk, they often do not take appropriate preventative actions.

Dillard et al. (2006) conducted a study on the existence of optimistic bias in smokers and whether or not this bias was unrealistic. In this study, results revealed

"smokers who were unrealistic optimists believed more strongly in the idea that there is no risk of illnesses from smoking if one only smokes a few years" (Dillard et al., 2006, p. 100). These individuals also reported that lung cancer depends mostly on genes and that more lung cancer patients are cured. The more smokers unrealistically view their chances of suffering from a smoking-related illness, the less likely they will quit smoking in order to prevent that illness.

Robb, Miles and Wardle (2004) used optimistic bias to study risk perception of colorectal cancer. These researchers defined having an optimistic bias as, "when an individual believes he or she is at a lower-than-average risk for a wide range of hazards and adversities, consistently more than they believe they are at a higher risk" (Robb et al., 2004, p. 21). This study first asked participants what they believed their chances were of suffering from colorectal cancer compared to an average other. Next, participants were medically screened for a hard outcome measure of each individual's risk of getting this cancer. This flexible sigmoidoscopy (FS) screening occurred in endoscopy units by specialized gastroenterologists. Robb et al. (2004) found a moderate significance between perceived and actual risk. Respondents were optimistic about their risk for colorectal cancer, but not as much so as found in other studies.

Although respondents were found to have an optimistic bias, those who rated themselves at a low risk for colorectal cancer were more likely to test at a low risk during the medical screen (Robb et al., 2004). Those who rated themselves at a higher than average chance of suffering from this cancer were more likely to test at a high risk during the medical screen. This study highlighted the difference between realistic and unrealistic optimists. Some individuals may be realistically optimistic about their risks

for colorectal cancer. Their realistic outlook can be attributed to how individuals take into account their personal health history and heredity when comparing themselves to others.

Whether individuals are realistic or unrealistic when perceiving their risks of illnesses or events, optimistic bias is an important concept to study and carries great implications through several fields. For example, a number of scientists have studied optimistic bias and crime. These studies researched how individuals view their risk of being a victim of a crime versus others' chances. Many of these studies have addressed child abuse and domestic violence to measure if individuals believe themselves as less likely to experience abuse than others.

In one study by Chapin and Coleman (2009), participants were asked, "compared to other people my age in the U.S., my chances of being abused by an intimate partner are much lower (-3), about the same (0) or much higher (3)" (p. 125). Those who scored a negative number were flagged as having an optimistic bias. In this research, a negative number indicated a perception that others are more likely to be victims of domestic violence (Chapin and Coleman, 2009). Results from this study indicated that participants were optimistic about their chances over others' for being victims of domestic violence.

Optimistic bias has also been used to study environmental health issues. Weinstein, Klotz and Sandman (1989) conducted a study in New Jersey about dangerous measures of radon in residents' homes. The purpose of this study was to identify what shapes perceptions of risk and how those perceptions shape the actions people take. Weinstein et al. (1989) found that only 10.4% of the residents had accurate perceptions of the risk of radon levels in their home. Optimistic biases were found as some residents

believed their homes to be safer than their neighbors'. Results from this study also revealed that the information needs of the residents were not being met. Residents reported that they did not understand the risks of radon as well as what levels of radon were considered dangerous.

In the health communication field, researchers have studied optimistic bias and its role in African American teens' risky sexual practices (Chapin, 2001). This study defined optimistic bias as the "misperception that one is less likely than others to experience negative consequences from health behaviors" (Chapin, 2001, p. 49). Results found optimistic biases for sexual risk-taking in youth, sexual intentions and attitudes toward sexual behavior.

Optimistic bias research on risk perceptions of getting cancer is a popular topic. Not only is this disease a leading cause of death, but several studies have shown that people perceive themselves as invulnerable to many forms of cancer (Fontaine and Smith, 1995). One study on optimistic bias and cancer compared how American and British adults evaluated their risk of suffering from this disease. This study took into account whether these adults tested as having an optimistic bias and if so, how levels of optimistic bias differed between the countries (Fontaine and Smith, 1995).

Fontaine and Smith (1995) predicted that although optimistic bias would be found in both Britain and America, the British respondents would show a greater level of optimistic bias. Fontaine and Smith hypothesized this because Americans are said to be more sensitive and aware of health and illness issues than other countries. Therefore, this study not only researched optimistic bias in the context of cancer, but also how culture affected levels of this bias.

Results revealed that the perceived likelihood of cancer for oneself versus the average person was significant. Not only did both American and British respondents have an optimistic bias about cancer, but British respondents tested to have significantly higher levels of optimistic bias than the American respondents (Fontaine and Smith, 1995). Fontaine and Smith (1995) discussed how Americans emphasize personal responsibility for good health and therefore pay attention to health information more so than other countries. This may account for why Americans are more aware of their vulnerability to disease (Fontaine and Smith, 1995). These researchers stressed the importance of testing how culture may influence risk perceptions in future studies on optimistic bias.

2.2. Measurement

Weinstein developed the direct method to measure optimistic bias (Harris, Griffin and Murray, 2008). The direct method assesses optimistic bias by asking participants in a study how their risk compares with an average other (Harris et al., 2008). Participants use a single scale to compare their risks to others. For example, Weinstein used a rating scale to study students' responses. Some students rated themselves at an above average chance of experiencing a positive event, while at the same time rated themselves at a below average chance for experiencing a negative event (Weinstein, 1980). In a self-other risk assessment, single scales give respondents choices such as "much less likely" or "more likely" (Harris et al., 2008, p. 1226).

Although this direct method is popular, there are many limitations to it. Harris et al. (2008) and Moen and Rundmo (2005) explained that using the single scale direct method creates complications when a researcher needs to know whether a variable

(controllable events, frequency of event, event severity, etc.) moderates optimistic bias rates of self-risk, other-risk or both. In light of this, researchers have suggested an indirect method for measurement.

The indirect method asks participants to make a judgment for themselves and then to make a judgment about an average other. The difference between the self and other rating gives researchers a comparative likelihood (Harris et al., 2008). While the direct method uses one scale to provide optimistic bias feedback, the indirect method rates comparative differences.

Several researchers have conducted studies to test the difference between direct and indirect measurements when evaluating optimistic bias. Covey and Davies (2004) investigated how well the direct and indirect measurements engage respondents' optimistic bias beliefs. In this study, respondents were asked about six health problems including Asthma, Parkinson's disease, HIV, lung cancer, a chronic disabling condition and a fractured limb. Participants were asked about their risk versus others risk of suffering these health conditions using both the direct and indirect measure. Covey and Davies (2004) explained that although they used the direct measure before the indirect in the questionnaire, this would make no difference. According to past studies, reversing the order in which direct and indirect measurements appear results insignificantly (Covey and Davies, 2004).

Results showed that participants were unrealistically optimistic for all six health issues in the indirect measurement responses, but only five of the six in the direct measurements (Covey and Davies, 2004). When they measured for particular variables, correlations were stronger in the direct measure for frequency of event and experience,

while the variable of preventability was stronger for the indirect measure. Covey and Davies (2004) found that the difference of correlations implied differences in how respondents constructed their judgments. They claimed that some of the significant differences between the measurements may signify that during the direct measure, respondents answered based on themselves rather than the difference between themselves and their peers.

Although correlations were stronger for one measurement over the other, Covey and Davies (2004) expressed that the strength was small to insignificant. They stated that both measures can be found to produce similar results when measuring optimistic bias. Covey and Davies cautioned that although these measures produced similar results, it can be true that different health problems or concerns may yield different results between measures. This was not tested within their study.

Aucote and Gold (2005) also examined differences between direct and indirect measurement of optimistic bias. Testing 120 female students on the risks of unwanted pregnancy, these researchers found the two measurements not to be equivalent. Aucote and Gold (2005) stated that if direct and indirect were equivalent measures, a strong positive relationship would exist between them. Aucote and Gold (2005) did find a positive relationship, but of moderate strength. Like Covey and Davies (2004), these researchers concluded that when individuals answered the direct questions, they tended to focus on themselves rather than on the average other. Auctoe and Gold (2005) explained this by the fact that individuals have better information on themselves than on an average other and thus based their answers on information they had at hand. Auctoe and Gold

(2005) also discussed the effects that egocentrism had on the direct measurement, which is the tendency for respondents to focus on information that concerns the self.

Although the above researchers suggested a chance that individuals tend to think of themselves rather than average others when answering a direct measurement question, they can not be sure this is always the case. Otten and Plight (1996) studied this same concept while having respondents think out-loud when answering a questionnaire. All thoughts were coded. Respondents completed a questionnaire about skin cancer risk starting with the direct measurement followed by the indirect. Otten and Plight (1996) found that both measurements signified an optimism and that significant differences were found between the direct and indirect measures in proportions to thought.

The significant differences were found in three categories of thought. Reasons why people engage in risky behavior, admitting they did not know what the risks were and ideas about the prevalence of skin cancer. A higher proportion of these thoughts were elicited by the indirect measure. Otten and Plight (1996) suggested their results may validate that participants picked up on comparing self to other for the indirect measure more often. The indirect measure elicited more thoughts of peers rather than focusing on self only, confirming research conclusions from Covey and Davies (2004) and Aucote and Gold (2005).

Coding thoughts deemed important in this study because although responses about comparative risk and absolute risk appeared similar in results, thoughts provided validity that respondents estimated risk slightly different between direct and indirect measurements. The direct measurement yielded few comparative to other thoughts. Otten and Plight (1996) also concluded that respondents found it easier and quicker to

answer direct measurement questions of optimistic bias because respondents had an easier time retrieving information to base their judgments. This may show that individuals tend to base judgments on easy information they have on themselves and their own risks.

Research shows that clarity is key when measuring optimistic bias; it is important to distinguish whether the question asked and rating scale affects self-risk assessment, other-risk assessment or both (Harris et al., 2008). Optimistic bias is a latent concept, therefore the indirect method of measurement is often preferable (Moen and Rundmo, 2005). Researchers may change how they both measure and define optimistic bias depending on the particular topic of their study.

Whether a researcher uses a direct or indirect approach, Rimal and Morrison (2006) have found that an optimistic bias is often a function of perceived similarity between oneself and another. For example, Rimal and Morrison (2006) found that the more different one believed him or herself to be from someone else, the more the magnitude of optimistic bias increased. Agreeing with Rimal and Morrison (2006), Salmon, Park and Wrigley (2003) stated that optimistic bias has been repeatedly greatest when subjects compared themselves to general others rather than a similar group member of the same age, gender or race. For example, a risk message about AIDS that targets African Americans may produce an unrealistic bias in Caucasians. Caucasians may believe that because they are not African American their risk of contracting AIDS is less. Rimal and Morrison (2006) suggested further research in this area by adding the variable of severity of perceived difference in future studies.

Although most studies measured optimistic bias by comparing self to someone of the same age and sex, Chang and Asakawa (2003) used a self versus sibling comparison. Comparing self to a sibling can be considered a significant in-group comparison compared to a nonsignificant other (no personal relationship to respondent). This sheds light on the importance for researchers to understand significant versus nonsignificant comparisons when studying optimistic bias. Participants may compare themselves differently to people they know personally versus a nonsignificant other.

Besides the differences in making comparisons to others, researchers measuring optimistic bias must also take into account the comparative statements on questionnaires. Dunning, Meyerowitz and Holzberg (1989) researched how individuals make self-evaluations and optimistic judgments. These researchers studied the ways in which people were more optimistic when questions in a questionnaire were more ambiguous. By ambiguous, Dunning et al. (1989) referred to how a said trait "can refer to any number of behaviors or characteristics" (p. 1083). Examples included personal descriptions such as sensitive or insecure. Participants were also presented with unambiguous trait descriptions such as wordy or clumsy. Respondents were asked to rate themselves on these characteristics versus their peers.

Results revealed that the respondents rated themselves more highly on ambiguous traits than on the unambiguous traits (Dunning et al., 1989). Also to note, respondents rated themselves higher on positive than negative characteristics. This study showed that when rating more defined characteristics, respondents self-appraised at an average level rather than an optimistic level. The opposite was true when respondents rated self-characteristics that were ambiguous. These researchers found that ambiguous and

unambiguous options in optimistic bias questionnaires could create boundaries for respondents and affect their answers.

2.3. Covariates

Researchers have studied many covariates of optimistic bias. These can include cognitive errors due to a scarcity of information about a topic (knowledge, motivational needs, self-esteem or to relieve anxiety (Avis, Smith and McKinlay, 1989) as well as five categories Weinstein (1984) studied. He found that people explained their risk perceptions through, "actions, heredity (in studies on health), physical/physiological, environmental and psychological" (Weinstein, 1984, p. 433). Some examples of these attributes include how individuals believe themselves to be healthier than others because they stay in shape (actions and controllability), they won't develop diabetes because their parents don't have the disease (heredity) or they seldom catch the flu (past experience). Environmental attributes include how individuals perceive themselves as safe because they live in a low polluted city and psychological attributes include how a person's personality and values influence optimistic bias (Weinstein, 1984).

Although there have been many covariates found to affect levels of optimistic bias, this next section will specifically address dispositional optimism, age, gender, education and personal experience. These attributes are discussed because of their relevance to this study.

2.3.1. Dispositional Optimism

How individuals view their risks differs from one person to the next. A second aspect of optimism research is the concept of dispositional optimism. Dispositional optimism occurs when an individual expects that he or she will experience positive life

events (Radcliffe and Klein, 2002). This definition of optimism describes how individuals have a psychological characteristic that reflects a general positive attitude about one's future. Along with this attitude is the view that bad events in life are less likely to happen (Hayes and Weathington, 2007). Dispositional optimism differs from optimistic bias because it is considered as a trait that cannot be defined as an accurate or inaccurate outlook, versus a perception that is considered as having a bias (Radcliffe and Klein, 2002).

The level of an individual's dispositional optimism can affect how people process risk related information and may explain how individuals regulate their actions (Luo and Isaacowitz, 2007; Hayes and Weathington, 2007). Dispositional optimists are known to be more attentive to health and risk information (Radcliffe and Klein, 2002). In their study on dispositional optimism, Radcliffe and Klein (2002) found that those who are optimistic had lower blood pressure, spent more time exercising and had a lower chance of experiencing a heart attack. This study also revealed that high dispositional optimists were more aware of risks.

To measure dispositional optimism the Life Orientation Test-Revised (LOT-R) is used. This test includes 10 statements with three positively worded, three negatively worded and four filler items (Hirsh et al., 2007). Individuals are asked to indicate how strongly they agree with each statement using a 5-point scale, from strongly disagree to strongly agree. This test includes statements such as "I'm a believer in the idea that every cloud has a silver lining" (Radcliffe and Klein, 2002, p. 837). The higher an individual's score, the greater dispositional optimism he or she has.

Studies researching effects of dispositional optimism concentrate on how it can be used to provide a measure of resilience against negative physiological and psychological outcomes (Hirsch et al., 2007). Those who have a high dispositional optimism may have a strong persistence in achieving their goals, despite the challenges they face. Radcliffe and Klein (2002) reported that people high in dispositional optimism have better physical health, adjust better to life stressors and cope better with obstacles.

Measuring a sample's level of dispositional optimism is important in studies on optimistic bias. Whether dispositional optimism and optimistic bias are related has been debated. Some have cautioned that individuals who are optimists may not take preventative measures (Radcliffe and Klein, 2002). Radcliffe and Klein (2002) suggested that more data on this subject is needed to conclude how having positive outlooks about the future affects unrealistic or biased optimism. In order to do so, these researchers analyzed the association between dispositional optimism and optimistic bias and found no correlation between the two. These researchers concluded, "although dispositional optimists are more likely to see their risk as low, they are no more or less likely to be biased on this belief" (Radcliffe and Klein, 2002, p. 844).

Although Radcliffe and Klein (2002) studied how dispositional optimism and optimistic bias have differed, research on this topic is scarce. Most research on dispositional optimism focuses on how having an optimistic outlook about future events affects health, dealing with difficult situations and general outlook on life. This study analyzed how dispositional optimism affects optimistic bias in relation to hurricane risk.

2.3.2. Age

Many researchers have studied how age affects optimistic bias and results have varied depending on the topic or event being studied. Avis, Smith and McKinlay (1989) researched how individuals perceived their risk of having a heart attack. They found that age did predict optimism and that those who were younger felt less vulnerable to heart attacks than others. Conversely, those who were older and had a parent die from heart disease were more pessimistic about their chances of having a heart attack. Many of the older adults' risk perceptions in the study could be considered realistic based off heart health statistics. Avis et al. (1989) also stated that younger respondents with less education about heart disease had an optimistic bias.

A second examination of age as a variable in optimistic bias focused on consumers' perceptions of food safety risk. Redmond and Griffith (2004) researched how individuals perceived their risks from food as well as how much control these individuals felt they had over preparing food. The purpose of this study was to test how being overly optimistic about risks from food preparation illnesses, such as food poisoning, may increase the likelihood that an individual will not prepare food responsibly. Among other variables tested in this study, younger respondents felt less responsible for their own food safety than the older participants did. Younger respondents were more optimistic of their risks from food handling related illnesses. Redmond and Griffith (2004) suggested that consumer awareness regarding food safety responsibilities should be increased among the public. These researchers found that better social marketing about food safety should target younger adults.

As discussed earlier, individuals can have unrealistic and realistic optimistic biases. In a study by Dillard et al. (2006) age was found as a factor for smokers having unrealistic optimistic risk perceptions. Those who were unrealistic optimists were significantly older than non-optimists. Results showed that older smokers rationalized their risks because they have been smoking a long time and have not suffered a smoking-related disease. These smokers began to feel safe from suffering from diseases such as lung cancer. Dillard et al. (2006) discussed the possibility that unrealistic optimistic bias may develop over time.

Although the above studies show that age can moderate optimistic bias, age as a covariate of optimistic bias is inconsistent (Chapin and Coleman, 2009). For example, in their study on optimistic bias and crime, Chapin and Coleman (2009) asked, "what impact, if any, do gender, age and education have on optimistic bias?" (p. 124). Results showed that age (and education) were not significant predictors of having an optimistic bias when it came to being a victim of a domestic abuse crime. Inconsistency of age in research on optimistic bias may be due to the specific topic or event being studied therefore, this thesis explored this variable further in relation to hurricane risk.

2.3.3. Gender

Like age, literature detailing how gender covaries with optimistic bias has been inconsistent. When gender is a factor on levels of optimistic bias it is usually topic or event dependent. For example, Chapin and Coleman's (2009) found that women, especially those who had already been victims of domestic violence, showed lower levels of optimistic bias than men. To Chapin and Coleman, this result was not surprising as they explain that the majority of domestic violence victims are women. This study

showed how gender can be a covariate in optimistic bias, but is dependent on a specific topic that favors one gender as being at a higher risk.

A second study that found gender as a covariate in optimistic bias is by Clarke, Williams and Arthey (1997). This study focused on sun tanning behaviors and sun protection in relation to skin type and optimistic bias in young adults living in Australia. Results revealed that females rated skin cancer as more severe than males had. Clarke et al. (1997) explained that this finding is consistent in past literature on this subject. Interestingly, this study reported that women spent more time than men deliberately trying to get a tan despite their heightened perceptions that skin cancer is severe. Having an optimistic bias may explain why women, while perceiving skin cancer as a severe risk continue to tan.

Dejoy (1992) conducted a study comparing gender differences in risk perceptions of traffic accidents. Dejoy (1992) studied male and female drivers ages 18 to 24 and asked them to rate their driving safety, accident likelihood and driving skill. Optimistic bias was measured using two comparisons. One comparison asked participants to rate themselves versus other drivers of their own age and sex and the second comparison was to rate themselves versus the average motorist (Dejoy, 1992).

Results showed that male drivers considered themselves safer drivers than others in their age and sex group as well as safer drivers than the average motorist. Dejoy (1992) found that 93% of the males considered themselves more skillful than others in both groups. These findings indicated that males were more optimistic than females, especially when it came to their driving skills in both comparisons. Dejoy (1992) also found that males rated actions such as driving without a seat belt and not making a full

stop at a stop sign as less serious than the females had. Dejoy (1992) discussed that because males in this study possessed an optimistic judgment of their own driving skills that this may lead them to underestimate their risks from various dangerous driving actions. Dejoy (1992) stated "the problem is that this danger is not perceived as applying to them personally" (p. 246). Whether a risk applies to a male or female personally may be a strong moderator of optimistic bias when studying gender differences. Gender difference in hurricane risk perception will be discussed further in chapter three.

2.3.4. Education

When using education in studies about optimistic bias the definition is often two-fold. On one side, education is measured on level of education attained (high school, college or graduate degree). On the other side, education is what a person knows about a specific risk. Most research on education and optimistic bias has focused on the use of education to improve an individual's knowledge on a specific risk in order to reduce unrealistic optimism.

Lipkus and Klein (2006) researched how providing education to individuals about their risks of colorectal cancer compared to similar others may influence how they perceive their risks of the disease. Lipkus and Klein (2006) hypothesized that the more individuals know about their actual risks, the less optimistic biases they will have. To study this, these researchers attained a sample of individuals from the ages of 50 to 75 and provided them with information regarding colorectal cancer risks. Levels of optimistic bias regarding colorectal cancer were measured before and after participants read risk information. After informing participants about high risks of colorectal cancer, Lipkus and Klein (2006) found that these individuals tended to reduce their original

optimistic bias. This study shows how knowledge about risks can affect levels of optimistic bias.

Education in job training has also been studied with the topic of optimistic bias. In a study on risk taking behavior measuring optimistic bias differences between sky-divers, firefighters and soldiers, Moen and Rundmo (2005) researched how volunteer risk taking (sky-diving) and dangerous occupations can affect levels of optimistic bias. Questionnaires for the three samples were geared toward possible injuries that are specific to each activity and occupation within each group. Skydivers reported that they are more unlikely than others to get hurt in a skydiving accident. On the other hand, firefighters believed that they are at as much risk for injury as others. Soldiers responded that their likelihood of injury was higher than others (Moen and Rundmo, 2005).

These researchers argued that education/training influences knowledge level, "and this in turn influences awareness of dangers" (Moen and Rundmo, 2005, p. 374). For example, soldiers and firefighters go through scenario training that educates these individuals of possible injuries and negative events that can happen in their occupation. As Moen and Rundmo (2005) explained, a firefighter can watch a fellow colleague become injured on the job and think "that could have been me" (p. 377). Just as soldiers train for combat, this education prepares these individuals for possible occupation consequences. This study suggested that more education should be implemented for skydivers to correct unrealistic optimism regarding their risk taking behavior. Moen and Rundmo (2005) suggested that "In the skydiving community, accidents are often a result of human error and not failure of the equipment or uncontrollable events. Skydivers do not think they will fail, and they do not take the necessary precautions to

avoid injury" (p. 377). Therefore, this study suggested that proper training and education for skydivers may help to reduce their unrealistic optimism.

Due to the fact that most research on optimistic bias and education focuses on knowledge of risks, this study explored how levels of education attained affects optimistic bias levels. As it pertains to hurricane risk, this study was interested to see if those who have a high school diploma differ from other education levels, such as a bachelor's degree.

2.3.5. Personal Experience & Event Frequency

Another factor tested in studies on this theory is personal experience. A woman who has lived through a hurricane with no injury and little damage to her home may be optimistic that she will be okay when the next hurricane hits. Conversely, experiencing a negative event can leave an individual less optimistic regarding that event. For example, a man may have always felt safe in his apartment and was optimistic enough to keep his windows open until he was robbed. After experiencing a burglary, this man always closes his windows realizing he is at more risk than he originally thought (Chapin and Coleman, 2009).

In their study about optimistic bias and crime, Chapin and Coleman (2009) hypothesized that optimistic bias will decrease as experience increases. Participants were asked about their first-hand experience with domestic violence as well as whether they knew someone who was a victim of this crime by answering five yes/no items. Results supported the hypothesis, revealing that, paired with beliefs about the prevalence of domestic violence in the community, first and second hand experience with domestic violence were strong predictors of an individual's risk perception (Chapin and Coleman,

2009). This study showed that when people assess their personal risk for an event, like a crime, they will recall their own beliefs and personal experience with that event (Chapin and Coleman, 2009).

Coinciding with personal experience is event frequency and as Price, Pentecost and Voth (2002) explained, results on event frequency vary. If an event is less frequent, individuals may carry an optimistic bias towards that event. Individuals do not see that event as a great risk to them because it hardly occurs. On the other hand, events that happen more often can make people more optimistic about their overall risk of that event, like living through more than one hurricane without physical injury or destruction of home. Another example of this comes from Chapin and Coleman (2009) when they explain about the risk of using a cell phone. It has been reported that using cell phones may cause brain tumors. Many have not seen harmful effects from using their cell phones. Experience using cell phones without developing brain tumors can cause individuals to remain optimistic that they can continue cell phones use without risk.

Campbell et al. (2007) researched how frequency and past experience moderates optimistic bias. These researchers extended studies on optimistic bias to technology use. Campbell et al. (2007) wanted to understand optimistic bias in relation to negative events on the internet, such as catching a computer virus, having personal information stolen, or harassment. These researchers wanted to study why individuals, regardless of general concerns for negative internet events, would continue risky online use (Campbell et al., 2007). In this study, risky online use included activities such as online shopping at unsecured Websites.

Campbell et al. (2007) examined the presence of optimistic bias in a sample of internet users. They found that individuals who frequently used the internet had significantly higher levels of optimistic bias than light users. Campbell et al. (2007) stated that "unrealistic optimism may explain why experienced internet users are willing to engage in risky behaviors despite their increased concern with online privacy and security" (p. 1281). Importantly, this result was also seen in Clarke et al. (1997) research on tanning behavior of women and optimistic bias.

Personal experience was also significantly correlated with optimistic bias in this study. Participants felt it less likely for a negative internet event to occur to them than an average other as personal experience with a negative event decreased. In other words, as found in Chapin and Coleman (2009), levels of optimistic bias are lowest in individuals who have experienced a particular negative event. Just as personal experience and event frequency can moderate an individual's level of optimistic bias pertaining to cell phone use, crime and internet use, it may also when it comes to hurricanes. Chapter three will explore hurricane risk and optimistic bias including the effects of covariates such as personal experience.

Chapter 3: Optimistic Bias and Hurricane Research

This chapter will review studies on risk perceptions of both natural disasters and hurricanes. First, it is important to understand how researchers have studied the concept of optimistic bias on the topic of natural disasters. Two studies on optimistic bias and earthquake risk are discussed. Next, this chapter will review characteristics that affect hurricane risk perception. These characteristics are; age, gender, household composition, type of housing, ownership of home, tenure and personal experience. These variables are discussed because they are analyzed as part of this study on optimistic bias. This study used this research combined with the above literature review on optimistic bias to identify research questions.

3.1. Natural Disasters and Optimistic Bias

Research on how optimistic bias affects natural disaster risk perception is scarce. Two studies were found which focused on optimistic bias and earthquakes. Spittal, McClure, Siegert and Walkey (2005) researched optimistic bias in relation to how people prepare for earthquakes. Results revealed that participants believed they adopted precautionary behaviors more often than their peers did and respondents judged themselves to be more prepared for a major earthquake than others in their town. These individuals also believed they were less likely to be injured in an earthquake than an acquaintance. What this study exhibits are the potential barriers that an unrealistic bias can have for a natural disaster. For example, if people do not believe they are subject to

injury during an earthquake, how will this affect their preparation activities? It is important for more research to be done on this subject so that risk communicators can properly develop the most effective messages to help avoid a public's tendency to have an unrealistic optimistic bias for natural disasters.

The second study on optimistic bias and natural disaster, by Helweg-Larsen (1999), was also conducted on optimistic bias and earthquake behavior. This study focused on the response to the 1994 Northridge Earthquake. Helweg-Larson (1999) concentrated on the role that personal experience played in moderating this bias. Background research has shown that those who experience a negative event are less optimistic about that event occurring in the future compared to people who have not experienced that event. Helweg-Larson (1999) hypothesized that experience will reduce an individual's perceived control over that event and reduce optimistic bias.

Participants in this study were asked questions about how they perceived risks after the 1994 Northridge earthquake. Among the findings, participants who did not experience injuries or did not know anyone who was injured because of the earthquake were more optimistic than those who had been injured. Helweg-Larson (1999) concluded that experience, especially direct experience with injury, lead to more realistic risk perceptions of that event.

In this study, Helweg-Larsen (1999) tested a time factor. When a person experiences a negative event and their optimism about that event lowers, does their level of optimistic bias increase after a period of time? When studying the Northridge earthquake, Helweg-Larsen (1999) found that optimistic bias perceptions about

earthquakes did not return 5 months after the earthquake. It is suggested that the time factor be tested with other studies on personal experiences and optimistic bias to see if there are certain characteristics of an event that will change whether an individual's optimistic bias returns after a period of time (Helweg-Larson, 1999).

These two studies are examples of how optimistic bias can be researched for natural disasters. Due to the scarce amount of research on this topic, this thesis extended optimistic bias research to hurricanes. This topic is important for scientists because the more that is known regarding how individuals perceive their risks during hurricane season, the better disaster management officials can educate and prepare publics.

3.2. Hurricane Risk Variables

In light of the inadequate amount of research on optimistic bias and hurricane risk perception, this research will review literature on risk perceptions of hurricanes. In order to study optimistic bias on the topic of hurricane risk, this research will focus on specific variables including, demographics, household composition, types of housing, homeownership, years spent living in an area (tenure) and personal experience. It is important to understand how these characteristics affect hurricane risk perception. Much of the research on hurricane risk perception is on the topic of evacuation behavior. These studies are important to this research because perceived risk is a significant predictor in evacuation behavior (Burnside et al., 2007). If an individual does not perceive a great risk from hurricanes, they are less likely to evacuate.

3.2.1. Demographics

Bateman and Edwards (2002) explained that when an individual is faced with the dangers of a disaster, they must first perceive what their risks are from this event. How a person perceives a hurricane risk depends on several characteristics. For example, an individual's age can explain how perceptions of risk are shaped (Donner and Rodriquez, 2008). Moen and Rundmo (2005) stated, "age was found to influence on whether a person assessed the likelihood of individual dangers or general danger as highest" (p. 378).

Findings on how age is associated with hurricane risk perceptions are inconsistent (Peacock et al., 2005). Peacock et al. (2005) studied the factors that contribute to hurricane risk perceptions of single-family homeowners in Florida. These researchers found age to have a negative effect and concluded that from their sample, older individuals had lower perceptions of hurricane risk.

Although Peacock et al. (2005) found age to have a negative effect; other studies have found age to have no significance on hurricane risk perception (Baker, 1991; Bateman and Edwards, 2002). Researchers have identified insignificant results in hurricane risk perceptions and age on the topics of both evacuation behavior and response to warning messages (Burnside et al., 2007). Other studies on age and hurricane risk perception have focused on elderly who suffer from illnesses and mobility restrictions that make them more vulnerable to risk than their younger counterparts (Baker, 1991). This has been a focus because in the United States, the population of those 65 and older is rapidly increasing and of those 65 and older, many live in coastal communities where they are at a high hurricane risk (Donner and Rodriquez, 2008). Although many older

individuals know they are at higher risks than others during a hurricane, many are still unable or unwilling to evacuate or seek shelter during storms. Population vulnerability, such as those who are 65 or older, and optimistic bias is an important topic that needs more research. It is important that researchers understand if an optimistic bias affects views of vulnerability and how this may affect hurricane risk perception.

Gender is a variable that has been studied extensively throughout risk perception research and especially in the context of natural disasters. Whether a study focused on natural disaster mitigation, preparedness, response or recovery, gender differences have important implications on hurricane risk perception. Literature has shown that women, more than men, will perceive more risks with disasters because men are prone to take more risks (Bateman and Edwards 2002).

Bateman and Edwards (2002) conducted a study on the likelihood that women are more likely to evacuate for hurricanes. These researchers hypothesized that women are more likely to evacuate than men because they have a higher perception of risk. Results supported this hypothesis and Bateman and Edwards (2002) reported that perceptions of risk and likelihood of evacuating during a hurricane reported by women depend on several factors. These researchers stated that women's perceptions of risk and evacuation behavior have to do with socially constructed gender differences. This includes gender roles in society, such as being a single mother, having a single source of income and being a caretaker.

In addition, more women reported living in mobile homes and therefore were less optimistic about the possibility that their home would be affected by flooding and wind damage during a hurricane. Peacock et al. (2005) stated that a common theme to explain

why women perceive higher risks of hurricanes is due to a lack of power and resources. Smith and McCarty (1996) further explained that women may have greater awareness of warnings because they have larger social networks and perceive disaster events as more serious than men. Women are known to talk with neighbors, friends and families in the community more so than men. This becomes important during hurricane evacuations. Researchers have found that the more an individual talks with other individuals who are evacuating from a hurricane the more likely that they will do the same. Smith and McCarty (1996) stated that these individuals are more likely to be less optimistic about risks from that disaster if they see that others perceive high risks.

When studying gender and risk perception it is important to note that although women are said to be more aware of their risks from a hurricane than men are, this does not mean they are able to avoid danger. For example, many women who are single-mothers and have a low income face complications during a hurricane, "a greater psychological sensitivity to risk means little if one lacks the cultural, social and economic capital to act on that sensation" (Donner and Rodriquez, 2008, p. 1102).

A demographic that can affect both women and men and their risk perception is education. Like age, research on how education affects hurricane risk perception has been inconsistent. Baker (1991) and Burnside et al. (2007) both found education attainment to have no affect on hurricane risk perception.

On the other hand, Peacock et al. (2005) stated that those with both low income and lower attained education have higher perceived risks of hurricanes because of their lack of power and resources. These researchers also explained that individuals who have higher educational degrees and/or knowledge about a natural disaster can also become

overconfident “and consider themselves and their households invulnerable” (Peacock, et al., 2005, p.123). In their study, Peacock et al. (2005) revealed that those with higher levels of education had lower perceived risks.

As seen in other demographic variables, the characteristic of level of education may make certain groups more vulnerable to risks from hurricanes and that affects their risk perceptions. Due to inconsistent research stating that both high and low education and/or knowledge can affect hurricane risk perception, more research should be done on how education and optimistic bias may be connected. This research explored education and its effects on optimistic bias as it pertains to hurricane risk to make further conclusions in this field.

3.2.2. Children and Household Composition

Another factor that is researched as a variable in how individuals perceive hurricane risk is the presence of children in a household. For example, being the caregiver to small children can increase an individual’s perceived perception of risk (Lindell et al., 2005). Many studies have tested the significance of whether having children in the household will affect evacuation behavior because of concerns for child safety. Lindell et al. (2005) found respondents with children at home were more likely to evacuate than stay in their homes during a hurricane.

Although Lindell et al. (2005) found children in household to affect hurricane risk perception, literature on this subject is relatively inconsistent. For example, Bateman and Edwards (2002) researched how single women respond to risks of hurricanes by whether they evacuate or not. Results revealed that the number of children in the household was not significantly related to evacuation. Baker (1991) also reviewed the effects of

presence of children in the home and found that this did not correlate to hurricane evacuation. Due to inconsistent results in past research, this thesis tested the significance of whether the presence of children in a household affected optimistic bias relative to hurricane risk.

3.2.3. Types of Housing

Hurricane risk perception can depend on the type of housing an individual lives in. Types of housing include single-family home, condos, apartment buildings or mobile homes. With each of these types of housing hurricanes present certain risks. For example, Baker (1991) explained that those living in mobile homes are more vulnerable to winds, debris, falling trees and other dangers from hurricanes. It is important to note that a high population of residents living in coastal regions live in mobile homes (Baker, 1991). Baker (1991) and Lindell et al. (2005) explained that mobile home owners are most likely to evacuate during hurricanes as they perceive themselves at greater risk. Less is known for risk perceptions of individuals living in other housing structures (Baker, 1991).

Smith and McCarty (1996) reported that individuals living in single-family units evacuated less than multifamily units. These evacuation results may reflect how optimistic individuals are regarding their house type safety. The expectation of damage, especially to a home, can adjust how an individual views their hurricane risk. Individuals may be unrealistically optimistic that their homes are well enough constructed to withstand water, wind and roof damage (Baker, 1979). In order to add important research to the theory of optimistic bias and hurricane risk, researchers must study not only mobile home owners but also those in apartments, condos and single-family units.

This research will help scientists understand if these housing structures can cause people to be more optimistic about their risks from hurricanes.

3.2.4. Own/Rent

Not only can a variety of housing types affect hurricane risk perception, but so can owning a home versus renting one. Homeownership makes individuals more concerned about protecting their homes (Smith and McCarty, 1996). Many homeowners feel it necessary to protect their homes from both physical damage and looters during hurricanes (Baker, 1991). To these individuals, the risk of a hurricane is not whether they will be safe, but the risk perceived is of having personal items damaged or taken from their home during a storm. Lindell et al. (2001) found that although respondents in their hurricane evacuation study reported that storm risk was the most important factor in their evacuation decision, looting risk was a close second. This study shows that protecting property is a very important factor in decisions made related to hurricane risk.

Studying whether owning or renting a home affects optimistic bias is important for risk perception education because it shows that individuals do not only perceive their risks from hurricanes as a danger to loss of life, but as a danger to loss of property and personal belongings. Past literature has stated that ownership of home affected decision making during a hurricane, therefore, this thesis tested if owning or renting a home affects an individual's level of optimistic bias in relation to hurricane risk.

3.2.5. Tenure/Hurricane Experience

In this study, tenure referred to how many years an individual has lived within 50 miles of his or her current home. Tenure has important implications for optimistic bias and hurricane risk perception. The number of years one lives in a hurricane prone area

affects personal experiences with hurricanes and knowledge of risks. For example, if you have lived within 50 miles of your home for over ten years and have survived three hurricanes, this may affect how optimistic you are towards the risks of hurricanes. As Mileti and Darlington (1997) described, "research has found experience to influence definitions of risk and public action since it elicits selective perception as new information is filtered to conform to personal history" (p. 92). Compared to someone who has lived in an area for a longer time, newcomers with little experience do not have the same risk reference and may be less optimistic regarding possible dangers.

Peacock et al. (2005) stated that experiencing hurricane damage is positively related to risk perception and that experience will differ between individuals. Personal experience and tenure may cause an individual to be more optimistic about their risks in a hurricane because the last experience they had produced no physical or personal injury. For example, some individuals may have lived through five non-direct hurricanes while another individual may have lived through one direct hit category three hurricane. Peacock et al. (2005) found that some Florida residents who live farther away from the coast are more likely to experience a miss than a direct hit from a hurricane versus someone closer to the coast.

Baker (1991) stated that individuals new to a hurricane prone area may be more likely to evacuate during a hurricane than individuals who have lived in that area for a longer period of time. Individuals who have never experienced a direct hit may not perceive the risk of a hurricane as dangerous. This scenario has been described as the false experience (Baker, 1991). The opposite may also be true, residents who have lived in an area longer may understand hurricane risk better. In research about risk perceptions

of tropical cyclones, tenure was found to influence risk perception. This study reported that short-term residents were less aware of the effects of cyclone risks versus long-term residents with more experience (Li, 2009). Long-term residents showed to have more accurate perceptions of wind and storm damage as well as safety risks (Li, 2009).

As stated in literature on optimistic bias, experiencing an event and suffering negative consequences may lower an individual's optimistic bias towards that event. Kalkstein and Sheridan (2007) stated that personal experience with a disaster "tends to reduce apathy, indifference, wishful thinking and denial" (p. 44). It is also important to note the opposite can also be true if no harmful effects are suffered from that event.

Baker (1979) clarified some limitations to personal experience and tenure. For example, Baker explained that measuring an individual's previous hurricane experience is a difficult task because the measurement depends on both the memory and beliefs of the event. At the same time, it is important to note that tenure and personal experience will carry different implications in risk perception according to the individual. For example, a woman may have moved to New Orleans in 2004 and experienced Katrina a year later. Although this woman only lived in New Orleans for one year, she is as capable of understanding hurricane risk the same as other residents who have lived in the same area for 10 to 20 years. More research should concentrate on how tenure and personal experience can affect optimistic bias on hurricane risk.

The above literature reviews hurricane risk covariates within the scope of this study: demographics, household composition, past experience, tenure and types of housing. These are used as variables in this study in order to analyze how they affect optimistic bias within the scope of hurricane risk.

3.3. Overview

This review has mentioned important covariates of optimistic bias that are more significant to this thesis and more likely than others to affect hurricane risk perception. It is important to note that many other covariates have been tested and have been shown to affect an individual's optimistic bias. Not included in this review, but equally important are optimistic bias covariates such as stigma, stereotypes, depressed mood, race and personal beliefs. These covariates were not used in this study because they were not measured in the survey used for this secondary analysis.

The importance of using optimistic bias in research relates to detecting and eliminating risk misperceptions in unrealistic optimists. A risk misperception has important implications, for example, an individual's bias of his or her chance of suffering from cancer may affect whether that person believes they need to participate in preventive screenings. Research on optimistic bias can help to create risk communication messages that can help change these misperceptions. Individuals may misperceive the risks of hurricanes and having an optimistic bias may be at the root for this misperception. As Robb et al. (2004) stated in their study, "health professionals should not assume that individuals have an accurate perception of their risk for disease" (p. 24). With this said, neither should local disaster management organizations assume a population understands the risks of hurricanes

Chapter 4: Research Questions

Literature is scarce on the subject of optimistic bias and hurricane risk, therefore this study explored this topic further. The following research questions were examined individually as well as collectively in their relationship to optimistic bias. These questions were based on the above literature review on optimistic bias and risk perceptions of hurricanes. It is hoped that these questions add to existing research on optimistic bias and provide new information on how this concept pertains to hurricane risk perceptions.

Dispositional Optimism in relation to optimistic bias was analyzed because of the scarce amount of research related to this subject. Age has been a variable in optimistic bias studies yielding inconsistent results, therefore this study further reviewed how this variable affected levels of optimistic bias pertaining to hurricane risk. Besides age and dispositional optimism, education was also analyzed to extend literature on optimistic bias. Although there have been several studies on how knowledge of risk can affect an individual's level of optimistic bias, more studies need to look at how levels of educational attainment may affect this concept. Results from dispositional optimism, age and education research on optimistic bias can help natural disaster managers understand if certain psychological outlooks, age groups or different levels of education attainment need to be targeted for hurricane risk education programs.

The following research questions explored the covariates of tenure (how many years an individual has lived within 50 miles of current home), home ownership and housing, number of children in home and past hurricane experience. These covariates were researched specifically because they have been known to have significant results in past studies. Due to their significance, it is important to extend these variables in research on optimistic bias. Based on the above rationale, this study asked the following eight research questions about optimistic bias in relation to hurricane risk:

1. Is optimistic bias associated with dispositional optimism?
2. Is optimistic bias associated with age?
3. Does optimistic bias vary across levels of educational attainment?
4. Is optimistic bias associated with past hurricane experience?
5. Does optimistic bias vary by home ownership and housing?
6. Is optimistic bias associated with the number of children in the home?
7. Is optimistic bias associated with the number of years an individual has lived in the area?
8. How well does this set of independent variables collectively predict optimistic bias?

Chapter 5 Methods: Secondary Analysis

This thesis analyzed the above research questions through a secondary analysis. This study used data from a mail survey that focused on hurricane risk perception and optimistic bias (Trumbo, 2007). Originally, the survey studied the effects of Hurricanes Katrina and Rita, concentrating on hazard proximity.

5.1. Data Collection

On January 12, 2006, the survey was mailed to households living in 41 counties along the Gulf Coast. The area included a 70-mile stretch of land from western Florida, eastern Alabama and in Texas, from Galveston west (Trumbo, 2007). This area is home to seven million people, equaling 300 persons per square mile (Trumbo, 2007). Importantly, this stretch of coastland has a maximum hurricane risk. Excluded from the sample were the areas of destruction from Hurricanes Katrina and Rita, for example New Orleans. This area was excluded because of the massive destruction from these hurricanes in 2005 and the anticipated sensitivity to the survey subject.

The University of Wisconsin Survey Center carried out the survey, which included an advance phone call, a $5 incentive and follow-up mailings (Trumbo, 2007). Instructions explained that any adult member in the household could complete the survey. A stratified sample was used to improve the spatial distribution of cases within the selected counties (Trumbo, 2007). This was chosen because a simple random sample of

the areas tended not to be spatially random, but weighted heavier according to population centers.

The survey center collected a sample of 1,375 households from 41 coastal counties, within these counties between two and five zip codes were randomly selected. This data totaled to 141 zip codes, within each of these zip codes, anywhere between eight and 20 households were randomly selected. The number of households selected depended on the number of zip codes per county with a goal of selecting thirty households per county. In this survey, the total averages were 34 households per county with 10 households per zip code.

This study used criteria from the American Association for Public Opinion Research (AAPOR) for response rate calculation. The AAPOR calculation equals completed returns divided by sample points subtracted by non-sample cases (AAPOR, 2009). The total amount collected was 843 returned surveys, an adjusted response rate of 61.5%. Some returned surveys were eliminated because the participant was deceased, was not an eligible adult or because the individual did not live within the defined study area. Eliminations also included nine returns which no longer had a tracking code, an important part of the original study. After eliminations, the final collection consisted of 824 surveys with a 60% response rate (Trumbo, 2007).

5.2. Measurement

The survey (see Appendix I) was written to measure several variables including optimistic bias and dispositional optimism. Optimistic bias was measured by the calculated difference between two probability self-other questions regarding hurricane

evacuation. These questions were arranged separately in the survey to avoid measurement bias.

> "For the average individual living on the Gulf Coast, what would you estimate the chances are (from 0 to 100%) that he or she will be forced to evacuate from a major hurricane during the next hurricane season?"
>
> "What would you estimate the chances are (from 0% to 100%) that you will be forced to evacuate from a major hurricane during next hurricane season?"

To measure dispositional optimism the survey included questions from the "Life Orientation Test-Revised (LOT-R, Scheier, 1994)." Participants were asked about their overall outlook on whether they, from a scale 1-5, "agree a lot" or "disagree a lot" with the following statements:

> "In uncertain times, I usually expect the best."
> "It's easy for me to relax."
> "If something can go wrong for me, it will."
> "I'm always optimistic about my future."
> "I enjoy my friends a lot."
> "It's important for me to keep busy."
> "I hardly ever expect things to go my way."
> "I don't get upset too easily."
> "I rarely count on good things happening to me."
> "Overall, I expect more good things to happen to me than bad."

Before rating their answers to the above 10 statements, respondents were instructed to try to not let one response of a statement influence their response to another. Participants were also told that there were no "correct" or "incorrect" answers and that they should not answer based on how they think "most people" would answer, but based on their own feelings.

The survey also asked participants three open-ended questions to measure hurricane experience. The sum of these questions were used for the hurricane experience variable:

"How many hurricanes have you been in?"
"How many times have you evacuated from a hurricane?"
"How many times have you had property damage from a hurricane"

Other questions in this survey covered participants' demographics. Participants were asked what year they were born and whether they were male or female. Race was asked by having respondents check whether they considered themselves to be White, American Indian, Native Hawaiian or other Pacific Islander, Black or African American or Asian. In a separate question, respondents were also asked if they consider themselves to be Hispanic or Latino.

Several housing composition questions were included on the survey. Participants were asked what type of housing they were currently living (owned single family, rented single family, condo, apartment building, mobile home or other).

To measure tenure, participants answered how many years they have lived within 50 miles of their current home. Respondents also answered how many adults (18 or older) and non-adults (under 18) were currently living in their household. The sum of these two questions made up the household size variable.

To measure income respondents were given a choice from less than $10,000 to greater than $80,000 in $10,000 increments. Education was assessed by having respondents check the highest level of education they have completed. They were given

the choices from less than high school to having a doctorate, medical, law or similar degree.

Using respondents' answers to this survey, this research will analyze and describe characteristics of the sample as well as investigate the significance of optimistic bias as it pertains to hurricane risk.

Chapter 6: Analysis

Using 824 survey responses, this study analyzed how various characteristics affected the dependent variable of optimistic bias. Independent variables were chosen based on the eight research questions and inconsistent findings from past literature on optimistic bias. The goal of this analysis was to add to literature on optimistic bias and analyze what new information this study could provide.

6.1. Descriptive

Descriptive analysis was done by computing frequencies of all variables; gender, age, income, education, household size, number of children per household, tenure, owners versus renters, hurricane experience and dispositional optimism. Although race was measured within the survey there was a lack of variance in the sample as 95% of the sample was white and 12% was Hispanic, therefore race was not analyzed.

6.2. T-test

After analyzing the sample characteristics, means were compared using t-tests at a 95% confidence level. T-tests analyzed the relationship between optimistic bias and gender as well as with optimistic bias and owners versus renters.

6.3. One-Way Analysis of Variance

This analysis used one-way ANOVA tests on education and three housing variables. Housing 1 compared types of housing with optimistic bias. The types of housing included owned and rented single family homes, condo, apartment buildings,

mobile homes and other. The housing 2 variable compared a structure to a mobile home. A structure was configured in the analysis as all types of housing from housing 1 variable excluding mobile homes. The final ANOVA test compared a homeownership variable (owned structure, rented structure and mobile home) with optimistic bias.

6.4. Correlation

In order to show degree of association between optimistic bias and several independent variables a correlation test was used in the analysis. Variables used in this test were optimistic bias, age, household income, tenure, number of children in household, household size, hurricane experience additive and dispositional optimism. Two-tailed significant levels of $p < .05$ were used to analyze results.

6.5. Linear Regression

Linear Regression was used to analyze the dependent variable optimistic bias with dispositional optimism, hurricane experience, gender, age, income, education, children in the household, tenure and housing 2.

Chapter 7: Results

The following describes results from the data analysis. Beginning with a discussion on the descriptive elements of the sample and followed by a bi-variate and multi-variate analysis. Bi-variate tests are organized by research question in order to highlight important results from the study. Multi-variate tests are summarized according to the model predictions.

7.1. Descriptive Analysis

Of the 824 survey respondents there were slightly more males (53.8%) than females (46.2%). The average age of participants was 59 years (SD 15.4). The youngest reported age was 22 years (two people) and the oldest reported as was 97 years (one person.) Figure 1 below demonstrates the sample's distribution of age.

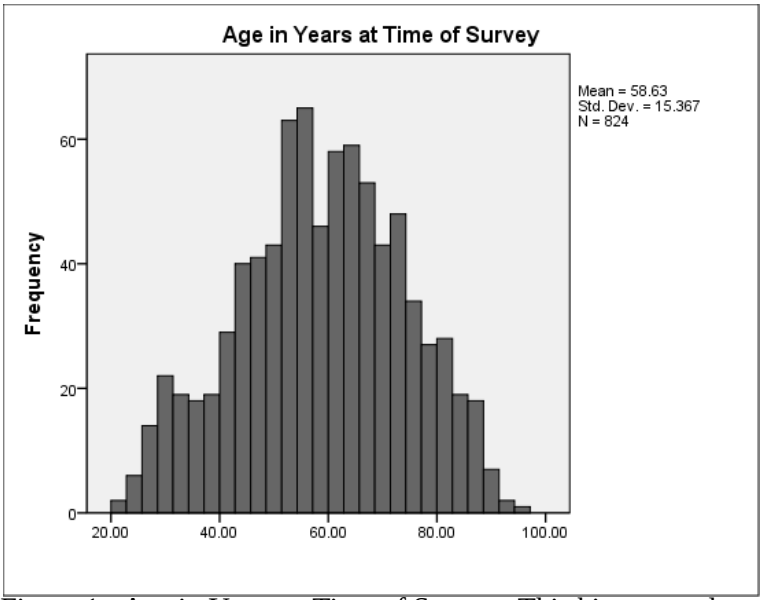


Figure 1. Age in Years at Time of Survey. This histogram demonstrates the distribution of age in the sample.

Figure 2 describes the annual household income. The sample's mode income was $40,000 to $49,000.

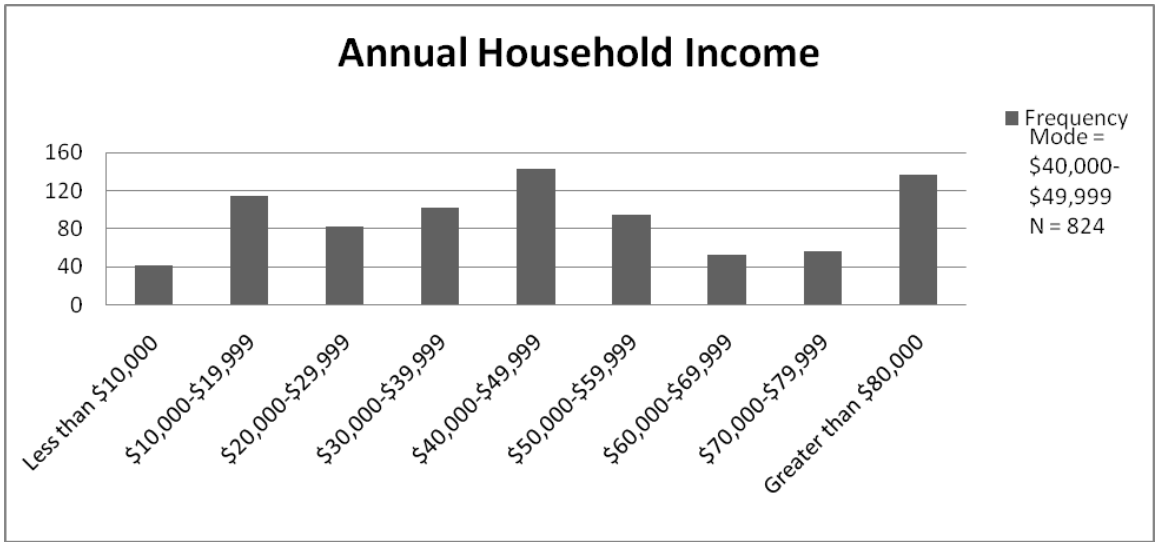


Figure 2. Annual Household Income. This bar graph demonstrates the frequency and percent of annual household income obtained from the sample.

Most of the sample (28%) had some college or technical school education. The second highest education level from the sample was high school graduates who accounted for 27%. Only 2.7% of the sample had a doctorate, medical, law or similar degree. Figure 3 shows participants' education levels.

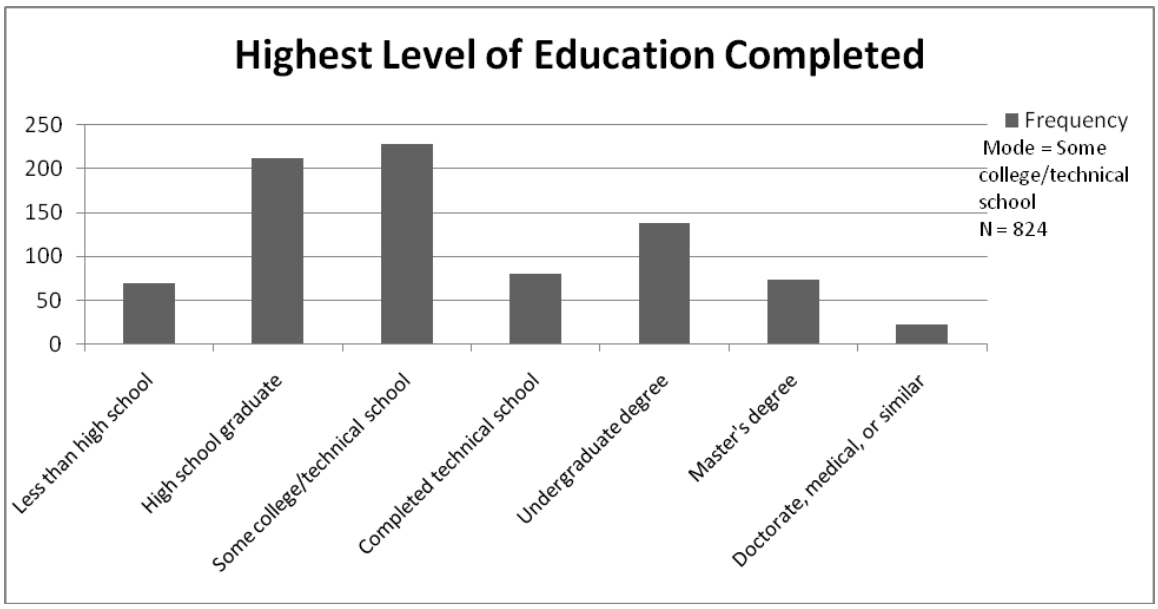


Figure 3. Highest Level of Education Completed. This bar graph demonstrates the frequency and percent of education levels obtained from the sample.

Type of housing was measured across six categories. Most of the respondents at the time of the survey owned a single family home (67%). The second highest percentage in the sample was those who lived in mobile homes at 18%. Of the entire sample, 82% lived in a structure (types of housing excluding mobile home) and more participants owned their homes (67%) than rented (33%). Table 1 demonstrates the frequencies and percentage of six types of housing in the sample.

Table 1
Types of Housing

Type of Housing	Frequency	%
Owned Single Family	551	66.9
Rented Single Family	40	4.9
Condo	36	4.4
Apartment Building	25	3.0
Mobile Home	146	17.7
Other	26	3.2
Total	824	100%

The average household size (number of adults plus number of children) was 2.4 (SD 1.3) with 44% of the sample having 2 persons per household. These households have a mean of .5 children (SD .93) with 72% of household having no children. Table 2 shows the total number and percentages of children.

Table 2
Number of Children in Household

Number of Non Adults	Frequency	%
0	594	72.1
1	112	13.6
2	76	9.2
3	26	3.2
4+	16	1.9
Total	824	100%

The mean number of years that individuals have lived within 50 miles of their home was 25 (SD 20). Tenure within the sample was spread out across the spectrum. Ten people had a tenure of 1 year while 1 respondent had a tenure of 86 years, which was the longest reported number of years an individual has lived within 50 miles of their current home. Figure 4 demonstrates the tenure (years lived within 50 miles of current home) distribution.

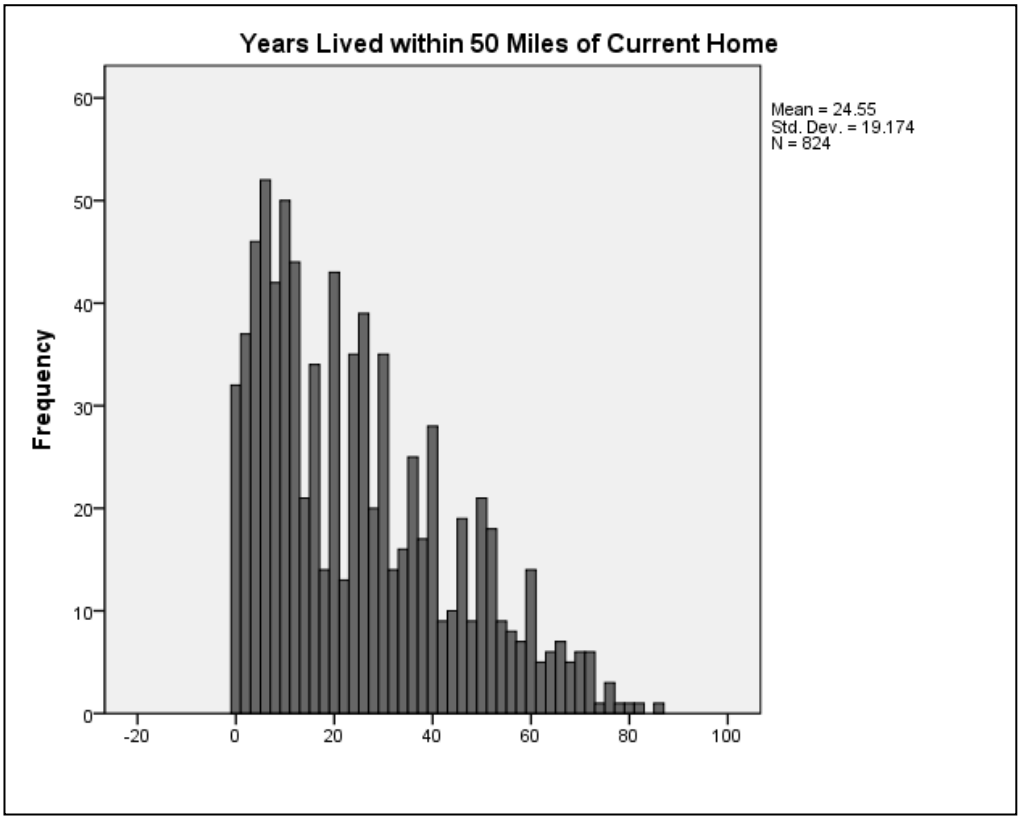


Figure 4. Years Lived within 50 Miles of Current Home (Tenure). This histogram demonstrates the tenure distribution.

Hurricane experience was measured by the sum of three survey questions (number of hurricanes a person has been in, how many times a person has evacuated and how many times property has been damaged from a hurricane). The average number of hurricanes within the sample was 4.3 (SD 3.2). The average number of times individuals evacuated was 1.5 (SD 1.9) and the average time that property had been damaged from a hurricane was 1.3 (1.7). The average hurricane experience additive score was 7 (SD 5).

When estimating the probability of evacuation, participants rated the likelihood that an average Gulf Coast resident will be forced to evacuate next hurricane season at 48% (SD 27). Participants rated their own chances of being forced to evacuate next hurricane season at an average probability of 53% (SD 29%). It is important to note that

the fact that probability of evacuating averaged around the 50% range for both questions was probably due to the indirect measurement method and tendency for respondents to answer with 50%. In addition, missing values (others n=21, self n=3) were replaced with the mode of 50 (Trumbo, 2007).

To measure optimistic bias of the sample, the score of the average person was subtracted from the individual score. Positive values indicated an optimistic bias. The relative optimism of the sample has a mean of 5 (SD 24). These results show that on average, participants had an optimistic bias. Figure 5 shows the total sample's optimistic bias distribution.

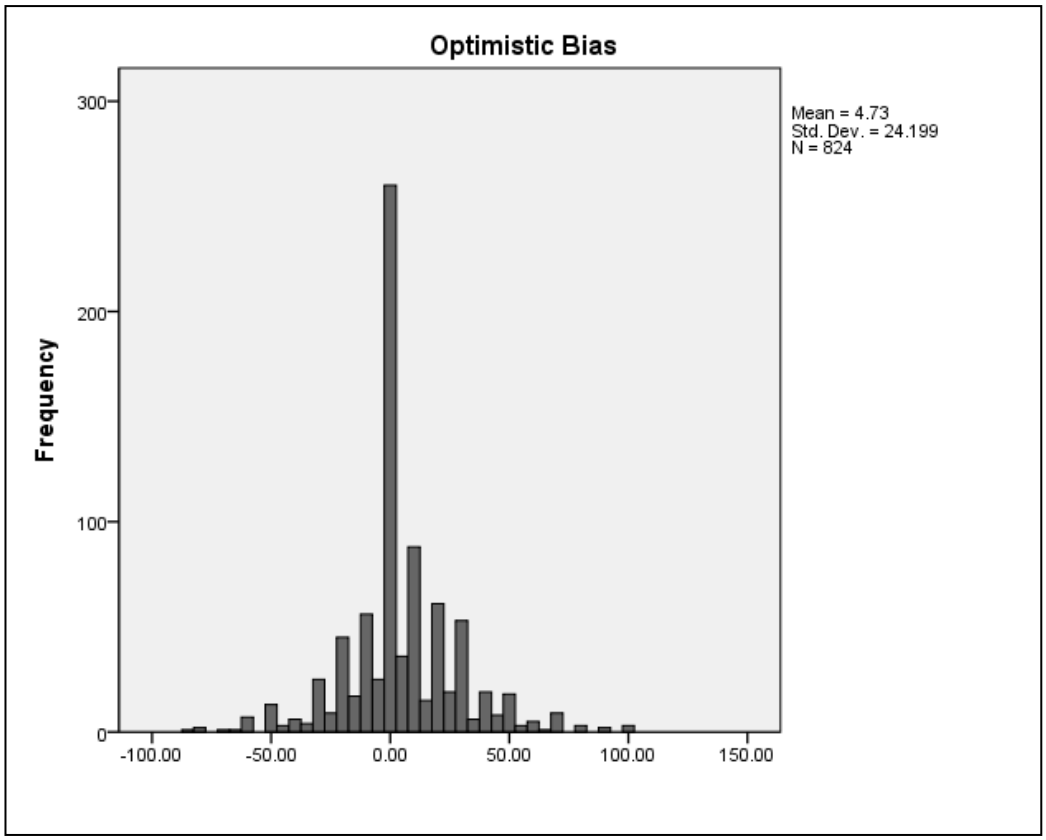


Figure 5. Optimistic Bias. This bar chart shows the sample's optimisitic bias distribution.

Dispositional optimism was also measured within the sample. This measurement shows whether people carry overall optimistic or pessimistic outlooks in their lives. In summary statements which related to an individual as having an overall optimistic outlook of life. For example, statements such as:

"In uncertain times I expect the best."

"It is easy for me to relax."

"I'm always optimistic about the future"

"I enjoy my friends a lot."

had the highest frequencies for "agree a lot" and "agree a little." Smallest frequencies were found in the disagree options. The dispositional optimism additive mean was 23 (SD 5) with Cronbach's alpha at .76. A mean of 23 indicates that on average, the sample was optimistic. Figure 6 shows this distribution.

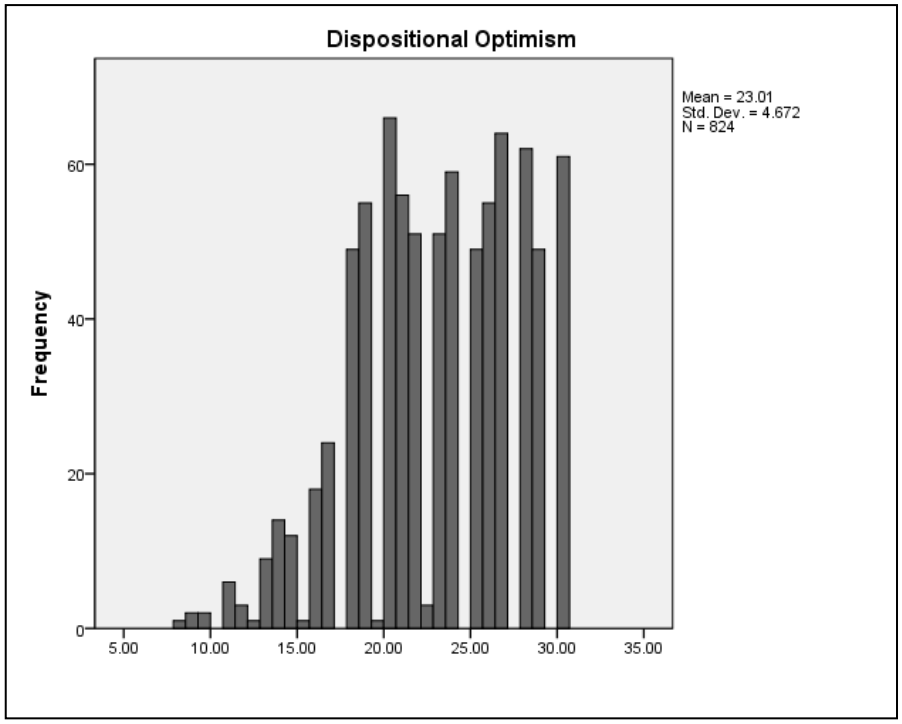


Figure 6. Dispositional Optimism. This bar graph demonstrates the distribution of dispositional optimism within the sample.

7.2. Bi-Variate Analysis

This bi-variate analysis will describe research results between specific independent variables and optimistic bias organized according to research question.

RQ1) Is optimistic bias associated with dispositional optimism?

The correlation test showed that dispositional optimism is significantly associated with optimistic bias and has a positive relationship. Table 3 shows the Pearson correlation coefficient calculated for the relationship between optimistic bias and dispositional optimism (r = .12). Table 4 shows a p-value of .001. These results show that the more optimistic individuals were over all, the higher levels of optimistic bias they had.

Table 3

Correlation Matrix

Measure	1	2	3	4	5	6	7	8
1. Optimistic Bias	-----							
2. Age	-.16**	-----						
3. Income	.11**	-.20**	-----					
4. Tenure	.08*	.17**	-.06	-----				
5. Children	.01	-.50**	.09*	-.07	-----			
6. Household Size	.02	-.49**	.19**	-.05	.85**	-----		
7. Hurricane Experience	.01	-.10**	.00	.22**	.07	.08*	-----	
8. Dispositional Optimism	.12**	-.03	.27**	.02	-.03	-.01	.05	-----

** Correlations is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4 lists correlation significance levels as well as Pearson correlation.

Table 4
Correlations With Optimistic Bias

Variable	Significance	*r*
Age	.003	-.16**
Income	.002	.11**
Tenure	.019	.08*
Non Adults in Household	.806	.01
Household Size	.609	.02
Hurricane Experience	.835	.01
Dispositional Optimism	.001	.12**

** Correlations is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

RQ 2) Is Optimistic Bias associated with Age?

Table 4 displays correlation results showing that age did have significant results with optimistic bias pertaining to hurricane risk (p = .003). Table 3 and Table 4 show the Pearson correlation coefficient calculated for the relationship between optimistic bias and subjects' age (r = -.11). This is a negative relationship, revealing that the younger an individual is, the higher optimistic bias they have.

R3) Does optimistic bias vary across levels of educational attainment?

The computed one-way ANOVA test showed optimistic bias to vary across levels of education at a significance level of .004 (F = 3.2). ANOVA results indicate that at least two of the means are different. Individuals who attained an undergraduate degree were more optimistically biased than those with lower levels of education. The only group mean which was not optimistic on average were those with less than a high school education, while those who completed an undergraduate degree had the highest levels of

optimistic bias. It is interesting to note that those with higher degrees have about the same optimistic bias levels as those with lower attained education levels. Figure 7 displays the education error-bar chart.

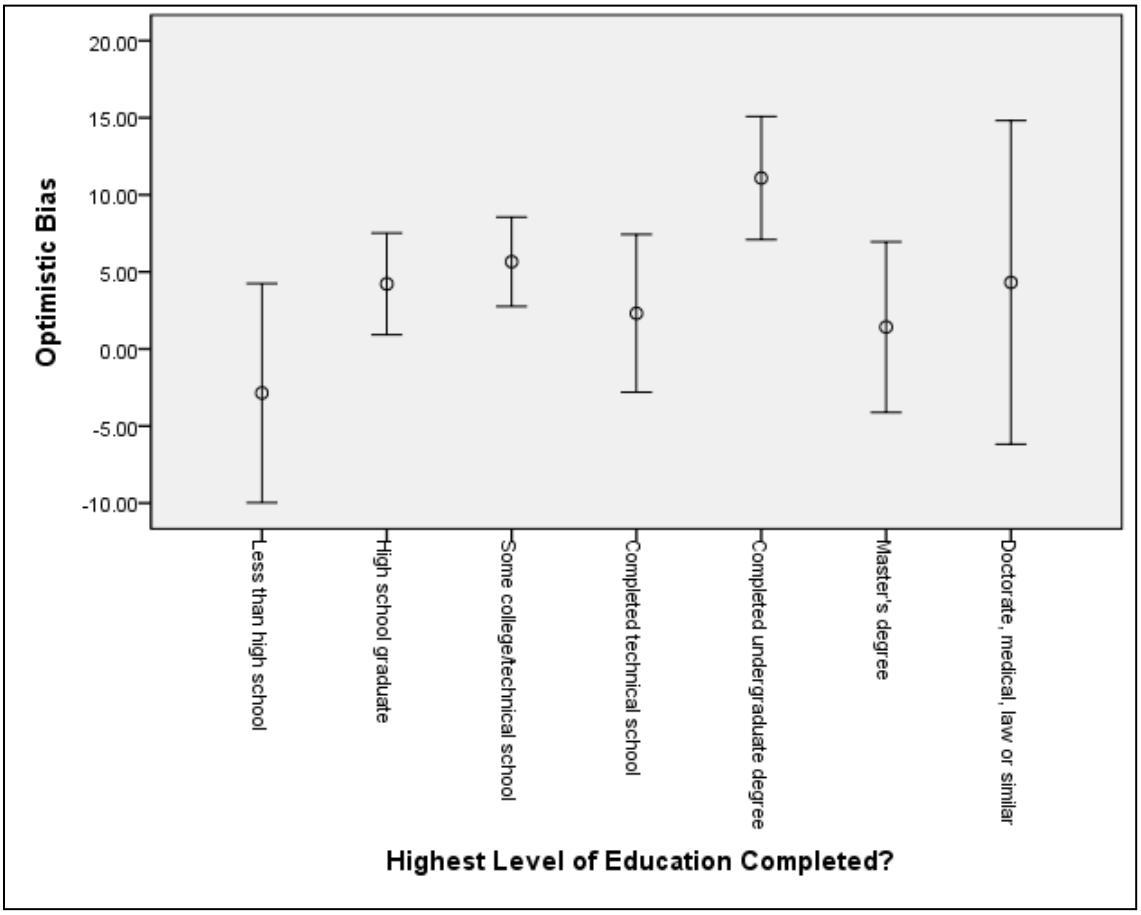


Figure 7. Highest Level of Education Completed Error-Bar Chart. This chart demonstrates that those with less than a high school degree had lower levels of optimistic bias levels.

R4) Is optimistic bias associated with past hurricane experience?

As previously explained, hurricane experience was measured by finding the sum of three questions, the amount of experienced hurricanes, the amount of times an individual has evacuated and how many times an individual had property damage from a hurricane. Results revealed that hurricane experience was not a significant factor on an

individual's level of optimistic bias. There were no significant correlation relationships (p = .835, *r* = .01) (Table 4).

R5) Does optimistic bias vary by home ownership and housing?

Levels of optimistic bias did not significantly differ whether an individual rented or owned their home with a t-test p-value of .085 (t = -1.72). Table 5 shows the t-test results for owners versus renters.

Table 5
Independent T-test: Rent/Own

Optimistic Bias	Rent/Own	N	Mean	t	Df	Significance
High Values individual feels own odds better than average	Rent	272	2.6654	-1.724	822	.085
	Own	552	5.7518			

95% Confidence Interval, p > .05

One-way ANOVA for the homeownership variable with optimistic bias also did not provide significant results (p = .199, F = 1.620). The one-way ANOVA tests, housing 1, which compared types of housing with optimistic bias, had no significant difference (p =.163, F = 1.582). The kind of housing individuals lived in had no significant relationship with levels of optimistic bias. The calculated ANOVA test of Housing 2 with optimistic bias produced a p = .544 (F = .368). There was no significant relationship between living in a well-constructed structure versus a mobile home and optimistic bias.

R6) Is optimistic bias associated with number of children in the home?

In reviewing how having children in the household may affect an adult's level of optimistic bias regarding hurricane risk no significant results were found. The correlation test calculated a significance level of p = .806 with *r* =.01 (table 4). It is important to note that the average number of children within the sample was .5. More studies should be done to investigate this question further, which has a sample with a higher average number of children in to see how this may change how optimistic adults are about their hurricane risk.

R7) Is optimistic bias associated with the number of years an individual has lived in an area (tenure)?

Results showed tenure to have a significant positive relationship with optimistic bias in relation to hurricane risk. The correlation test (table 4) had a tenure (p = .019, *r* =.08). The test showed that the longer an individual has lived within 50 miles of his or her current the home, the higher levels of optimistic bias he or she had.

R8) How well does this set of independent variables collectively predict optimistic bias?

The question will be discussed in the multi-variate analysis, section 7.3.

7.2.1. Additional Results

In the process of investigating the above research questions, this analysis produced additional information on the theory of optimistic bias. Yearly income showed significant results in the correlation test (p =.002, *r* = .11) (table 4). The more money individuals earned in a year the greater levels of optimistic bias they had. On the other hand, the relationship between household size (adults plus kids) and optimistic bias (table 4) was not significant (p =.609, *r* = .02).

Gender is a topic that has been studied to an extent in hurricane risk and optimistic bias. Table 6 shows the gender t-test results, which did not have a significant p value. This result explains that being either female or male did not affect levels of optimistic bias. Table 6 shows t-test results for gender.

Table 6

Independent t-test Gender

Optimistic Bias	Gender	N	Mean	t	Df	Significance
High Values individual feels own odds better than average	Female	381	4.8294	0.106	822	0.916
	Male	443	4.6501			

95% Confidence Interval, p > .05

7.3. Multi-Variate Analysis

The following analysis consists of linear regression results pertaining to the research questions. Table 7 shows the linear regression steps with change in R-squares, p-values and adjusted R-square.

Table 7
Regression on Optimistic Bias (coefficients from saturated model, n = 824)

Independent Variables	**β**	**t**	**p**	**ΔR^2**	**p**
Dispositional Optimism	.12	3.4	.001	.014	.001
Dispositional Optimism	.12	3.4	.001		
Hurricane Experience	.00	.04	.966	.000	.966
Dispositional Optimism	.10	2.6	.008		
Hurricane Experience	-.01	-.19	.847		
Sex	-.01	-.25	.799		
Age	-.09	-2.5	.013		
Household Income	.07	1.6	.107		
Education	.01	.24	.814	.014	.017
Dispositional Optimism	.10	2.5	.013		
Hurricane Experience	-.03	-.93	.350		
Sex	-.01	-.19	.847		
Age	-.14	-3.3	.001		
Income	.06	1.5	.132		
Education	.03	.68	.494		
Children	-.05	-1.3	.186		
Tenure	.12	3.1	.002	.014	.003
Dispositional Optimism	.09	2.5	.012		
Hurricane Experience	-.04	-.98	.334		
Sex	-.01	-.17	.863		
Age	-.14	-3.3	.001		
Income	.07	1.6	.107		
Education	.03	.77	.445		
Children	-.05	-1.3	.187		
Tenure	.12	3.2	.001		
Housing 2	.03	0.7	.489	.001	.489
			Adj. $\mathbf{R^2}$	.032	.000

RQ8) How well does this set of independent variables collectively predict optimistic bias?

Observed in the linear regression test is that dispositional optimism, tenure and age continued to be significant in relation to optimistic bias as they were in the correlation test. Although income was significant in correlation, linear regression shows that the effect of income on optimistic bias is insignificant when accounting for other variables.

Observed in Table 7 are the significant changes of R-squared in each block. Dispositional optimism by itself had significance in predicting optimistic bias, but when hurricane experience is added into the mix, this drops the predictive value. On its own, dispositional optimism is significant at .001 (β = .12) with an overall change in R-squared of .014 (p = .001). The addition of Hurricane Experience (p = .966, β =.00) does not increase R-squared (ΔR^2 = .00, p = .966).

As seen in the third regression block (Table 7), the change in R-squared is .014 (p = .017) with the addition of demographics. Age was the only significant variable. Other variables in this block were sex, income and education. Dispositional optimism (p = .008, β = .10) and age (p = .013, β = -.09) were the only variables to increase prediction of optimistic bias. Shown in Table 7, the rest of the variables have no effect.

In block four of the regression, number of children in the household and tenure were added. Age and dispositional optimism remained significant when accounting for these additional variables. Although children had no effect (p = .186, β = -.05), tenure showed significance (p = .002, β = .12). Adding tenure into this block increased R-squared by .014 (p = .003).

The last added variable (block 5) was housing 2 ($p = .489$, $\beta = .03$). Adding this variable showed that as a group, these components did not affect the prediction of optimistic bias, increasing R-square by only .001 with a p-value of .489. Observed adjusted R-square for the total model was 3.2% ($p = .000$).

The explained variance is very low. In light of this, order of variables within the blocks were rearranged. In two additional linear regression tests, adjusted R-square remained at 3.2% despite change in order. Order of hurricane experience, mobile home, age and tenure was concentrated on in both the retests. Dispositional optimism, tenure and age remained as the significant variables independently adding to the prediction of optimistic bias. Each block's change of R-squares reflected this.

These results further supported the bi-variate analysis, except with the additional result of income being significant in the correlation test. The linear regression test showed income as insignificant when other variables were taken into account and that it did not independently add to a prediction of optimistic bias.

In relation to research question one, the linear regression test continued to show that dispositional optimism was positively associated with optimistic bias. Research question two, asked if optimistic bias was associated with age. Results from the regression test further supported that age has a significant negative association.

Although the one-way ANOVA showed that those with lower levels of education had lower levels of optimistic bias, the regression test showed education to have no affect when other variables were added. This information adds to the analysis of research question three, which asks if optimistic bias varies across levels of education attainment. As it does vary across levels of education, regression testing shows that this can be

insignificant when accounting for other variables. In the bi-variate analysis, research questions four and six were further supported by linear regression. As a whole, results showed that hurricane experience and the number of children in the home were insignificantly associated with optimistic bias and did not independently predict optimistic bias.

In conclusion, the bi-varaite and multi-variate analysis may help social science researchers better understand optimistic bias in relation to hurricane risk. The meanings of these results will further be discussed, including expanding on research question 8. Included in this discussion will be the fact that correlations tended to be weak and explained variance was low. Explanations and suggestions for future research on this topic will be analyzed in Chapter 8.

Chapter 8: Discussion

Results from this study revealed that the sample from the Gulf Coast demonstrated an overall optimistic bias regarding their hurricane risk. Weinstein, Klotz and Sandman (1989) explain this result by stating that people tend to underestimate the seriousness of natural disasters. This is especially true because when it comes to a hurricane, an earthquake, a tornado or other natural hazards, there is no human or as Weinstein et al. (1989) describe, no villain to blame. In order to further analyze why individuals carry optimistic bias towards their hurricane risk, this discussion will describe the potential influence certain variables had on levels of optimistic bias in relations to hurricanes.

Research question one addressed the association of optimistic bias and dispositional optimism. This positive relationship, which was significant in both correlation and regression testing, may not be surprising. A person who is generally optimistic about life and its events will likely have more optimistic bias as it pertains to hurricane risk. This is important for natural disaster managers who want to understand how individuals perceive risks of hurricanes. What this may lead to is a conclusion that when addressing hurricane risk, optimistic people carry an optimistic bias towards their hurricane risk as a way to cope with a potential anxiety ridden situation.

When studying the correlation test, besides optimistic bias, only one other variable had a significant association with dispositional optimism. Income had a positive

relationship showing that individuals in the sample who had a higher average income per year also had higher levels of dispositional optimism. Income later became ruled out as a predictor of optimistic bias during the regression test, but in speculation this may not omit its influence on optimistic bias. Having a higher income makes people generally more optimistic about life (according to this study) and having a higher dispositional optimism was shown as an important factor predicting individuals to have higher optimistic bias levels pertaining to their hurricane risk. This may not only be explained by the possibility that having more money makes people more optimistic about their present and future, but pertaining to hurricane risk, having more money may make people more comfortable during hurricane season.

Having a higher income increases dispositional optimism and in return increases the prediction of optimistic bias in relation to hurricane risk because those who make more money may have more of a "buffer" or safe income. Fothergill and Peek (2004) stated that preparedness increases with income levels. Preparedness helps individuals and families protect their home from physical damage as well as prepare them for evacuations and the associated costs. Those with higher incomes are able to absorb accumulative costs that occur during a hurricane and can afford better temporary housing during recovery stages. On the other hand, individuals and families who live pay-check-to-pay-check many not be able to afford fees associated with evacuation. These fees include shelter, food, water and transportation to name a few.

Low-income families are more vulnerable during hurricane season because hurricanes will not affect all individuals equally (Fothergill and Peek, 2004). Having a low income affects all disaster experiences from risk perception to post-disaster

reconstruction. Those living on low incomes suffer the greatest threats during natural disasters because of limited access to public and private recovery aspects (Fothergill and Peek, 2004). Low-income households often have a lack of access to resources, less insurance and less savings (Fothergill and Peek, 2004).

Individuals who earn a low income have also been known to be more stressed about losing their jobs due to a disaster (Fothergill and Peek, 2004). Those with higher incomes and on a salary found it easier to collect paychecks during and after crises versus those in low paying jobs that are not paid during a natural disaster (Fothergill and Peek, 2004). This research may help to explain why those in the Gulf Coast who have higher incomes are more positive about their life and in a later connection, more optimistic about future hurricanes.

A second explanation of the association between dispositional optimism and optimistic bias is having a sense of control. Those who are more optimistic about life may feel that they have more personal control over what happens to them, which may connect to their views of hurricane risk. Optimistic bias and having a sense of control has been studied extensively. Salmon, Park and Wrigley (2003) refer to perceived control as people's tendency to believe that they can take steps to increase the likelihood of desirable outcomes. Future studies on optimistic bias and hurricane risk should include a variable that measures how much control individuals perceive themselves to have over risks from hurricanes. This research should investigate how much control individuals feel they have over their risks from hurricanes versus the fact that humans cannot control the severity of weather. Future research on this topic should study perceived control based on the five categories of hurricanes that cause different levels of

destruction and risks. It is also crucial to couple this research with greater vulnerability such as low income, low attained education and being older.

Results from this study revealed that of the sample from the Gulf Coast, younger adults had higher levels of optimistic bias. Age was significant in the correlation test and it was also a significant predictor of optimistic bias in the regression test. Research question one, which asks how age is associated with optimistic bias may be explained by past studies found on this concept. The findings of this study are consistent with Avis et al. (1989) research on optimistic bias and risk perceptions of suffering a heart attack. As previously stated, this study revealed that the younger participants felt less vulnerable to heart attacks as well as other conditions and diseases in general.

Chapin (2001) explained the tendency for younger individuals to be more optimistic and take more risks because they tend to ignore or underestimate their actual risks. Chapin explains this through the "personal fable." This happens when younger individuals tend to view themselves as special or an exception to the rule. When young individuals believe this they tend to think that others will suffer consequences after taking risks, but they will not. On the topic of hurricanes, taking a risk would refer to not evacuating during a hurricane.

This optimistic bias may exist in the younger individuals of the sample who believe that they will not suffer consequences from a hurricane, like physical injury or major destruction to living space, but others will. This may explain why they rated themselves as having less of a chance of evacuating during next hurricane season than others. For individuals younger than 18, Chapin (2001) refers to this risk perception as adolescent egocentrism. Although in this study, all respondents were 18 and older. What

is not known within this study is if younger adults have realistic or unrealistic optimistic bias regarding hurricane risk.

A second way to explain age and levels of optimistic bias is understanding vulnerability. Feelings of invulnerability may explain why younger respondents were more optimistic than older respondents in the sample. Vulnerability and age has been studied extensively in the natural disaster field. Results from this study can be seen positively. It is good that older adults felt less optimistic regarding hurricane risks, revealing that older adults may be understanding their hurricane risks realistically. Old age was the most important factor in determining who died in Hurricane Katrina in 2005 and the Chicago Heat Wave in 1995 (Peek, 2010). The older someone is increases the likelihood that they may have limitations because of mobility and chronic health issues (Peek, 2010). Evacuation during a hurricane can be very challenging for older adults who may not have adequate transportation or the ability to obtain prescription medication during a crisis. Health conditions such as heart disease, diabetes and respiratory conditions put these individuals in greater risk during a hurricane. If an individual with a condition does not evacuate, their risk of injury or death during a hurricane can increase.

Not only do older individuals face risks due to their health, they also may have a lack of resources. Older adults are more vulnerable during hurricanes because they may have a small social network. Having a social network improves the chance that a neighborhood or friend/family will help those in need with food, preparation, and transportation. Individuals who may live independently prior to a disaster may become reliant on others when a disaster strikes (Peek, 2010). Older adults who do not have assistance are more susceptible to die in disaster conditions. This is important to

understand because as the chances of stronger hurricanes increase so is the amount of elderly in the United States. Those 65 or older are expected to grow by 71.5 million in 2030 (Peek, 2010). As vulnerable populations begin to increase those in natural disaster management must make sure these individuals continue to understand their risks. This suggests that it is a good sign that older adults in this study had lower levels of optimistic bias.

In addition to these conclusions, correlation results present more interesting explanations of the effects of age and hurricane risk. The significant correlation between age and income was negative, explaining that younger generations in the sample had higher incomes. When assessing the descriptives of this sample the average age was 59, a population closer to retirement age. Retirement age and fixed incomes may account for this result. Of the sample, younger adults having higher income may also help to explain their higher optimistic bias levels and why age was a significant predictor of optimistic bias. Correlation results also showed that younger adults in the sample had more children and larger household sizes, hence the need for a larger income to support a family.

For research question three this study asked how optimistic bias varied across levels of educational attainment. Although optimistic bias varied very little when assessing the error-bar chart, the one-way ANOVA showed significance in that less educated individuals had lower optimistic bias levels. This group of individuals' higher vulnerability status may explain this finding.

These individuals may understand that they would be more likely to evacuate during the next hurricane season than others. They are not vulnerable because they did not attain a high level of education, but because of several other factors connected to

having a lower level of education. For example, someone with a high school degree may not be able to find a job that pays a sufficient income. These individuals may also live in higher risk areas in relation to the elevation level of their home, which was seen in New Orleans in the Ninth Ward. In addition to housing conditions, less educated individuals (high school degree or less) may also have a lack of resources. This study may show that individuals with lower educations levels living on the Gulf Coast may realize their vulnerability to hurricanes and may be referred to as having accurate views of hurricane risk. More research is needed to support this conclusion in full.

A second possible explanation for this result is over confidence of highly educated individuals. A study by Peacock, Brody and Highfield (2005) discussed that when individuals have more knowledge they can have lower perceived risks (or higher optimistic bias levels) they may be overconfident and consider themselves to be invulnerable. More research on education and optimistic bias in relation to hurricanes should be completed to make this conclusion.

Results from this study are inconsistent with past research. In their study on perceptions of heart attack risk, Avis et al. (1989) found that less educated individuals had higher levels of optimistic bias about their chances of suffering a heart attack. Avis et al.'s results may be explained by the idea that a lack of education may cause individuals to be unaware of their risks. This brings up the importance of studying knowledge of risks versus overall education level. Past literature has stated that the more individuals know about their actual risks the less optimistic they are about the event or condition (Lipkus and Klein, 2006). Educational attainment did not independently add to the prediction of optimistic bias. Although it is not known why, it may be that

knowledge of risks rather than education attainment may be a better predictor of optimistic bias. This study did not measure overall knowledge of hurricane risk and the implications of this will be discussed later.

Results from this study found that in both the correlation and regression tests, hurricane experience was not associated with and did not predict optimistic bias (research question 4). One explanation for this result is the low average found in this sample's hurricane evacuation experience. As stated in the descriptive section of the results, the average hurricane experience additive index score was 7. Individuals, on average, experienced 4.3 hurricanes, only evacuated an average of 1.5 times and had property damaged 1.3 times. In this study, optimistic bias was measured by asking individuals to rate their likelihood and an average other's likelihood of evacuating during next hurricane season. Most individuals in the sample had experience with hurricanes, but did not evacuate frequently, therefore not evacuating frequently may have affected how hurricane experience was associated with optimistic bias because of the question it was measured by. In addition, hurricane experience was only measured using three questions and these may have not adequately captured what individuals experience during a hurricane. Including questions regarding financial loss, loss of life and experience with long-term displacement may more accurately capture how hurricane experience is associated with optimistic bias

Hurricane experience was positively associated with tenure in the correlation test, meaning that the longer people have lived in an area the more hurricane experience they have had. This may indicate the importance of tenure, which showed to independently add to the prediction of optimistic bias. The reason why hurricane experience did not

independently predict optimistic bias in the linear regression test may be associated with the fact that it is an artifact of tenure.

Another explanation of the insignificance of hurricane experience may be due to a common measurement error. Baker (1979) clarifies that measuring a person's hurricane experience is difficult because it depends on memory and beliefs of the event. The insignificance of hurricane experience may be due to memory problems, especially in elderly individuals.

Experience with a damaged home due to a hurricane can affect how optimistic bias may vary between owning versus renting a home. As stated in the literature review, both of these topics are important in hurricane risk research. Results from this study showed that whether a person owned or rented a home insignificantly affected levels of optimistic bias. These results are inconsistent with past research. Past research has indicated that owning a home plays a significant role in evacuation behavior because during hurricanes individuals often feel the need to protect their home from looters (Smith and McCarty, 1996; Baker, 1991; Lindell et al., 2001).

This research studied how renting versus owning a home may affect optimistic bias, but this study may have missed the point. Insignificant results may be explained because the survey did not ask respondents about their views of risks of looting during a hurricane or how important it was to them to physically protect their home during a hurricane. These questions could show that renters are less concerned about their property than those who own their home and thus more optimistic about hurricanes. These kinds of questions may lead to more implications about different optimistic biases

between renters versus owners. In this case, more research is needed to expand on this portion of research question five.

The second portion of research question five included the association of types of housing with optimistic bias. Different types of structured housing as well as living in a mobile home did not significantly associate with optimistic bias. This may be explained by the sample, most of the respondents lived in a single-family home and a structure (or well-constructed home) and that respondents may feel safe in their homes no matter the type of structure. Respondents may also not perceive their type of home as factor in their perception of hurricane risk.

With this said, the second largest percentage of the sample were residents who lived in mobile homes, therefore the insignificant results for mobile homes may be alarming. What would be hoped to be reported is a difference between mobile home owners and other housing types. Results from this study are inconsistent with Lindell et al. (2005) who explained that mobile home owners are most likely to evacuate because they perceive themselves at greater risk. Profesor Robert J. Blendon from Harvard University's School of Public Health sheds light on why results of this study may be statistically insignificant, but nonetheless important. Professor Blendon stated that "it will be a challenge for public officials to convince many of these people to leave their homes because they view their homes as safe and evacuating as dangerous" (Harvard School of Public Health, 2006). Professor Blendon also found that individuals living in mobile homes were no more likely to evacuate during a hurricane than the general public. The results from this study indicate that those living in mobile homes showed no difference in optimism regarding likelihood of evacuating next hurricane season. As

Professor Blendon stated, they do not believe the type of home they life in would put them at higher risk during a hurricane.

This may shed light that mobile home owners may need more education regarding their vulnerability to hurricanes (knowledge of risk). Individuals living in mobile homes are at a higher risk for floods, fires, tornados, earthquakes and hurricanes (Fothergill and Peek, 2004). Even in a category one hurricane, the lowest on severity level, mobile homes built before 1994 are at risk of destructions and being pushed off foundations (NOAA, 2010). Although hurricane risk grows with each category of storm, mobile home owners are always in danger.

Research question seven inquired how optimistic bias is associated with the number of children in the home. Insignificant results from both the correlation test and linear regression can be explained in a few ways. The sample in its entirely averaged .5 children. This is a very small number and may account for why children did not associate with optimistic bias. This average may have been so low because the average age of the sample was 59 years. It could be assumed that many 59 years old who do have children, have children who are over 18 and are most likely living on their own. Therefore, children under 18 in the household may not have been a factor for residents in this sample.

With this said, those who had the most children in the household were younger adults as the correlation shows a negative relationship between age and children. As previously stated, younger generations also correlated with higher incomes. If younger generations earn more money and have higher optimistic biases, these factors may have played in the insignificance of having children in the household. This can be compared

to a young adult who has little supportive income and children to take care of who may be a lot less optimistic about their hurricane risk. In this scenario, the number of children in the household may be more of a significant factor. With this said, significant levels may have been different if the study measured single parent households versus two parent households, which may also affect income and optimistic bias levels.

In relation to children, it is appropriate to discuss the results of gender in this study. Past research has shown that gender varied in studies on optimistic bias because it is topic dependent according to which gender is at risk (Chapin and Coleman, 2009). In this study, gender showed insignificant results. It is important to retest this result when other variables, as mentioned above, such as being a single parent and defining social roles are included. This is important because past research has found that being male or female may have important implications on how individuals perceive their risk. For example, women may perceive higher risks of hurricanes because of a lack of power and resources (Bateman and Edwards, 2002). Women are also often the caretakers of young children. Including additional variables that describe the sample in more detail could change results on gender.

Research question seven addressed the association of tenure and optimistic bias. The variable of tenure was important in this study. Results showed that the longer individuals have lived within 50 miles of their current home, the higher levels of optimistic bias they had. These people believed others were more likely to evacuate next hurricane season than themselves. Baker (1991) stated that individuals new to a hurricane prone area may be more likely to evacuate. Mileti and Darlington (1997) explained that newcomers with little experience do not have the same risk reference and

may be less optimistic regarding possible dangers. Those who have not lived in the area may not know what to expect during a hurricane, therefore err on the safe side, and plan to evacuate more often.

The correlation test showed that tenure and hurricane experience had a positive relationship. Hurricane experience had more association with tenure than a strong influence on optimistic bias, as discussed earlier. Those who have lived around one area longer had more hurricane experience. The fact that longer tenures had higher optimistic bias levels may be explained by low number of times evacuated from hurricanes and low average of property damaged from a hurricane. An individual who has lived in an area for several years may have experienced more hurricanes without personal or property damage. These experiences may cause the individual to be more optimistic that he or she will not have to evacuate during hurricane season.

Another factor to consider is how many times a hurricane had not directly hit the area an individual has lived in. This may cause a safe feeling that a non-direct hit is more probably in the future. Researchers may caution this finding as Baker (1991) described this as the false experience. Many individuals who have not experienced strong category hurricanes, direct hits or property damage may carry unrealistic perceptions of risk. This may indicate that those with longer tenures may benefit from education. Further explanations of this result may be found once the variable of event severity is accounted for in future research.

Discussed above is a variable by variable explanation of the results from this study on optimistic bias in relation to hurricane risk. The last research question of this study asks how well these variables collectively predict optimistic bias. The variables

measured in the survey are all important for this research and for future research on this subject. Although they are all important, just three of these variables provide the most concrete information on optimistic bias in relation to hurricane risk. This study shows that dispositional optimism, age and tenure may best predict optimistic bias in relation to hurricane risk within the confines of this sample. The rest of the variables help to explain what might make these three variables important. For example, hurricane experience has important implications on tenure, but it is tenure that predicts optimistic bias.

With that said, just because this study found only three significant variables in predicting optimistic bias, it does not mean that future studies should not use all included variables. If other covariates were included in a future study, these variables may collectively predict optimistic bias. In other words, it may be due to the absence of important covariants that only three variables were found to predict optimistic bias. Suggested covariates that may be included in future research are event severity, race, household composition variables such as single-parent homes, knowledge of risk and feelings of control over risk. These covariates will be further discussed below.

This discussion has shed light on reasoning for results and what they may mean, but a disclaimer must be made. These weak overall correlation coefficients and only 3.2% explained variance points to the fact that these variables alone may not fully describe optimistic bias in relation to hurricane risk. Reasoning for this includes missing covariates that may be important as well as measurement error that is commonly found in studies on optimistic bias. These weaknesses and limitations of this study will be further discussed.

8.1. Limitations

Although it is hoped that this study contributes to research on optimistic bias pertaining to hurricane risk, it is important to recognize certain limitations. Limitations were found in generalization, measurement error and the small percentage of variance accounted for throughout the regression model steps. In addition to these limitations, also discussed are covariates not included in the analysis that are suggested to improve results from this study.

The stratified sample method did provide data that was spatially random rather than having problems with distribution weighted toward higher population areas, but it cannot be generalizable to other hurricane prone areas. Based on the purpose of this survey, these results cannot be generalized to those living on the Atlantic coast. This is because the Atlantic coast includes different demographics, tenures, types of housing, frequency of hurricanes and so on.

Another limitation is the exclusion of covariates that are important to measure with optimistic bias. By committing to variables used in the survey, this study did not research important variables such race, event severity, gender in relation to being a single-parent, those with disabilities or other vulnerable populations, sense of control and knowledge of risk. The elimination of these variables may explain the weak correlations and low explained variance.

Two of these covaraites were included in the survey, but could not be used. An important limitation is the fact that the sample reported a predominantly white race. Due to this limitation, race could not be tested as a covariate of optimistic bias. In the natural

disaster field, race is a crucial variable that helps to explain many study implications. Having a predominantly white sample limits generalizability.

A second covariate that could not be used was severity of storm. Although this survey measured evacuation predictions according to category of storm, this analysis did not include results due to measurement limitations. In the survey, respondents were asked to imagine four hurricane scenarios and about how these scenarios would influence their decision to voluntarily evacuate (Trumbo, 2007). Each respondent was asked:

> "Imagine a hurricane is approaching your location. Landfall is between 2 and 2 1/2 days away. The National Weather Service issues a probability that your location will be hit directly."

Respondents were asked to rate how high the chances had to be for them to voluntarily evacuate immediately. Each category of storm from two through five were followed by a scale from 0% to 100% in 5% increments. Issues in validity were recognized. It would be assumed a positive hierarchal advance in percentage of evacuation per category of storm (per question). This was not found. Therefore, measurement error was suspected and event severity could not be used in this study. It is suggested that event severity can influence optimistic bias pertaining to hurricane risk.

A second measurement limitation is the use of scales from 0% to 100%. As seen in the results, according to the data, it is important to consider that when respondents did not know how to answer percentage questions or may not have understood the questions, that they were prone to answer at a neutral 50% option. For example, 203 of 824 (25%) participants responded 50% when asked about the chances of an average other being forced to evacuate next hurricane season. The same was found when participants

answered the chance that they themselves would be forced to evacuate during next hurricane season with 185 of 824 (23%) answering at 50%. These answers affected the total optimistic bias for the indirect measure. When the differences between the average other and self questions were calculated, 260 of 824 or 32% ended close to zero. Results may have been different if an alternative scale was used. This measurement error may also account for low significance within the results.

A third measurement limitation involves the measurement of optimistic bias. What needs to be understood is how respondents compare themselves to an average other. More think-out-loud studies may be needed to correct this limitation as seen in Otten and Plight (1996). It is important for optimistic bias researchers to continue comparing direct and indirect methods of measurement. It is also suggested that these measurements include a way to understand if respondents are unrealistic or realistic optimists. One way to accomplish this in hurricane research may be to measure an individual's knowledge of hurricane risk.

8.2. Directions for Future Analysis

This study provides a good start for future studies on optimistic bias in relation to hurricane risk. Although significant results were found, the explained variance and correlations were weak, therefore it is suggested that researchers further analyze this topic. This section includes suggestions regarding reducing optimistic bias, adding covariates to studies, measurement changes and suggestions for qualitative research.

8.2.1. Knowledge of Risk

Many researchers have used the variable of education when studying optimistic bias. Scientists have wanted to know how a person's education affects their levels of optimistic bias. Education has been measured in two main ways in past studies; one way is to study educational attainment and the other is to study knowledge of the risk itself. This study could have benefited from knowing how much each respondent understood about their personal hurricane risks. Testing knowledge and optimistic bias may reveal important implications. One important question to ask is if it matters how much an individual understands about hurricane risk. If an individual has an ample understanding of hurricane risk, but still carries optimistic bias towards their risk, this has important implications. This may imply that education is not enough or that respondents are optimistic in order to reduce anxiety because they understand their risks, but still keep an optimistic outlook.

8.2.2. Additional Covariates

When studying optimistic bias in relation to hurricanes, it is suggested that this topic be further analyzed by comparing hurricanes to a intention human-caused disaster such as a terrorist attack. It would be beneficial to understand how levels of optimistic bias may differ when individuals have a human to blame for a crisis versus something that happens in nature. This kind of analysis could include the covariate of control, a variable that is popular in research on optimistic bias.

Another covariate that should be added is single-parents. Together with job status, average income, available resources, being a single parent may shed more light on

how individuals view their risks of hurricanes. This is true because not only do single parents live with one income, they also face great risks if a hurricane displaces their family. This makes finding housing, employment, transportation, schooling and childcare more difficult (Tobin-Gurley et. al, 2010). If single parents test to be unrealistic optimists, this information provides important implications for future education programs.

8.2.3. Additional Hurricane Prone Areas

The sample from the study covered a large area, but one important city left out was New Orleans. As previously stated, New Orleans was not surveyed because of the heightened sensitivity after Hurricane Katrina. This study, with improvements, could benefit from adding individuals from New Orleans to the sample. Adding New Orleans is important because residents from the city suffered greatly after Hurricane Katrina in 2005. Individuals living in New Orleans not only experienced a hurricane, but also experienced levee failures and problems with disaster management planning. Researching levels of optimistic bias among these individuals can add greatly to research in this field in relation to how experiencing extreme destruction, flooding and long-term displacement after a hurricane affects optimistic bias.

Although this stratified sample has important implications for those living on the Gulf Coast, research should also be completed on the Atlantic Coast. Future studies should analyze both coasts and can then compare differences. Analysis may provide important implications for those in natural disaster management.

8.2.4. Longitudinal Studies

One of the most important suggestions for future research on optimistic bias is to use longitudinal study methods. It is important for researchers to understand how levels of optimistic bias change over time. In relation to hurricanes, researchers must ask how the absence of a severe hurricane over a period of years changes levels of optimistic bias. Helweg-Larsen (1999) conducted a study on optimistic bias and earthquakes. Part of this study was to measure differences of optimism over time. Results revealed that no optimistic bias existed among respondents one week after the 1994 Northridge Earthquake and the same was found even after five months. More research should be conducted on how time affects optimistic bias pertaining to hurricanes. This research has important implications for natural disaster management such as risk education and continuous hurricane preparedness activities.

8.2.5. Qualitative Methods

How individuals on the Gulf Coast view their risk of hurricanes is complicated. Many variables and situations can affect levels of optimism in ways that a survey may not reveal. In this case, it is suggested that future research on optimistic bias and hurricanes add qualitative methods using interviews with respondents. Information gathered from interviews can then be used to create a more detailed survey, which can help to better explain optimistic bias in relation to hurricane risk.

8.2.6. Reducing Optimistic Bias

The literature review on optimistic bias showed that unrealistic optimism exists among individuals on many topics such as health conditions, crime, violence and environmental problems. Now that researchers know that unrealistic optimistic bias exists, it is just as important to conduct more research on how to reduce it. Using targeted education may be one suggestion, but even this suggestion needs further investigation.

Research should be done on how to educate individuals about their risks. Is it enough to send emails, make a web page or information packet? This research can use past studies on changing health and risk taking behavior. In the communication field it is also important to study the effect that different mediums have on educating the public to help reduce unrealistic optimism.

8.3. Practical Implications: Suggestions on how this study and future studies can be useful for those working in natural disaster management.

Although researchers have long discussed how studies on optimistic bias depend on the topic or event itself, there is one aspect that has been common among these studies. Researchers can use studies on optimistic bias to identify specific groups of people who may benefit from targeted education about a specific risk. Educational programs are targeted when specific groups of individuals with similar characteristics become the focus of what is taught. For example, relative to hurricanes, those with long tenure could benefit from education which focuses on the fact that although past storms may have not been direct hits, future storms can be. This is versus mobile home targeted

education that would focus on the fact that mobile home owners are always at risk and should evacuate during every hurricane, no matter the severity. The results of this study and future ones on this topic can help communicators become aware of the needs of citizens who are faced with hurricanes. Understanding what information different groups of people need will help public officials develop educational strategies to reduce unrealistic optimism and promote life-saving preparation activities. This is important because of the association between unrealistic optimism and how some individuals neglect taking precautions for certain risks (Redmond and Griffith, 2004).

This study helps public officials in disaster management understand how certain individuals perceive their risks of hurricanes. Public officials can take this information to facilitate communication and education in communities in order to help others understand their risks more realistically. By targeting those who are too optimistic regarding their hurricane risk, disaster management officials can help these individuals help themselves. Public officials must acknowledge the important role that mandating targeted education can play in the public's preparation and response activities.

Mileti (1995) explained that public education about natural hazards can have positive results. Rather than blanketing a community with hurricane risk information, it is important to target certain individuals. Weinstein, Klotz and Sandman (1989) warn communicators about leaving individuals to draw conclusions from blanketed information about their degree of personal risk and what precautions to take. For example, if a preparedness brochure addressing hurricane risk is written for a citywide audience, those who live in mobile homes may not draw the conclusion that they are

more vulnerable than other individuals in the area because of their housing situation. The same can be said for younger adults who read blanketed information about risks for those with disabilities or for the elderly. Young adults may assume they do not face great hurricane risks because they are not disabled or part of the elderly population. If people do not believe that information is meant for them, they will likely ignore it (Mileti, 1995). Therefore, it is important that those in natural disaster management personalize risks.

Communication scholars have long written about the importance of targeting an audience. Chapin and Coleman (2006) studied the importance of targeted education for those with unrealistic optimism. Results from their study showed that knowledge regarding risk of violence increased after implementing an education program. Chapin and Coleman also found that this knowledge decreased participants' optimistic bias. Through targeted education, communicators can use several strategies to minimize unrealistic optimism in specific groups.

Weinstein, Klot and Sandman (1989) suggest emphasizing the magnitude of a threat, comparing the threat to other familiar risks, stressing the consequences of the risks and providing evaluative information. Evaluative information can include examples of low, moderate and high threats; this is where information about different strengths of hurricanes would come in. Communicators will need to shape low, moderate and high threat comparisons to specific groups. For example, threat levels for mobile homeowners will differ from threat levels for single-family homeowners.

One problem for targeted education is that some people may not understand the information. Not only may individuals not understand the information, but they may also

reference a risk in a way that makes it seem less as a hazard than it is. For example, this study showed that those with longer tenures had higher levels of optimistic bias concerning their hurricane risk. Individuals who have lived in an area for a long time may not have experienced severe damage during hurricane season, but this does not mean this will be the same experience in future hurricanes.

For example, As Hurricane Katrina approached Mississippi, newspapers tried to explain the mass destruction and potential dangers that would result from the future storm (Venette, 2008). The newspapers did this by comparing Hurricane Katrina to Hurricane Camille in 1969, one of the most violent hurricanes to hit the United States. Venette (2008) explains that when individuals rate the risks of a current hurricane based off past hurricanes, these individuals tend to be too optimistic about their safety. These newspapers may have contributed to individuals being unrealistically optimistic about their risks. Future research on optimistic bias may help communicators understand what information or misinformation may cause individuals to inaccurately assess their risk.

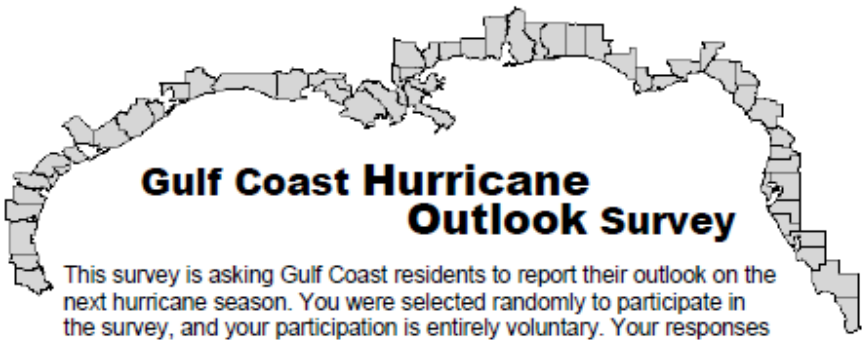
Using statistical information can help add to the success of reducing unrealistic optimistic. In their study on perceptions of radon risk and optimistic bias, Weinstein, Klotz and Sandman (1989) found that participants' information needs were not being met. Respondents in this study suggested that they needed more facts or statistics in order to better compare their risks to others. With this in mind, it is suggested that if mobile home owners need to be targeted, they should be given statistics on their hurricane risks compared to those living in well constructed homes and areas. Using statistics may also help individuals believe that information is accurate (Mileti, 1995).

It is hoped that reducing optimistic bias pertaining to hurricane risk will help individuals on the Gulf Coast understand that they are at risk and therefore will do more to prepare themselves for next hurricane season. Targeted education using information packets on hurricane risk and prevention activities may help fill these holes by specifically providing this information. Making sure individuals understand what they can do to prevent risks is important. Therefore, the more knowledge residents on the Gulf Coast have about the risks of hurricanes, the more actions they will take to prepare for a storm. It is important to continue research on optimistic bias in relation to hurricane risk because information from these studies can be used to help save lives in future storms.

8.4. Conclusion

In this study several covariates were studied in relation to optimistic bias pertaining to hurricane risk. Dispositional optimism, age and tenure showed significant results. Future research should be conducted on optimistic bias and hurricane risk including more variables and all hurricane prone regions. It is hoped that more research will help us understand the role optimistic bias plays in how individuals perceive their risks of hurricanes. Those who are unrealistically optimistic regarding this risk may benefit from education on hurricanes. In the long run, it is hoped that studies like these help better prepare communities during hurricane season and save lives.

Appendix I: Gulf Coast Hurricane Outlook Survey



Gulf Coast Hurricane Outlook Survey

This survey is asking Gulf Coast residents to report their outlook on the next hurricane season. You were selected randomly to participate in the survey, and your participation is entirely voluntary. Your responses will remain confidential. The results of the survey will help emergency planning officials to understand how individuals living on the Gulf Coast view hurricane threats.

The information you can provide is very helpful, and we thank you for your participation.

First, a few questions about yourself:

Year you were born: _____ Sex: ____ male ____ female

In what type of housing are you currently living? Check one:

____ owned single family home ____ apartment building
____ rented single family home ____ mobile home
____ condo ____ other: _____

Which do you consider yourself to be? Check one:

___ white ___ black or African American
___ American Indian of Alaska native ___ Asian
___ native Hawaiian or other Pacific Islander

Do you consider yourself to be Hispanic or Latino? ___ Yes ___ No

How many adults (18 or older) are there currently in your household? _____

How many non-adults (under 18) are there currently in your household? _____

How many years have you lived within 50 miles of your current home? _____

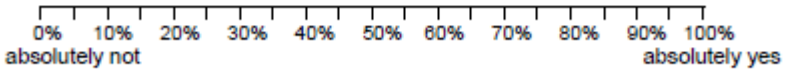
Please tell us about your lifetime experience with hurricanes:

How many hurricanes have you been in? _____

How many times have you evacuated from a hurricane? _____

How many times have you had property damage from a hurricane? _____

For the average individual living on the Gulf Coast, what would you estimate the chances are (from 0 to 100%) that he or she will be forced to evacuate from a major hurricane during the next hurricane season? Place a check anywhere on the line below:



Next, please tell us how you feel about the next hurricane season:

How likely do you think it is that a hurricane will prevent you or members of your household from being able to go to work or go to your jobs during the next hurricane season? Check one:

___ Very Unlikely ___ Unlikely ___ Medium ___ Likely ___ Very Likely

How likely do you think it is that a hurricane will disrupt your daily activities during the next hurricane season? Check one:

___ Very Unlikely ___ Unlikely ___ Medium ___ Likely ___ Very Likely

How likely do you think it is that a major hurricane will potentially damage your home during the next hurricane season? Check one:

___ Very Unlikely ___ Unlikely ___ Medium ___ Likely ___ Very Likely

Please tell us about any personal loss, such as an injury, emotional upset or financial loss, that you may have experienced with hurricanes Katrina and/or Rita:

Did you experience any personal loss from Hurricane Katrina? ___ Yes ___ No

Did someone you know experience any personal loss from Hurricane Katrina?
___ Yes ___ No

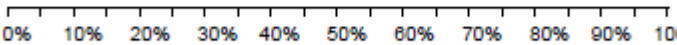
Did you experience any personal loss from Hurricane Rita? ___ Yes ___ No

Did someone you know experience any personal loss from Hurricane Rita?
___ Yes ___ No

Next, we would like you to imagine 4 hurricane situations and how they would influence your decision to voluntarily evacuate.

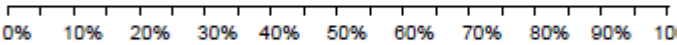
Imagine a hurricane is approaching your location. Landfall is between 2 and 2 1/2 days away. The National Weather Service issues a probability that your location will be hit directly.

If this is a category 2 hurricane, how high do the chances have to be (from 0 to 100%) for you to voluntarily evacuate immediately? Place a check anywhere on the line below:



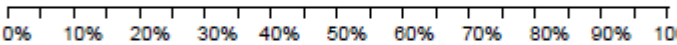
absolutely not absolutely yes

If this is a category 3 hurricane, how high do the chances have to be (from 0 to 100%) for you to voluntarily evacuate immediately? Place a check anywhere on the line below:



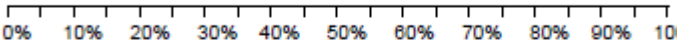
absolutely not absolutely yes

If this is a category 4 hurricane, how high do the chances have to be (from 0 to 100%) for you to voluntarily evacuate immediately? Place a check anywhere on the line below:



absolutely not absolutely yes

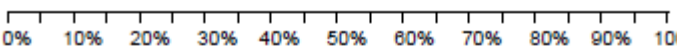
If this is a category 5 hurricane, how high do the chances have to be (from 0 to 100%) for you to voluntarily evacuate immediately? Place a check anywhere on the line below:



absolutely not absolutely yes

========

What would you estimate the chances are (from 0 to 100%) that you will be forced to evacuate from a major hurricane during the next hurricane season? Place a check anywhere on the line below:



absolutely not absolutely yes

We would like to know something about your overall outlook.

The following 10 items are a standard questionnaire. Please be as honest and accurate as you can throughout. Try not to let your response to one statement influence your responses to other statements. There are no "correct" or "incorrect" answers. Answer according to your own feelings, rather than how you think "most people" would answer.

Mark one box for each question using these letters:

A = Agree a lot **B** = Agree a little **C** = Neutral **D** = DISagree a little **E** = DISagree a lot

A	B	C	D	E	
					In uncertain times, I usually expect the best.
					It's easy for me to relax.
					If something can go wrong for me, it will.
					I'm always optimistic about my future.
					I enjoy my friends a lot.
					It's important for me to keep busy.
					I hardly ever expect things to go my way.
					I don't get upset too easily.
					I rarely count on good things happening to me.
					Overall, I expect more good things to happen to me than bad.

Finally, just two more things about yourself:

Approximately what is your annual household income? Check one:

___ less than $10,000
___ between $10,000 and $19,999
___ between $20,000 and $29,999
___ between $30,000 and $39,999
___ between $40,000 and $49,999
___ between $50,000 and $59,999
___ between $60,000 and $69,999
___ between $70,000 and $79,999
___ greater than $80,000

What is the highest level of education you have completed? Check one:

___ less than High School
___ High School graduate
___ some college or technical school
___ completed technical school
___ completed undergraduate degree
___ master's degree
___ doctorate, medical, law or similar

THANK YOU!
PLEASE PLACE THE SURVEY IN THE ENCLOSED RETURN ENVELOPE AND MAIL TODAY.

References

AAPOR (2009). *Response Rates: An overview*. Retrieved on September 26, 2009 from http://www.aapor.org/Content/NavigationMenu/PollampSurveyFAQs/DoResponseRatesMatteR/ResponseRatesAnOverview/default.htm.

Aucote, H. & Gold, R. (2005). Non-equivalence of direct and indirect measures of unrealistic optimism. *Psychology, Health & Medicine, 10*, 346-383.

Avis, N., Smith, K., & McKinlay, J. (1989). Accuracy of perceptions of heart attack risk: What influences perceptions and can they be changed? *American Journal of Public Health, 79,* 1608-1612.

Baker, E.J (1979). Predicting response to hurricane warnings: A reanalysis of data from four studies. *Mass Emergencies, 4*, 9-24.

Baker, E.J. (1991). Hurricane evacuation behavior. *International Journal of Mass Emergencies and Disasters, 9*, 287-310.

Bateman, J. & Edwards, B. (2002). Gender and evacuation: A closer look at why women are more likely to evacuate for hurricanes. *Natural Hazards Review, 3,* 107-117.

Burnside, R., Miller, D.S., & Rivera, J. (2007). The impact of information and risk perception on the hurricane evacuation decision-making of Greater New Orleans residents. *Sociological Spectrum, 27*, 727-740.

Campbell, J., Greenauer, N., Macaluso, K., & End, C. (2007). Unrealistic optimism in internet events. *Computers in Human Behavior, 23,* 1273-1284.

Chang, E. & Asakawa, K. (2003). Cultural variations on optimistic and pessimistic bias for self versus a sibling: Is there evidence for self-enhancement in the west and for self-criticism in the east when the referent group is specified? *Journal of Personality and Social Psychology, 84*, 569–581.

Chapin, J. (2001). It won't happen to me: The role of optimistic bias in African American teens' risky sexual practices. *The Harvard Journal of Communications, 12*, 49-59.

Chapin, J. & Coleman, G. (2009). Optimistic bias: What you think, what you know, or whom you know? *North American Journal of Psychology, 11*, 121-132.

Clarke, V., Williams, T., & Arthey, S. (1997). Skin type and optimistic bias in relation to the sun protection and suntanning behaviors of young adults. J*ournal of Behavioral Medicine, 20*, 207-222.

Covey, J. & Davies, A. (2004). Are people unrealistically optimistic? It depends on how you ask them. *British Journal of Health Psychology, 9*, 39-49.

Crossett, K., T. J. Culliton, P. Wiley, and T. R. Goodspeed. (2004). Population trends along the Coastal United States, 1980–2008. Silver Spring, Maryland: *National Oceanic and Atmospheric Administration*. p. 47. Retrieved on December 1, 2009 from http://oceanservice.noaa.gov/programs/mb/pdfs/coastal_pop_trends_complete.pdf

Dejoy, D. (1992). An examination of gender differences in traffic accident risk perception. *Accident Analysis and Prevention*, 24, 237-246.

Dillard, A., McCaul, W., & Klein, W. (2006). Unrealistic optimism in smokers: Implications for Smoking myth endorsement and self-protective motivation. *Journal of Health Communication, 11,* 93–102.

Donner, W. & Rodriguez, H. (2008). Population composition, migration and inequality: The influence of demographic changes on disaster risk and vulnerability. *Social Forces 87*, 1089-1114.

Dunning, J., Meyerowitz, J.A., & Holzberg, A.D. (1989). Ambiguity and self-evaluation: The role of idiosyncratic trait definitions in self-Serving assessments of ability. *Journal of Personality and Social Psychology, 57*, 1082-1090.

Fontaine, K. & Smith, S. (1995). Optimistic bias in cancer risk perception: A cross-national study. *Psychological reports, 77,* 143-146.

Fothergill, Alice & Peek, L. (2004). Poverty and disasters in the United States: A review of recent sociological findings. *Natural Hazards 32*, 1, 89-110.

Harris, P. Griffin, D., Murray, S. (2008). Testing the limits of optimistic bias: Event and person moderators in a multilevel framework. *Journal of Personality and Social Psychology, 95,* 1225-1237.

Harvard School of Public Health (2006, July 20). *Despite last year's devastating hurricane season, one-third in high-risk areas say they may ignore evacuation order*. [Press Release]. Retrieved January 20, 2010 from http://www.hsph.harvard.edu/news/press-releases/2006-releases/press07202006.html.

Hayes, C. & Weathington, B. (2007). Optimism, stress, life satisfaction, and job burnout in Restaurant managers. *Journal of Psychology, 141*, 556-579.

Helweg-Larsen, M. (1999). (The lack of) Optimistic biases in response to the 1994 Northridge Earthquake: The role of personal experience. *Basic and Applied Social Psychology, 21*, 119-129.

Hirsch, J., Wolford, K., LaLonde, S., Brunk, L., Parker Morris, A. (2007). Dispositional Optimism as a moderator of the relationship between negative life events and suicide ideation and attempts. *Cognitive Therapy and Research, 31*, 533-546.

Inman, M. (2010, January 25). Strongest hurricanes may double in frequency, study says. *National Geographic*. Retrieved on February 1, 2010 from http://news.nationalgeographic.com/news/2010/01/100121-hurricanes-global-warming/.

Kalkstein, A. & Sheridan, S. (2007). The social impacts of the heat–health watch/warning system in Phoenix, Arizona: Assessing the perceived risk and response of the public. *International Journal of Biometeorology,52*, 43–55.

Li, G. (2009). Tropical cyclone risk perceptions in Darwin, Australia: A comparison of different residential groups. *Natural Hazards, 48*, 365-382.

Lindell, M. K., Jing-Chein Lu, & Prater, C. (2005). Household decision making and evacuation in response to hurricane Lili." *Natural Hazards Review, 6*, 171-179.

Lindell M.K, Prater C.S., Sanderson W.G., Jr., Lee H.M., Zhang Y., Mohite A. and Hwang S.N. (2001). *Texas Gulf Coast Residents' Expectations and Intentions Regarding Hurricane Evacuation.* College Station TX: Texas A & M University Hazard Reduction & Recovery Center.

Lipkus, I. & Klein, W. (2006). Effects of communicating social comparison information on risk perceptions for Colorectal Cancer. *Journal of Health Communication, 11*, 391-407.

Luo, J. & Isaacowitz, D. (2007). How optimist face skin cancer information: Risk assessment, attention, memory and behavior. *Psychology and Health, 22*, 8, 963-984.

Mileti, D. S. (1995) Factors related to flood warning response. U.S.-Italy Research Workshop on the Hydrometerology, *Impacts and Management of Extreme Floods, Perugia, Italy, November, 1995*. Retrieved on March 21, 2010 from http://www.engr.colostate.edu/~jsalas/us-italy/papers/46mileti.pdf.

Mileti, D. & Darlington, J.D. (1997). The role of searching in shaping reactions to earthquake risk information. *Social Problems 44*, 89-103.

Moen, Bjorg-Elin & Rundmo, T. (2005). Predictors of unrealistic optimism: A study of Norwegian risk takers. *Journal of Risk Research 8*, 363–382.

NOAA/National Weather Service (2010). *The Saffir-Simpson hurricane wind scale summary table*. Retrieved on March 3, 2010 from http://www.nhc.noaa.gov/sshws_table.shtml?large"%20http://www.nhc.noaa.gov/sshws_table.shtml?large".

Otten, W. & Plight, J.V.D. (1996). Context effects in the measurement of comparative optimism in probability judgments. *Journal of Social and Clinical Psychology, 15*, 80-101.

Peacock, W.G., Brody, S.D., & Highfield, W. (2005). Hurricane risk perceptions among Florida's single family homeowners. *Landscape and Urban Planning*, *73*, 120-135.

Peek, L. (2010). Age. In B.D. Phillips, D.S.K. Thomas, A. Fotherfill & L. Blinn-Pike (Eds), *Social vulnerability to disasters* (pp. 155-185). Boca Raton, FL: CRC Press. Or is it London: Taylor and Francis.

Price, P., Pentecost, H., Voth, R. (2002). Perceived event frequency and the optimistic bias: Evidence for a two-process model of personal risk judgments. *Journal of Experimental Social Psychology 38*, 242–252.

Radcliffe, N. & Klein, W. (2002). Dispositional, unrealistic, and comparative optimism: Differential relations with the knowledge and processing of risk information and beliefs about personal risk. *Personality and Social Psychology Bulletin, 28*, 836-845.

Redmond, E. & Griffith, C. (2004). Consumer perceptions of food safety risk, control and responsibility. *Appetite, 43*, 309-313.

Rimal, R. and Morrison, D. (2006). A Uniqueness to personal threat (UPT) Hypothesis: How similarity affects perceptions of susceptibility and severity in risk assessment. *Health Communication, 20*, 209-219.

Robb, K., Miles, A., & Wardle, J. (2004). Subjective and objective risk of colorectal cancer. *Cancer Causes & Control, 15*, 21-25. Retrieved March 2, 2009, from http://www.jstor.org/stable/3553911.

Salmon, C., Park, H. S., Wrigley, B. J. (2003). Optimistic bias and perceptions of bioterrorism in Michigan corporate spokesperson, Fall 2001. *Journal of Health Communication, 8*, 130-143.

Scheier, M., Carver, C., & Bridges, M. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A re-evaluation of the Life Orientation Test. *Journal of Personality and Social Psychology, 67*, 1063-1078.

Smith, S.K. & McCarty, C. (1996). Demographic effects of natural disasters: A case study of Hurricane Andrew. *Demography, 33*, 265-275.

Spittal, M., McClure, J., Siegert, R., Walkey, F. (2005). Optimistic bias in relation to preparedness for earthquakes. T*he Australasian Journal of Disaster and Trauma Studies, 1*. Retrieved March 12, 2009 from http://www.massey.ac.nz/~trauma/issues/2005-1/spittal.htm.

Tobin-Gurley, J., Peek, L., and Loomis, J. (2010). Displaced Single Mothers in the Aftermath of Hurricane Katrina: Resource Needs and Resource Acquisition. *International Journal of Mass Emergencies and Disasters* (In Press).

Trumbo, C. (2007). *Proximity to extreme events: The Effect of Hurricane Katrina and Rita on subsequent hurricane risk perception and optimistic bias in individuals living in Gulf Coast counties.* Draft Unpublished Manuscript, Colorado State University.

United States Geological Survey. (2006, June 7). *Hurricane hazards: A national threat.* Retrieved August 30, 2009, from http://pubs.usgs.gov/fs/2005/3121/.

Venette, S. (2008). Risk as an inherent element in the study of crisis communication. *Southern Communication Journal, 73*, 197-210.

Weinstein, Neil. (1980). Unrealistic optimism about future life events. *Journal of Personality and Social Psychology, 39*, 806-820.

Weinstein, N. D. (1984). Why it won't happen to me: Perceptions of risk factors and susceptibility. *Health Psychology, 3,* 431-457.

Weinstein, N., Klotz, M.L., and Sandman, P. (1989). Promoting remedial response to the risk of radon: Are information campaigns enough? *Science, Technology, and Human Values, 14*, 360-379. Retrieved on April 13, 2009 from http://www.jstor.org/stable/689682.