FACTORS EXPLAINING THE RISK PERCEPTION OF COUNTY EMERGENCY MANAGERS

A Thesis
Submitted to the Graduate Faculty
of the
North Dakota State University
of Agriculture and Applied Science

By

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In Partial Fulfillment of the Requirements
for the Degree of
MASTER OF SCIENCE

Major Department:
Emergency Management

October 2014

Fargo, North Dakota

North Dakota State University

Graduate School

Title

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The Supervisory Committee certifies that this ***disquisition*** complies with North Dakota State University's regulations and meets the accepted standards for the degree of

MASTER OF SCIENCE

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ABSTRACT

This thesis attempted to explore how county emergency managers understand the risks most likely to manifest in their jurisdiction using an internet survey. This study addressed the following research questions:

1) What risks do county emergency managers perceive to be the most likely to manifest in their jurisdiction?
2) What factors explain their risk perceptions?

Data were collected by internet survey which was sent to county emergency managers in FEMA Region V. When data collection ceased, 165 county emergency managers had completed the internet survey in full. Regression analysis revealed that a small amount of the variance in risk perception was explained. The notion of extending traditional variables professionally in a way that makes sense for county emergency managers proved to be valuable. Additionally, operationalization issues raised in this study can be used as valuable lessons learned for future risk perception research.

ACKNOWLEDGEMENTS

I would like to thank a handful of important individuals for their guidance, support, and friendship throughout my graduate career. First I want to thank the individual who served as my chief source of leadership and guidance—a true mentor—Dr. Jessica Jensen. I believe that her enthusiasm for emergency management will continue to grow and remain unparalleled by her predecessors and peers. Her selfless service to students is a testament to her unwavering dedication to continuous improvement of the field of emergency management. I sincerely appreciate the time you spent helping me make this project happen. You not only helped me grow in a professional sense, but also in my personal life.

I would like to extend my appreciation to Dr. Daniel Klenow and Dr. George Youngs for encouraging me to pursue a path that is important to me, and showing me the value of not taking myself too seriously.

The influence that my parents have had on the way I conduct myself publicly and privately is immeasurable. Thank you for your love and support in all of the decisions I have made throughout my life.

I must thank the cohort of students that I came into the emergency management graduate program alongside. John, Laura, Samantha, and Amanda provided me with advice, laughs, constructive criticism, and countless memories in the four semesters I spent with them in Fargo. Thank you for so many reasons, but above all, thank you for teaching me things about myself that I never would have discovered without you.

Finally, to Jenna, who has impacted my life in a way that I never imagined. You make me want to be a better person in all parts of my life. I cannot wait to see what the future brings.

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LIST OF ABBREVIATIONS

DHS..... Department of Homeland Security

DoS ..... Department of State

FBI ..... Federal Bureau of Investigation

FEMA ..... Federal Emergency Management Agency

NDSU..... North Dakota State University

NWS..... National Weather Service

PADM..... Protective Action Decision Model

PDD..... Presidential Declaration of Disaster

SDEM ..... State Department of Emergency Management

SES..... Socioeconomic Status

SFC ..... State Fusion Center

USGS ..... United States Geological Survey

CHAPTER ONE: INTRODUCTION

This study explored how county emergency managers perceive risk in terms of impact to their jurisdiction. County emergency managers in this study were found in the states of Federal Emergency Management Agency (FEMA) Region V. The research questions included the following:

1) What risks do county emergency managers perceive to be the most likely to manifest in their jurisdiction?
2) What factors explain their risk perceptions?

Risk Perception

Risk perception research has been rapidly growing within psychology and broadly within natural hazards and disaster research. However, despite the rapidly growing literature on the topic of risk perception, there is remarkably little consensus over what is meant by the term. First, the definitions from psychological research will be expanded on, followed by the hazards research definitions.

According to Sjöberg (1998), "perception" is a term used mainly for sensory experience, while risk perception addresses a much broader set of phenomena. There are clearly multiple definitions of risk perception; in fact, five different researchers are likely to define the term in five distinctly different ways (see for example: Fischhoff et al., 1978; Lindell & Perry, 2000; Mileti & Sorenson, 1987; Sjöberg et al., 2004; Slovic et al., 1985).

Risk has also been defined in various ways. Its nature is complex and a wide range of meanings have been assigned to the term. Fischhoff, Watson, and Hope (1984) suggest that no definition has emerged as the correct one because there is no one definition suitable for all hazardous situations. Slovic (1999) contends that defining risk is an exercise in power. He

asserts that whoever controls the definition of risk controls the rational solution to the problem at hand. Risk has been defined in a number of ways, and "wherever it is discussed, it seems that there is a consensus that the essence of risk consists of the probability of an adverse event and the magnitude of its consequences" (Rayner & Cantor, 1987, p. 4).

Perceptions of risk involve the broad associations made when individuals become aware of various hazards (Slovic, 1987). Because of this complexity and a lack of consensus among scholars, defining risk perception is difficult. Sjöberg (2004) defines risk perception as the subjective assessment of an event happening and how concerned an individual is with the consequences. Put simply, risk perceptions are beliefs or attitudes toward risk (Fischhoff et al., 1978; Lichtenstein et al., 1978; Slovic et al., 1981). To perceive risk includes evaluations of probability, or likelihood, as well as the consequences of a negative outcome. Essentially, the literature breaks risk perception down to a matter of likelihood and consequences.

The disaster literature has emphasized a definition of risk perception in terms of people's expectations of the likelihood of personal impacts from a hazard event (see for example: Jackson, 1981; Lindell & Perry, 2000; Lindell & Perry, 2012; Lindell & Whitney, 2000; Mileti & Sorenson, 1987; Perry & Lindell, 2008; Zhang et al., 2010). Studies of individual risk perceptions have typically used the timeframe of 5 to 10 years (Lindell & Perry, 2012; Lindell & Prater, 2000) when examining the likelihood people associate with experiencing personal impacts as the result of a given type of hazard event. Possible expected personal impacts explored include death, injury, property damage, and interruption of daily activities. Empirical research has demonstrated that risk perception is a predictor of people's decisions to adjust to different types of hazards (Lindell & Perry, 2000; Peacock et al., 2005; Siegrist & Gutscher, 2006).

Due to the lack of agreement among definitions of risk perception, the researcher has chosen a definition that that is in keeping with both the risk perception literature and the disaster literature (Fischhoff et al., 1978; Lindell & Perry, 2012; Perry & Lindell, 2008; Mileti & Sorenson, 1987; Short, 1984; Sjöberg et al., 2004). This research will define risk perception as county emergency managers' perceived likelihood that their jurisdiction will experience a hazard.

Experts vs. Laypeople

There have been relatively few empirical studies done that investigate the risk perception of experts. Before United States Environmental Protection Agency (1987), there had only been one small sample study (N=15) of experts (Fischhoff et al., 1978, p. 92). In their review of the literature on experts vs. laypeople, Rowe & Wright (2001) note that since the United States Environmental Protection Agency (1987) study, there have been only eight original empirical studies on expert-lay differences in risk perception (Barke & Jenkins-Smith, 1993; Flynn et al., 1993; Gutteling & Kuttschreuter, 1999; Kraus et al., 1992; Lazo et al., 2000; McDaniels et al., 1997; Slovic et al., 1995; Wright et al., 2000). Since Rowe & Wright (2001), the researcher could only identify one additional study (Thomson, 2004). A summary of these articles can be found in Table 1. Of note, none of these studies included county emergency managers.

Table 1. Summary of empirical studies on expert risk perception partially adapted from Rowe & Wright (2001)

Study	*Expert Sample*	*Year*
Slovic, Fischhoff, and Lichtenstein	*N* = 15, Various professions	1985
US Environmental Protection Agency	*N* = 75, US EPA career managers and employees	1987
Kraus, Malmfors, and Slovic	*N* = 170, Members of the Society of Toxicology	1992
Flynn, Slovic, and Mertz	*N* = 40, Members of the American Nuclear Society	1993
Barke and Jenkins-Smith	*N* = 1,011, Scientists of the American Association for the Advancement of Science	1993
Slovic et al.	*N* = 150, Members of the Canadian Society of Toxicology	1995
McDaniels, Axelrod, Cavanagh, and Slovic	*N* = 16, Aquatic science professionals	1997
Gutteling and Kuttschreuter	*N* = 91, Computer experts	1999
Wright, Pearman, and Yardley	*N* = 21, Members of the United Kingdom Offshore Operator's Association	2000
Lazo, Kinnell, and Fisher	*N* = 26, Pennsylvania State researchers and US EPA employees	2000
Thomson, Önkal, Avcioglu, and Goodwin	*N* = 64, Experienced and novice helicopter pilots	2004

Rowe & Wright (2001) contend there is little empirical evidence to support the notion that experts perceive risk differently than laypeople nor is there evidence supporting the notion that expert risk perceptions are more accurate. While commonly asserted that experts have different risk perceptions than laypeople (see for example: Bostrom, 1997; Covello, 1983; Sjöberg, 1999, Wright et al., 2000), it has been noted that the small body of existing research on expert risk perception has methodological issues and does not measure the influence of important factors such as demographics (Rowe & Wright, 2001; Thomson, 2004). Additionally, existing literature tended not to look at how experts and laypeople perceive risk, instead studying the way

individuals define and communicate risk (Siegrist & Gutscher, 2006; Sjöberg, 1998; Slovic, 1999). Although these are risk-related issues, they are not the same as risk perception. Nevertheless, Thomson et al. (2004) argue that expert risk perception is important to study in and of itself.

According to Jasonoff (1998), "laypeople are those not qualified as experts by virtue of specialized education, skills, knowledge, or experience" (p. 91). In many situations, however, the title of "expert" may be simply given to those who hold particular roles rather than on the basis of actual expertise (Rowe & Wright, 2001). Shanteau (1992) notes that the usual way an individual acquires the label of "expert" is through peer-consensus. These definitions leave the line between laypeople and experts uncertain. Experts may be enormously knowledgeable about some aspects of a risky situation (e.g., engineering or mortality statistics), more than other relevant factors (e.g., sociological or human factors). The distinction between laypeople and experts is largely open to interpretation (Janasoff, 1998, p. 92).

County Emergency Managers

County emergency managers were considered experts for the purposes of this study, and the researcher contends their risk perceptions are worth investigating. Emergency management as a profession is defined as the managerial function charged with setting the framework in which organizations and communities respond to, prepare for, mitigate against, and recover from hazard events (Federal Emergency Management Agency, 2007). As articulated in the previous section, there have been few studies on the risk perception of experts. To the researcher's knowledge, there have been no studies investigating the perceptions of county emergency managers using a comprehensive list of variables found to influence risk perception through

research. Existing research has been focused on laypeople and has failed to establish the issues or factors involved in expert perception of risk.

At the professional level, the critical tasks prior to, during, and following a hazard event involve coordination among organizations, different levels of government, and any assortment of people at the individual and household level (Waugh & Streib, 2006). The effective coordination of these complex operations falls largely on the shoulders of county emergency managers (Drabek, 1987).

While this study did not focus on behaviors that result because of risk perceptions, it is important to note research has found that perceptions *inform* behavior. As early as 1927, W.I. Thomas suggested attitudes play a key role in the formation of behavior (Thomas, 1927). The relationship between attitudes and behavior has been a major topic of research in social psychology (see for example: Ajzen, 1991; Eagly & Chaiken, 1993; Weber et al., 2002). Additional research in psychology suggests that risk perceptions highly influence decisions made by individuals (see for example: Schwartz & Hasnain, 2002; Sitkin & Weingart, 1995; Weber & Millman, 1997).

Similarly, disaster researchers have consistently found that risk perception influences the extent to which individuals and households undertake hazard adjustments (see for example: Burton & Kates, 1964; Keller et al., 2006; Lindell & Perry, 2000; Peacock et al., 2005; Siegrist & Gutscher, 2006; Terpstra & Lindell, 2012; Terpstra et al., 2009; Whitney et al., 2004). Hazard adjustments are actions or behaviors that intentionally or unintentionally reduce risk from hazard events (Lindell & Perry, 2000). Having established the connection between risk perception and behavior, this study did not explore the behaviors that people engage in based on their risk perceptions. However, the notion that perception informs behavior gives further weight to the

value of investigating the risk perception of county emergency managers. These individuals have not been studied, and the decisions they make based on their risk perception may influence the behavior of people in their jurisdiction.

This study examined the factors that cause county emergency managers' risk perceptions to vary, if any. An important next step would be research on how these perceptions inform the professional behavior of county emergency managers.

Significance

The body of traditional risk perception literature has failed to integrate similar work from different disciplines, most notably natural hazards and disaster research. The researcher synthesized and tested concepts and theory from disaster research, and combined them with the traditional risk perception literature. This study tested risk perception in a more comprehensive way than previous studies by incorporating explanatory variables from multiple bodies of literature that have not been tested together before. Additionally, traditional explanatory variables were extended logically in terms of how they apply to county emergency managers as professionals. It was the researcher's hope that this fusion would provide further support in some areas, as well as lead to the exploration of how other factors might influence risk perception. This research also considered the risks county emergency managers perceive to be the most likely to manifest in their jurisdiction.

The researcher hopes the results of this study will provide a better understanding of the extent to which the risk perceptions of county emergency managers vary and why. This study attempted to set the foundation for future exploration of whether county emergency managers' risk perceptions are connected to the protective activities in which they engage in and how.

Risk perception research has provided us with a significant amount of information about the risk perception of laypeople, and the public in general. Yet, few studies have investigated the risk perception of experts empirically, and none have examined county emergency managers specifically. This study also attempted to synthesize risk perception research from different disciplines and submit new, professionally extended explanatory variables alongside traditional ones in an effort to understand county emergency managers' risk perception. While these new variables produced a small adjusted R^2, this study made contributions to the aforementioned areas of weakness in the existing research.

Conclusion

There remains considerable work to be done to understand expert or professional perception of risk. Investigating the risks that county emergency managers perceive to be most likely, and the factors that explain variation in those perceptions, will help provide researchers with a better understanding of risk perception. This chapter has presented the research questions for this study and the potential significance for the results. Chapter Two discusses the frameworks through which risk perception has been investigated, how risk perception has been tested, and factors related to risk perception. Chapter Three explains the methodology that was used to operationalize risk perception in this study.

CHAPTER TWO: LITERATURE REVIEW

The following Literature Review discusses how the risk perception and disaster literature informed this research. The Literature Review is comprised of two main sections. The first section outlines two frameworks of risk perception research. The second section includes several subsections that describe the factors related to risk perception that have been identified throughout the literature as variables that influence the way individuals perceive risk.

Dominant Risk Perception Frameworks

Risk perception emerged as an important policy issue in the 1960s, most notably pertaining to nuclear technology (Sjöberg et al., 2004, p. 8). When opposition to this technology arose, Sowby (1965) suggested that comparisons of risk should be made. A few years later, an important paper by Starr (1969) prompted the growth of risk perception research throughout the 1970s. Groundbreaking studies in this period suggested that risk perceptions could be quantified (Fischhoff et al., 1978; Lichtenstein et al., 1978).

After several decades of research on perceived risk, two distinct theories have emerged as dominant in the study of risk perception. One, the Psychometric Paradigm, originated in the discipline of Psychology and various branches of mathematics (Sjöberg et al., 2004). The other is the disaster literature's approach of investigating risk perception. The disaster literature approach both provides further support for the variables suggested in the risk perception literature, and suggests several additional variables (e.g., information source, trust, hazard experience) are related to risk perception. These two approaches to studying risk perception will be briefly reviewed in the coming pages.

The reader should be aware that other models have been used to study risk perception, but have faded in popularity over time (Slovic, 1987). For instance, the Axiomatic Measurement

Paradigm is rooted in utility theory, and uses numbers to express the probability of risk numerically (Coombs & Pruitt, 1960; Edwards, 1953; Mosteller & Nogee, 1951). Empirical research employing aspects of the Axiomatic Measurement Paradigm continues to a small extent today, but has largely been dismissed as descriptive and methodologically flawed (Slovic, 1987; Slovic et al., 1982). The disaster literature provides many theoretical models that could have been used to study how individuals form risk perceptions and take protective measures including the Theory of Reasoned Action (see for example: Fishbein & Ajzen, 1975), the Theory of Planned Behavior (see for example: Ajzen, 1991), and the Protective Motivation Theory (see for example: Rogers, 1983). These frameworks are similar to a more recent approach called the Protective Action Decision Model (PADM), which attempts to explain, among other things, how individuals decide that a threat is real and whether or not to take action related to a threat (Lindell & Perry, 1992, 2000, 2004, 2012). While all of the disaster literature approaches to risk perception have been used to inform this study, the PADM has been the dominant framework in disaster research, and it provides the best explanation for people's thought processes leading up to decisions and subsequent behavior.

The Psychometric Paradigm

The Psychometric Paradigm was first articulated and tested in an article by Fischhoff et al. (1978). This approach is the overwhelming favorite in the field of risk perception in terms of both promise and empirical results (Bronfman, et al. 2005; Fischhoff et al., 1978; Jenkin, 2006; Lichtenstein, 1978; Marris et al., 1997; Schmidt, 2004; Siegrist et al., 2005; Sjöberg, 1996). The fundamental assumption underlying the Psychometric Paradigm is that risk is inherently based on an individual's feelings; in other words, it is determined by psychological processes internal

to each individual (Jenkin, 2006; Krimsky & Golding, 1992; Sjöberg, 2000; Sjöberg et al., 2004; Slovic et al., 1985; Slovic, 1987).

This paradigm is built around the cognitive processes with which individuals collect and process information and form perceptions (Oltedol et al., 2004; Rippl, 2002; Scherer & Cho, 2003; Slovic et al., 1982; Slovic, 1992; Slovic et al., 1985). A major development in the Psychometric Paradigm was the discovery of mental strategies called *heuristics* (Slovic et al., 1980; Slovic et al., 1982). People employ heuristics in order to make sense out of an uncertain world, most commonly when a quick decision or response is required (Finucane et al., 2000; Sjöberg, 2000; Slovic et al., 1980; Slovic et al., 1979; Tversky & Kahneman, 1974). The use of heuristics can influence an individual's risk perception by causing a person to make split-second decisions without considering a full range of available or relevant information.

The goal of researchers has been to define the abstract concept of risk by using psychological scaling procedures in which participants are asked to rate a given set of hazardous activities, substances, and/or technologies, and then indicate their level of concern for their lives and personal property related to these hazards (Green, 1980; Renn, 1981; Slovic et al., 1979; Slovic et al., 1982; Slovic et al., 1985). These studies have typically employed multivariate analysis to produce quantitative representations of risk perceptions. In early studies, researchers used surveys to examine factors in people's perception of risk. Some studies have both tested variables and categories of variables that were found to influence an individual's risk perception and replicated those findings (Fischhoff et al., 1978; Hinman, 1993; Lichtenstein et al., 1978; Slovic et al., 1981; Slovic et al., 1982;).

There are several criticisms of the Psychometric Paradigm. For instance, some have claimed that the Paradigm disregards the potential influence of sociodemographic characteristics

and has not adequately accounted for the subjectivity of individuals in self-report based research (Bellaby, 1990; Bronfman, 2005; Kraus & Slovic, 1988; Lupton, 1999; Sjöberg, 1996; Sjöberget al., 2004; Vlek & Stallen, 1981; Wilkinson, 2001). Another criticism of the Psychometric Paradigm has been its use of aggregate, or average data across participants, rather than raw data (Bronfman et al., 2005; Marris et al., 1997; Siegrist et al., 2005). The use of aggregate data can make perceptions at an individual level unclear because it is more of a summary of a *collection* individuals. In other words, critics claim that previous research has neglected to distinguish between the risk perceptions of individuals and groups of people. This discussion about aggregate data has led some authors to contend that studies using the Psychometric Paradigm are simply models or descriptions of data without explanatory power (Siegrist, 1999; Sjöberg, 1998; Wilkinson, 2001; Windschitl & Wells, 1996). A further critique is the Psychometric Paradigm's failure to account for the influence of culture on risk perception (Freudenberg & Pastor, 1992; Wilkinson, 2001). Slovic et al. (1982) admit, "virtually anything can be a determiner of risk perception." A number of biases are also of concern, including an "anchoring" bias in which test subjects choose a representative value that seems relevant in their minds. Additionally, there still appears to be little agreement upon the meaning of risk perception (Fischhoff et al., 1978; Lindell & Perry, 2000; Mileti & Sorenson, 1987; Sjöberg et al., 2004).

The Disaster Literature Approach

In a study of county emergency managers, the researcher contends that a disaster literature approach to risk perception is critical to the comprehensiveness of this study. This section will explain a second way of investigating risk perception that originated in the disaster literature. While no current theoretical model completely accounts for a psychological and behavioral response to natural disasters, elements of complimentary frameworks and research

have been used in the development of several models and theories. The Conservation Warning and Response Model (Lindell & Perry, 1992; Perry & Muschkatel, 1984) has been useful in the past for understanding psychological and behavioral reactions to the threats posed by natural hazards. Protection Motivation Theory investigates the cognitive processes involved in behavioral change (Floyd, et al., 2000; Rogers, 1983). The Theory of Reasoned Action (Fishbein & Ajzen, 1975) is concerned with the determinants of consciously intended behaviors.

Within disaster research, theories have not been explicit about studying risk perception. For example, existing literature has often looked at the way individuals *define* and *communicate* risk, and use it as a proxy for the ways in which individuals *perceive* risk. To the extent that disaster research has explicitly investigated risk perception, studies have employed the PADM (Lindell & Perry, 2000). The PADM contains elements that make it particularly useful in a study of individual risk perception. The PADM is "a direct extension of earlier theories of emergent norms, response to environmental hazard vulnerability, and emergency warning response" (Lindell & Perry, 2000, p. 485). It is important to reiterate that while most disaster research frameworks and theories investigate behaviors to some extent, this research is not aimed at the actions of individuals, but rather at the ways in which individuals perceive risks that lead to those actions.

Within the PADM, individuals are led to ask a series of questions about their situation. Only the period of time leading up to the first question in the model—"whether the threat is real"—is of interest for the purposes of this research. This is the period of time in which a county emergency manager will determine if a hazard event is likely to impact their jurisdiction. Studies employing the PADM often involve a test for differences among risk perception items. These studies predominantly use multivariate regression analysis to test the correlation between

risk perception and hazard adjustments (Lindell & Hwang, 2008; Lindell & Prater, 2000; Lindell & Whitney, 2000; Perry & Lindell, 2008) and have had mixed results pertaining specifically to the predictive power of risk perception on hazard adjustments. With the exception of a small emphasis on the PADM, this research will draw on the existing body of disaster literature in general as it pertains to risk perception.

One of the major limitations of disaster studies is that in many cases variables form causal chains (Lindell & Hwang, 2008). In order for these variables to be significantly correlated, the preceding variable needs to be present. For instance, hazard experience causes risk perception, and risk perception is predicted to cause hazard adjustment adoption. Additionally, some studies have only provided a partial explanation of the relationship between risk perception and hazard adjustment when much higher correlations were expected (Lindell & Hwang, 2008; Lindell & Prater, 2000).

These two frameworks have a great deal in common, most obviously their attempts at measuring risk perception. However, very rarely have researchers looked for further explanatory power outside of a given framework's disciplinary boundaries (Marris et al., 1998). Traditionally, the Psychometric Paradigm has been promoted by psychologists. The researcher contends that this study's addition of the disaster literature approach will provide for a more valid measurement of risk perception. The variables the reader will see in the next section will merge the variables used in the frameworks outlined above. The researcher intends for these factors to help address his second research question: What factors explain variation in county emergency managers' risk perceptions? A summary of the most important characteristics of each framework can be found in Table 2.

Table 2. Summary of risk perception frameworks

	Psychometric Paradigm	*Disaster Literature*
History	Long	Short
Assumptions	Risk is inherently based on an individual's feelings and thoughts, and it is psychologically determined	Social context, environmental cues, and social information about a hazard act together with prior personal experience by stimulating people to ask a series of questions about their situation
Dominant Method	Quantitative	Quantitative
Operationalization of Risk Perception	The subjective assessment of an event happening and how concerned an individual is with the consequences	Expectations of the likelihood of personal impacts from a hazard event
Extent of Use	High	Low; limited to hazards and disaster research
Critique	• Disregard of sociodemographic characteristics • Subjectivity of individuals • Failure to account for the influence of culture on risk perception	• Creates causal chains of variables; • Provided a only partial explanation of the relationship between risk perception and hazard adjustment when stronger correlations were expected

Factors Related to Risk Perception

This section will describe several categories of variables that influence risk perception. These variables are derived from the bodies of literature previously discussed. Each of the variable categories identified in the risk perception literature will be used to identify and operationalize the independent variables for this study.

Demographics

Individual socioeconomic and demographic characteristics play an important role in determining risk perception (Peacock et al., 2005). Sex is strongly related to risk perception. Many studies have found differences in sensitivity to risks among women in contrast to men, and, more specifically, many studies have documented the finding that males tend to assign less significance to risks than do females (Brody, 1984; Boholm, 1998; Davidson & Freudenberg, 1996; Dejoy, 1992; Flynn et al., 1994; Fothergill, 1996; Peacock et al., 2005; Slovic, 1999). Several studies have tested sex as a general variable influencing risk perception and have produced significant correlations (Finucane et al., 2000; Flynn et al., 1994; Fothergill, 1996; Ho et al., 2008; Lindell & Hwang, 2008; Slovic et al., 1997).

Age is a variable that has been assumed to influence risk perception (Bellaby, 1990; Wilkinson, 2001), although the findings have been inconsistent (Peacock et al., 2005). Research has focused on teens and their decisions to engage in risky behavior. For example, several studies have shown that younger drivers are more likely to engage in risky driving behaviors and are more likely to have been involved in accidents and violations because they perceive fewer risks (Finn & Bragg, 1986; Jonah, 1990; Jonah & Dawson, 1987; Matthews & Moran, 1986). However, these are studies that focus on a particular age. Recent studies in which age has been tested as a general variable influencing risk perception have produced minimal significant correlation (Lindell & Hwang, 2008; Lindell & Whitney, 2000; Peacock et al., 2005; Rivers et al., 2010; Siegrist & Gutscher, 2006).

Socioeconomic status (SES) is the social standing or class of an individual or group. In the past, researchers have generally used one or a combination of education (see for example: Armas & Avram, 2009; Ho et al., 2008; Lindell & Whitney, 2000; Peacock et al., 2005), income

(see for example: Lindell & Hwang, 2008; López-Marrero, 2010; Siegrist & Gutscher, 2008), and occupation (see for example: Bastide et al., 1989; Bontempo et al., 1997). The combination of these three indicators most commonly used to operationalize SES has been said to provide for a relatively accurate assessment of an individual's place in the societal hierarchy (Adler et al., 1994). Education is typically positively correlated to risk perception while income is negatively correlated, but often not statistically significant (Kellens et al., 2013). Occupation will not be tested in this study because all respondents are county emergency managers.

Race and ethnicity has been looked at within risk perception research with inconsistent results. Members of ethnic minorities have been lumped together as "non-white," and there is need for a much greater differentiation (Bastide et al., 1989; Bellaby, 1990; Boholm, 1998; Karpowicz-Lazreg & Mullet, 1993; Vaughan & Nordenstam, 1991; Wilkinson, 2001). Limited evidence suggests that ethnic *minority* status is significantly related to risk perception (Adeola, 2000; Fothergill et al., 1999). This lack of differentiation is both unfortunate and significant because theoretical and methodological doubts have been raised about ethnicity as a determinant in the perception of risk. Tierney et al. (2001) are among the researchers who suggest that more research is needed to understand which ethnic groups are most likely to perceive themselves as more vulnerable to risk.

Finally, home ownership has been shown to be related to perceived risk (Kellens et al., 2013). Research suggests that owning a property results in higher levels of perceived risk than renting a residence (Burningham et al., 2008; Kreibich et al., 2009). It has been suggested that homeowners may suffer much more loss than tenants because of their responsibility for damages to the building itself (Grothmann & Reusswig, 2006).

The literature has made it clear that the above variables are involved in individual risk perception. Thus, any study of individual risk perception should test for the relationship between the following variables, and their influence on risk perception. They include:

- Sex
- Age
- Socioeconomic Status (SES)
    - Income
    - Education
    - Occupation
- Race/Ethnicity
- Home ownership

Because of this study's focus on county emergency managers, the demographic variables will be extended logically in terms of how they apply to a professional. To the extent that previous research has studied the risk perception of professionals, demographic variables have been examined only on a personal level. In other words, questions in past studies have not been framed in terms of how they might apply to a professional, which has been problematic during data collection. It is the researcher's hope that professionalized demographic variables will provide a more accurate measurement of risk perception. Moreover, many of the variables have a very clear logical extension. When age is being used in the literature, it seems as though it is being used as a proxy for experience. Thus, a logical extension in a professional sense would be to ask county emergency managers the number of years of experience they have in their position.

Income is a way of looking at available sources, and the professional equivalent is the total budget for a jurisdiction's emergency management program. Education can be seen as a

proxy for a person's knowledge and/or skills. The professional extension of the education variable might assess whether or not county emergency managers hold an emergency management certification and the total number of hours of training they have had related to: existing hazards and how they work, hazard analyses, vulnerability analyses, and risk assessments. A final professionalized variable is jurisdiction population. While this variable does not extend directly from one of the personal-level demographic variables, the researcher contends that total population of a jurisdiction is an important consideration in a study on risk perception. There has been suggestion in the disaster literature that rurality may influence how a host of emergency management issues are approached and perceived (Baez & Santos, 2007; Manley et al., 2006). Population will serve as a proxy for rurality.

Several demographic variables did not have a logical extension in a professional sense. These include sex, occupation, race/ethnicity, and home ownership. Thus, in addition to the traditional demographic variables, the following extended variables were included in this study:

- Years of experience
- Emergency management program budget
- Emergency management certification
- Hours of training
- Jurisdiction population

Hazard Experience

Research has shown that physical exposure to hazards and experience with previous hazard events can influence risk perception (Kellens et al., 2013). Previous hazard experiences have been found to increase risk perception (Burningham et al., 2008; Kellens et al., 2011; Keller et al., 2006; Siegrist & Gutscher, 2006), and the likelihood that individuals will adopt hazard

adjustments (Grothmann & Reusswig, 2006; Hung, 2009). Finally, some studies have suggested that the effects of hazard experience on perceived risk are indirect, and mediated by other variables (Lindell & Hwang, 2008; Terpstra, 2011; Zaalberg et al., 2009).

Research has defined hazard experience as the extent of impacts (e.g., damage to property or environment, personal injury) experienced by the respondent him/herself, by members of the immediate or extended family, or by friends, neighbors, and/or co-workers (Jackson, 1981; Kellens et al., 2013; Lindell & Perry, 1992; Lindell & Hwang, 2008; Sattler et al., 2000; Weinstein, 1989). Additionally, other research suggests that more recent and frequent experiences of hazard events lead to higher levels of risk perception (Burn, 1998; Siegrist & Gutscher, 2006). As we get to know a new risk, or as more time passes, the risk gradually becomes more accepted even though the technical risk remains the same. This decrease in risk perception is known as attenuation or habituation (Kasperson & Kasperson, 1996). Physical exposure to a hazard is mostly determined by an individual's location or his or her proximity to a hazard source (e.g., coastlines, fault lines, etc.). Given respondents' roles as county emergency managers, it is assumed they are dealing with risks, which is why there is a position for county emergency managers in the first place. Therefore, it does not make sense to measure exposure in this study.

People may or may not recall what they experience directly or indirectly. An individual's ability to remember their hazard experiences is influenced by heuristics. Heuristics are defined as mental shortcuts or guidelines, which are used by individuals to reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations (Tversky & Kahneman, 1974). Heuristics have been found to be related to individual risk perceptions, particularly where uncertainty about the risk exists (Kahneman et al., 1982; Renn, 1998; Siegrist

& Gutscher, 2006; Sjöberg, 2000; Tversky & Kahneman, 1974). Generally, these shortcuts are simple, but they can also lead individuals to make critical errors in their perception of risk.

Two heuristics in particular appear sporadically throughout risk perception and disaster literature. First, the availability heuristic relates to what people remember and not to what actually has taken place (Boholm, 1998; Folkes, 1988; Kahneman et al., 1982; Tversky & Kahneman, 1974). Second, the affect heuristic relates to feelings or emotions about a previous experience that influence decisions (Finucane et al., 2000; Keller et al., 2006; Slovic & Peters, 2006; Slovic & Västfjäll, 2010). In both cases, an individual's risk perception may be influenced while likely leaving relevant information out.

The literature has made it clear that hazard exposure and previous hazard experience have an influence on risk perception, although the extent of that influence is somewhat unclear. This study will examine their influence upon other variables, as well as their influence on risk perception. The hazard experience variable will be operationalized as follows:

- Personal Hazard Experience (you personally)
    - Type of hazard event
- Impact
    - Frequency
    - Recency
    - Severity of impacts
    - Personal feelings

Because of this study's focus on county emergency managers, the hazard experience variables will be extended logically in terms of how they apply to a professional. As previously mentioned, to the extent that existing research has studied the risk perception of professionals,

questions have only been asked in terms of how professionals perceive risk themselves personally, and not in a professional sense. It is the researcher's hope that professionalized hazard experience variables will provide a more accurate measurement of risk perception. Moreover, many of the variables have a clear logical extension simply by adding questions regarding people in a county emergency manager's jurisdiction in addition to questions regarding the county emergency manager personally.

A logical extension for frequency in a professional sense would be to ask county emergency managers about not just their personal experience with a hazard event but their jurisdiction's experience as well. Similarly, the professional extension for recency will be to ask county emergency managers how recently their jurisdiction experienced a type of hazard event. The professional equivalent of extent of impact will be to ask county emergency managers how severe the impacts experienced by their jurisdiction were with respect to the jurisdiction's most recent experience with a type of hazard event. Finally, the logical extension of feelings about impact in a professional sense will be to ask county emergency managers to indicate the intensity with which people in their jurisdiction experienced certain feelings with respect to the jurisdiction's most recent experience with a type of hazard event. Thus, in addition to the traditional hazard experience variables, the following extended variables will be included in this study:

- Professional Hazard Experience (your jurisdiction)
    - Type
        - Natural hazard
        - Act of terror
- Impact

- Frequency
- Recency
- Severity of impacts
- Jurisdiction's feelings about impact

Information

A variety of social groups, such as authorities, news media, and peers can serve as sources of risk information (Lindell & Hwang, 2008). It is often suggested that inaccurate risk perception can be "fixed" by clearly informing the public about a hazard (McCaffrey, 2004). Viscusi (1997) would argue however that the information source itself is not as important as the extent to which it is trusted.

Trust or credibility of the information source, or those responsible for managing hazard information, has been identified as a key influence of risk perception (Frewer et al., 1996; Lindell & Hwang, 2008; Lindell & Perry, 2012; Oltedol et al., 2004; Perry & Nigg, 1985; Peters et al., 1997; Slovic, 1999; Slovic et al., 1991). Risk and trust intertwine, and the amount of trust an individual places in an information source can be a key factor in risk perception (Kasperson et al., 1992; Marris et al., 1998; Sjöberg, 2001; Slovic, 1999; Slovic et al., 1991; Viscusi, 1997; White, 2005).

Research has recently shown empirical evidence of trust's influence on risk perception. For example, Peters et al. (1997) found that perceptions of trust were dependent on three factors: perceptions of knowledge and expertise; perceptions of openness and honesty; and perceptions of concern and care. Similarly, Kasperson et al. (1992) identified four dimensions of trust: 1) commitment to a goal 2) competence 3) caring and 4) predictability. Additional studies have

produced mixed results relative to these two studies (Marris et al., 1998; Metlay, 1999; Sjöberg, 2001; Slovic, 1999).

In addition to trust and credibility, the effectiveness of hazard information depends on a consistent source with a consistent message (Faupel & Kartez, 1991; McCaffrey, 2004; Mileti & Sorensen, 1990; Sorensen, 2000). In most hazard events there are numerous inconsistencies when information is disseminated. As Mileti & Sorensen (1990) note, consistency can be created by simply referencing and repeating what was last said, what has changed, and why (pp. 3-12).

Any study of individual risk perception should examine the extent to which individuals trust, rely on, and perceive to be consistent a given set of information sources. The information variable will first be operationalized as follows, and then will be professionally extended by providing professional information sources:

- Source
- Reliance
- Trust
- Consistency

Because of this study's focus on county emergency managers, an additional variable suggested will be the existence or status of a jurisdiction's hazard analysis, vulnerability analysis, and/or risk assessment. These assessments provide county emergency managers with valuable information about their jurisdiction that could directly influence their risk perception (Pine, 2009). Thus, the following additional variables will be included in this study:

- Existence or status of
    - Hazard analysis

- Vulnerability analysis, and/or
- Risk assessment

Uncertainty and Dread Risk

In 1978, an historic paper published by Fischhoff, Slovic, Lichtenstein, Read, & Combs began exploring the extent to which perceived risks influenced individual's assessments of the likelihood that certain hazard events or threats would manifest. Nine dimensions were hypothesized to influence risk perceptions, and are listed below.

1. Voluntariness- Do people get into these situations voluntarily?
2. Immediacy of Effect- To what extent is the risk of death immediate?
3. Knowledge about risk- To what extent are the risks known precisely by the persons who are exposed to those risks?
4. Knowledge about risk- To what extent are the risks known to science?
5. Control over risk- If you are exposed to a risk, to what extent can you, by personal skill or diligence, avoid death while engaging in the activity?
6. Newness- Are these risks new, novel ones or old, familiar ones?
7. Chronic-catastrophic- Is this a risk that kills people one at a time (chronic) or a risk that kills large numbers of people at once (catastrophic risk)?
8. Common-dread- Is this a risk that people have learned to live with and can think about reasonably calmly, or is it one that people have great dread for—on the level of a gut reaction?
9. Severity of consequences- When the risk form the activity is realized in the form of a mishap or illness, how likely is it that the consequence will be fatal?

The nine dimensions were highly intercorrelated (Fischhoff et al., 1978). This finding was interpreted to mean that the dimensions together *as a group* predict the dependent variable—risk perception—very well, but that the predictive power of a single dimension may not produce valid results. Subsequent research has reduced these nine dimensions to two. The first dimension, *uncertainty*, suggests that hazard events that are uncertain or uncontrollable heighten perceived risk (Burns et al., 2012). Typically, uncertainty has been measured by combining the measures for:

- Knowledge about risk by persons
- Knowledge about risk by science
- Newness of risk

The second, *dread*, suggests hazard events that are dreadful to contemplate heighten perceived risk (Burns et al., 2012). Dread has typically been measured by combining the measures for:

- Control over risk
- Catastrophic-chronic potential
- Severity of consequences

Work since 1978 has consistently tested these two dimensions as opposed to the old nine dimensions (Burns et al., 2012; Kleinhesselink & Rosa, 1991; Loewenstein et al., 2001; McCaffrey, 2004; Schmidt, 2004; Sjöberg, 2001; Slovic, 1987; Slovic, 2010; Slovic et al., 1985; Slovic et al., 1991; Wright et al., 2000). The literature has made it clear that, at minimum, ambiguity associated with risk influences individual risk perceptions. Therefore, a study of individual risk perception should investigate the degree to which these variables are related to risk perception. Thus, this study will explore perceptions of:

- Personal uncertainty associated with different types of hazard events

- Personal dread associated with different types of hazard events

These variables will be professionally extended logically in terms of how they apply to people in a county emergency manager's jurisdiction. As previously mentioned, to the extent that existing research has studied the risk perception of professionals, questions have only been asked in terms of how professionals perceive risk themselves personally, and not in a professional sense. It is the researcher's hope that professionalized uncertainty and dread variables will provide a more accurate measurement of risk perception. Moreover, many of the variables have a clear logical extension simply by addressing questions toward people in a county emergency manager's jurisdiction rather than toward the county emergency manager personally.

The logical extension in a professional sense for knowledge about risk will be to ask county emergency managers the extent to which they believe a type of hazard event is known precisely by people in their jurisdiction. The professional equivalent for control over risk will be to ask county emergency managers the extent to which they believe people in their jurisdiction can avoid death form a type of hazard event by virtue of their personal skill or actions they take. The professional extension of severity of consequences will be to ask county emergency managers how severe they believe consequences associated with a type of hazard event will be to people in their jurisdiction. Newness of risk, catastrophic consequences, and chronic consequences did not have a logical extension in a professional sense.

Conclusion

This Literature Review has synthesized variables commonly used in psychology and disaster research to study risk perception. These variables will be examined in this study of county emergency managers' risk perception. Additionally, this study will extend the variables commonly tested in a professional sense to assess their individual influence on county

emergency managers' risk perception. Chapter Three will now introduce and justify the research design for this study.

CHAPTER THREE: RESEARCH METHODS

Chapter Three is comprised of five sections. The first section outlines this study's population and sampling procedures. The second section presents the study's method of data collection. The third section reviews the survey design and measures. The fourth section addresses the issues of reliability and validity in this study. And the fifth section reviews the study's limitations.

Population and Sampling

The population for this study was all county emergency managers working in the six state area of FEMA Region V including Indiana, Illinois, Michigan, Minnesota, Ohio, and Wisconsin. This study was a census of all county emergency managers in FEMA Region V. The process of identifying a sample of county emergency managers in FEMA Region V began by consulting each state's emergency management website to determine how many county emergency managers were in each state, and then retrieving their contact information. Email addresses were available for all county emergency managers in all states in the region. There are a total of 524 county emergency managers listed in the six states. See Table 3 below for a breakdown of the numbers by state.

Table 3. Breakdown of county emergency managers in FEMA Region V

State	*Number of County Emergency Managers*
Illinois	102
Indiana	92
Michigan	83
Minnesota	87
Ohio	88
Wisconsin	72
Total	524

This research is exploratory in nature and used an expanded survey that investigated variables on both a personal and professional level. The researcher invited all county emergency managers in the population to participate with the assumption that the response rate would relatively low based on the experience of other people in this department who have attempted to sample county emergency managers (Bundy, 2013; Carr, 2014; Jensen, 2010a). These studies were successful—sometimes in combination with alternative methods—as defined by their study.

Data Collection

The primary method of data collection for this study was an internet survey. This survey was cross-sectional; in other words, the information was collected at one point in time, as opposed to over a period of time in a longitudinal survey (Creswell, 2003). A survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Babbie, 1990; Creswell, 2003, p. 153). The reader should note that there are at least three types of surveys: telephone, mail, and internet. Each of these survey types provides different challenges and advantages.

The data for this study were collected through an internet survey. Internet surveys can raise a number of problems for some respondents, including lack of access to the internet, poor internet connection speed, and varying respondent ability to use the internet (Dillman et al., 2009). Additionally, internet surveys are somewhat of a risk because of the likelihood that they may not reach the intended recipients or they may never be opened and read by some recipients (Dillman et al., 2009, p. 280). Nevertheless, the researcher contends that, in this case, the advantages of an internet survey outweighed the potential disadvantages. Specifically, it allowed the researcher to send questionnaires to an entire sample inexpensively and in a timely manner.

The emergency management website for each state in FEMA Region V lists an email address alongside the name of each county emergency manager. Email was the primary form of communication in this study. Two recent studies of county emergency managers used email surveys as the primary means of data collection (Jensen, 2010; Krueger et al., 2009). The participation rates for Jensen (2010) and Krueger et al. (2009) were 17.4% and 12.2%, respectively, suggesting that, at the very least, there has been some success in emergency management research using this type of survey. Moreover, as the use of computers and the internet has increased, people have become more familiar with the medium. Many work places use the internet on a regular basis, while some depend on it entirely (Dillman et al, 2009).

Step One

Prior to approval of the thesis committee and the Institutional Review Board (IRB), the survey went through a pre-evaluation process with three practicing county emergency managers in a state outside of the sample area to ensure the survey instrument was free of error, omission, grammatical issues, vague or confusing wording, missing options, offensive or biased wording, and any other problems.

Feedback from the three county emergency managers prompted a few minor changes to the survey instrument. For example, the original survey only allowed respondents to choose whole year intervals in response to the question "When did the following entities most recently experience an event related to this type of hazard?" The survey was adjusted to allow participants to respond with decimal points after the whole year value. Another minor change was to provide more clarity for expected responses to the question, "how many times have the following entities experienced an event related to this type of hazard?" One county emergency manager asked, "how far back are you referring, would it just be my career at the county, or in

my lifetime?" The survey was adjusted to provide more specific guidelines to make the mental task easier for potential participants. After the adjustment was made, an IRB protocol was submitted to the IRB at NDSU and approval was received. See Appendix A for a copy of the IRB approval letter for this study.

Step Two

Initial contact was made with potential respondents informing them of the researcher's intent and that they had been selected to participate in a study of county emergency managers' risk perceptions. This contact was made both by email and post-card. In the interest of gaining the attention of potential respondents in this research, the researcher phrased the contact emails and post-cards to appeal to county emergency managers' perception of natural disasters vs. terrorism beginning with the pre-notice email and continuing in the contacts that followed (it is of note that an open-ended question was inserted into the survey to be consistent with the marketing of this study even while data from it were of no central interest to this study).

The email informed potential respondents that a subsequent email containing the survey URL and survey instructions would be sent to them from the researcher in one week's time and outlined the timeframe in which they would be asked to complete the survey. This contact served as the pre-notice email. See Appendix B for a copy of the pre-notice email.

An additional pre-notification contact was made with a postcard mailed to each prospective participant to help establish a more personal connection between researcher and respondent. A mixed mode approach has been shown to improve timeliness, reduce coverage error, improve response rates, reduce nonresponse error, and reduce measurement error (Dillman et al., 2009, pp. 300-305). The postcard informed potential respondents that a subsequent email containing the survey URL and survey instructions would be sent to them from the researcher. It

also provided information about the survey and its usefulness to them as county emergency managers. See Appendix C for a copy of the pre-notice post-card.

Step Three

One week after the researcher e-mailed the pre-notice letter, an invitation letter including the survey URL was sent to all county emergency managers within the population. See Appendix D for a copy of the invitation email. When a respondent followed the survey URL, they immediately saw an information sheet explaining their rights that included a checkbox to indicate their willingness to participate in the survey. The information sheet is the first 2 pages of the survey in Appendix E and is followed by the survey.

A traditional mail survey would typically include some form of a token of appreciation. Since this was an internet-based survey, problems providing tokens of appreciation arose, most notably providing compensation for participation in the form of electronic gift cards. Dillman et al. (2009) note, "incentives such as these have been shown to only modestly increase response rates compared to sending no incentive" (p. 274). The limited success of gift certificates sent electronically may very well stem from the added difficulty (i.e., costs) of redeeming them (Dillman et al., 2009, p. 274). The researcher instead attempted to award participation and show appreciation by thanking the respondent and expressing to him or her how valuable their participation was to this research, as well as how this research may benefit him or her in the future.

During this step, the researcher received error emails indicating there had been a problem with 15 potential respondents' email addresses. After checking the master list to correct any spelling errors on the researcher's behalf, this number shrank to 12. Several emails were still

bounced back due to non-existent or not-functioning email addresses, thus, the original 524 potential respondents became 512 for the purposes of data collection.

Step Four

Throughout the data collection process, the researcher maintained a master list of respondents. The researcher tracked which respondents completed the survey on this master list in order to avoid unnecessary repeat reminder e-mails. Five days after the researcher sent the invitation with survey link, a reminder email with the survey URL was sent to all respondents who had not yet completed the survey. See Appendix F for a copy of the reminder email. This email focused on the short amount of time remaining to complete the survey and the benefits of responding.

In addition to the first reminder email, a reminder post-card was sent. As previously stated, a mixed mode approach can help improve timeliness, reduce coverage error, improve response rates, reduce nonresponse error, and reduce measurement error (Dillman et al., 2009, pp. 300-305). This post card focused on the content of the survey and its importance to emergency management higher education and practice. See Appendix G for a draft of the reminder post-card.

Step Five

The researcher continued to maintain the master list of respondents in the week following the reminder email. At the end of a one-week period, the researcher sent another reminder email containing the survey URL to all respondents who had not yet completed the survey. Multiple contacts and varying message content to potential web survey respondents is the most effective way to increase response rates (Dillman et al., 2009, p. 275). The researcher varied contact methods to the extent possible. However, based on the success of the second reminder email, the

researcher sent out a third reminder email that was identical to the second one. Because sending additional email contacts is inexpensive, one can often leave the final decision on the number of follow-ups until well into the data collection process. For example, if the first and second follow-ups yield significant responses (as was the case in this study), a third follow-up may be useful as well (Dillman et al., 2009). After another one-week period passed, the researcher sent a final reminder email containing the survey URL to all respondents who had not yet completed the survey. See Appendix H for a copy of the final reminder email.

Step Six

The researcher closed the survey and ceased data collection on August 15th, 2014—one week after the final reminder email was sent. As of that date, 214 people followed the survey URL, and 165 people fully completed the survey, resulting in a 32% participation rate (165 out of 512). See Table 4 for the summary of the completions yielded during each step.

Table 4. Summary of survey completions during each step of data collection

Data Collection Step	*Surveys Completed*	*Cumulative Total*
1	0	0
2	74	74
3	34	108
4	29	137
5	28	165

When cleaning the data, it was obvious that some respondents were not being truthful, and there were several outliers that skewed the data so drastically that the cases were dropped. In all, 9 cases were dropped, bringing the total to 156 out of 512, or 30.5%.

Overall Timeframe

The data collection process took four weeks. The return rate of web surveys tends to be quicker than that of traditional mail surveys. Because responses come in quicker from web

surveys, the contacts can be sent out faster (Dillman et al., 2009, p. 279). The optimal timing sequence for web surveys has not been determined yet but the researcher believes the timing of email contacts in this study was reasonable and consistent with the Dillman et al. (2009) guidelines.

Privacy and Confidentiality

All respondents were promised confidentiality. The researchers were the only individuals with access to information obtained from the survey. For the purpose of tracking the data, the names of counties and states were collected. These identifiers were used for tracking survey completions and were not used in any analysis. Additionally, when the data were reported, identifying information was used at the aggregate level, not at the individual level. Thus, the confidentiality of respondents was not at risk. Following the completion of data analysis and the development of a report of the research findings, all data—including any remaining identifiers used—was be destroyed.

Survey Design

The researcher designed the survey instrument in keeping with Dillman et al.'s (2009) suggested procedures to maximize response rates and it was also designed for multivariate regression analysis with reliability and validity in mind. In a multivariate regression study, survey questions must be framed in a way that allows for the appropriate level of measurement. Listed below are several guidelines for crafting good survey questions, provided by Dillman, Smyth, & Christian, (2009).

- Make sure the question applies to the respondent
- Make sure the question is technically accurate
- Ask one question at a time

- Use simple and familiar words
- Use specific and concrete words to specify the concepts clearly
- Use as few words as possible to pose the question
- Use complete sentences with complete sentence structures
- Make sure “yes” means yes and “no” means no
- Be sure the question specifies the response task (Dillman et al., 2009, pp. 79-89)

The measures in this study are presented below, and have been designed following these guidelines.

Risk Perception

The researcher was interested in understanding the factors explaining the risk perception of county emergency managers. Respondents could have answered questions differently based on the type of event involved. To make the mental task of completing the survey easier for the respondent, and the findings of this research more valid and more likely to contribute to existing research, respondents were given a list of hazards, and asked which one represented the most likely event to manifest in their jurisdiction (e.g., Please identify the single most likely hazard to impact your jurisdiction). The decision to use this design was discussed a number of times with the researcher’s advisor and another member of the supervisory committee for this study. The list of hazard events included:

- Biological Threats
- Chemical Threats
- Cyber Attack
- Drought
- Earthquake
- Explosions

- Extreme Heat
- Floods
- Hurricanes
- Landslides/debris flow
- Nuclear Blast
- Radiological Dispersion Device (Dirty Bomb)
- Thunderstorms and Lightning
- Tornadoes
- Tsunamis
- Volcano
- Wildfire
- Winter Storms and Extreme Cold
- Other (please specify)

Then, the degree to which they perceive the chosen hazard event to be likely to occur in their jurisdiction was assessed (e.g., Indicate the extent to which you believe an event related to this hazard will occur in your jurisdiction in the next five years). For the chosen type of hazard event, county emergency managers were provided with the following anchors for a 7-point Likert scale: 0 (Definitely Will Not Occur), 2 (Unlikely), 4 (Likely), and 6 (Will Definitely Occur). County emergency managers were also provided with the options of 7 (Do Not Know), and 8 (Not Applicable). Instructions were provided on subsequent pages in the survey exploring various independent variables. Those instructions asked county emergency managers to answer the questions in the context of the type of hazard event they identified as the greatest risk.

Demographics

The first set of independent variables identified in the literature review is demographics. This research utilized the demographic variables traditionally used in empirical risk perception studies. Additionally, the demographic variables have been extended logically in terms of how they apply to a professional. In previous research, questions about demographic information have not been framed in terms of how they might apply to a professional. This study asked personal-level demographic questions, and then explored them in a professional sense. The measures of the traditional variables will be explained first, followed by the measures of the extended variables.

Traditional demographic variables. The traditional demographic characteristics assessed include the following: a) age, b) sex, c) income, d) education, e) race/ethnicity, and f) whether or not the respondent is a homeowner. For the age variable, county emergency managers were asked to enter their age in years. Sex was coded as a dichotomous variable: 1=male, 2=female. Annual personal income (e.g., Identify the category in which your personal income fits) was measured by providing county emergency managers a list adapted from United States Census Bureau (2010). Income was coded as a dichotomous variable: 1=Less than $50,000 per year, 2=$50,000 per year or more. The options for income included:

- No income
- Under $25,000
- $25,000-$49,000
- $50,000-$74,999
- More than $75,000

The education of county emergency managers was assessed by providing a range of various levels of education and asking them to identify the highest level they had completed (e.g., Identify the highest level of education you have completed). Education was then coded as a dichotomous variable: 1=Less than Bachelor's degree, 2=Bachelor's degree or higher. Respondents chose from the following levels of education, adapted from the United States Census Bureau (2010):

- Less than high school
- Regular high school diploma or GED
- Some college
- Associate's degree
- Bachelor's degree
- Master's degree
- Professional degree beyond a bachelor's degree
- Doctorate degree

For the race/ethnicity variable, county emergency managers were provided with a list of races and ethnicities to choose from (e.g., Identify the option that best describes your race or ethnicity). Race/Ethnicity was coded as a dichotomous variable: 1=white, 2=non white. The list included the following choices adapted from the United States Census Bureau (2010):

- Black, African American, or Negro
- Hispanic, Latino, or Spanish Origin
- White
- American Indian or Alaska Native
- Asian Indian

- Chinese
- Filipino
- Guamanian or Chamorro
- Japanese
- Korean
- Native Hawaiian
- Samoan
- Vietnamese
- Other—*Print Race*

Finally, whether or not county emergency managers rent or own their place of residence (e.g., Do you rent or own your place of residence?) was measured by providing county emergency managers with the options of "rent" or "own." This variable was coded as a dichotomous variable.

Extended demographic variables. The extended demographic characteristics assessed include the following: a) jurisdiction population, b) emergency management program budget, c) years of experience as a county emergency manager and, d) professional certifications and training.

Jurisdiction population was assessed by asking county emergency managers to provide the population of their jurisdiction (e.g., What is the total population of your jurisdiction?) in a fill-in box. In a similar fashion, they were asked to provide the budget of their emergency management program (e.g., What is the total budget for your emergency management program?) in a fill-in box. Then, county emergency managers were asked to provide their years of

experience (e.g., How many years of experience do you have as a county emergency manager?) in a fill-in box.

Finally, the professional training of county emergency managers was assessed through two questions. The first question determined whether or not they hold any emergency management certification (e.g., Do you hold the following types of emergency management certification?). County emergency managers were asked to choose "yes" or "no" for the following types of certifications:

- State emergency management certification, and
- Professional organization emergency management certification

The second question determined the number of hours of training they have had in the following areas (e.g., Identify the total number of hours of training you have had related to the following areas). Respondents were provided fill-in boxes in which to provide the number of hours of training they had related to the following four areas:

- Existing hazards and how they work
- Conducting a hazard analysis
- Conducting a vulnerability analysis
- Conducting a risk assessment

Hazard Experience

The second set of independent variables specified in the literature review is hazard experience. This section operationalizes the availability and affect heuristics explained in Chapter Two. Due to the way the questions for this set of variables appear on the survey, this section represents a blend of traditional and extended hazard experience variables.

The characteristics assessed in this section of the survey include the following: Whether or not county emergency managers have *personally* experienced, and whether or not *their jurisdiction* has experienced the previously chosen type of hazard event (e.g., Have you ever personally experienced an event related to this type of hazard; As far as you are aware, has the jurisdiction you serve ever experienced an event related to this type of hazard?). Both of these variables were coded as dichotomous variables: 1=no, 2=yes. If respondents answered "yes," they were directed to address additional questions to explore the following factors associated with their experience: a) frequency, b) recency, c) severity of impacts, and d) feelings about the impacts. If respondents answered "no," a skip pattern was built into the survey so they were not prompted to answer unnecessary questions.

The availability heuristic relates to what people most readily remember and was operationalized by assessing frequency, recency, and severity of impacts. For the frequency variable, county emergency managers were asked how many times they personally, and/or the jurisdiction they serve have experienced the previously chosen type of hazard event (e.g., How many times have you experienced an event related to this type of hazard; As far as you are aware, how many times has your jurisdiction experienced an event related to this type of hazard?). They were then provided with fill-in boxes to answer the questions, one for their personal experience and one for their jurisdiction.

The recency variable was measured by asking county emergency managers how recently they personally, and/or the jurisdiction they serve have experienced the previously chosen type of hazard event (e.g., When did the following entities most recently experience an event related to this type of hazard?). They were then provided with two fill-in boxes to answer the question,

one for the numbers of years since they personally experienced the hazard event, and one for the number of years since their jurisdiction experienced the hazard event.

For the extent of impact variable (e.g., With respect to your most recent experience with an event related to this type of hazard, how severe were the impacts; With respect to your jurisdiction's most recent experience with an event related to this type of hazard, how severe were the impacts?), county emergency managers were provided with the following anchors for a 7-point Likert scale: 0 (No Impact), 2 (Minor Impact), 4 (Significant Impact), and 6 (Very Severe Impact). County emergency managers were also provided with the options of 7 (Do Not Know), and 8 (Not Applicable).

The affect heuristic relates to feelings or emotions about a previous experience and was operationalized by assessing feelings about impacts. For the feelings about impacts variable, county emergency managers were asked two questions, each with four components (e.g., Indicate the intensity with which *you personally* experienced the following feelings related to your most recent experience with an event related to this type of hazard and, Indicate the intensity with which you perceive *the people in your jurisdiction* to have experienced the following feelings related to your most recent experience with an event related to this type of hazard). The four feelings are: sadness, anger, worry, and anxiety. Each feeling was measured on a 7-point Likert scale with the following anchors: 0 (Not at all), 2 (Mild), 4 (Somewhat Intensely), and 6 (Very Intensely). County emergency managers were also provided with the options of 7 (Do Not Know), and 8 (Not Applicable).

Information

The third key set of variables specified in the literature review is information. The characteristics assessed in this section of the survey include the following: a) information source

and extent of reliance, b) trust in information source, c) consistency of information, and d) existence or status of hazard analysis, vulnerability analysis, and/or risk assessment. The survey measured information source, trust, and consistency by providing county emergency managers with a list of common hazard information sources originally inspired by Lindell & Hwang (2008). However, there did not seem to be an obvious way to ask county emergency managers about their personal risk perception as opposed to their professional role. Thus, the way information source was examined was in the professional sense only, although there is some overlap between those with Lindell & Hwang (2008). The list included the following hazard information sources:

- Academics
- Communication with people in my social network
- Department of Homeland Security (DHS)
- Department of State (DoS)
- Federal Bureau of Investigation (FBI)
- Historical Archives
- Internet
- National Weather Service (NWS)
- Newspapers
- Radio
- State Emergency Management Department or Agency
- State Fusion Center (SFC)
- Television
- United States Geological Survey (USGS)

To measure the information variable for the chosen type of hazard event, county emergency managers were provided with a question about their perception of various sources of hazard information (e.g., Indicate your ratings regarding the extent to which you first, rely on, second, trust, and third, perceive as consistent the following *sources of hazard information about this type of hazard*). Then, for each hazard information source, county emergency managers were provided with three 7-point Likert scales with the following anchors: 0 (Never), 2 (Not Often), 4 (Often), and 6 (Always). County emergency managers were also provided with the options of 7 (Do Not Know), and 8 (Not Applicable).

County emergency managers were also provided with three similarly worded questions to assess the existence or status of a hazard analysis (e.g., How recently did your county conduct/update a hazard analysis), vulnerability analysis (e.g., How recently did your county conduct/update a vulnerability analysis?), and risk assessment (e.g., How recently did your county conduct/update a risk assessment?). These statements were accompanied by two possible choices:

- We have not conducted a [type of analysis/assessment], and
- We have conducted/completed a [type of analysis/assessment]. *Number of years since conducted/completed:* _____.

County emergency managers who selected the second choice were also asked to indicate how long ago the analysis or assessment was conducted or updated in a fill-in box.

Uncertainty and Dread

The fourth set of key independent variables specified in the literature review is uncertainty and dread. To make the survey easy for respondents, this section represented a blend of traditional and extended uncertainty and dread variables. The questions used to measure

uncertainty and dread were adapted from a combination of studies that measured the concepts in similar ways (i.e., Burns et al., 2012; Kleinhesselink & Rosa, 1991; McCaffrey, 2004; Slovic, 2010; Slovic et al., 1985; Wright et al., 2000). Existing literature has asked people about themselves as individuals. This study consistently extends previous measures to not only include county emergency managers themselves, but to also include people in their jurisdictions. Uncertainty and dread were assessed for the previously identified type of hazard (e.g., Answer the following questions with the most likely hazard in mind).

Uncertainty was measured by two question sets. The first question set was comprised of three statements that participants were asked to evaluate using Likert scales. Statements measured the knowledge that laypeople, scientists, and county emergency managers personally have about the chosen type of hazard event (e.g., Indicate the level of precision to which you believe the risk associated with this type of hazard is known), respectively. Three identical 7-point Likert scales were provided—one for the county emergency manager personally, one for laypeople in their jurisdiction, and one for scientists—with the following anchors: 0 (Not Known at All), 2 (Barely Known), 4 (Somewhat Known), and 6 (Known Precisely). In addition to the 7-point Likert scales, county emergency managers were also provided with the options of 7 (Do Not Know), and 8 (Not Applicable). The values of 7 and 8 were included as options for all Likert scale questions, and will not be continually referred to hereafter in this section. The second question measured the newness of a hazard event (e.g., Indicate the extent to which you believe this type of hazard is a new risk). County emergency managers were provided with the following anchors for a 7-point Likert scale: 0 (Very Old), 2 (Old), 4 (Somewhat New), and 6 (Very New). These values were reverse coded for the purposes of data analysis to properly reflect the concept of uncertainty.

Dread was measured by two questions. The first question measured personal control over a hazard event (e.g., Indicate the extent to which you believe the following people can avoid death related to this type of hazard by virtue of the actions they take). Two 7-point Likert scales were provided—one for the county emergency managers, and one for the people in their jurisdiction—with the following anchors: 0 (Impossible), 2 (Unlikely), 4 (Somewhat Likely), and 6 (Very Likely). These values were reverse coded for the purposes of data analysis to properly reflect the concept of dread. The second question had four components, and measured the consequences associated with the chosen type of hazard event (e.g., Indicate the extent to which you believe the following consequences associated with this type of hazard are likely). County emergency managers were provided with four subsequent Likert scales on which to rate the catastrophic (e.g., Kill large numbers of people at once), chronic (e.g., Consistently kill people over time), and fatal (e.g., Consequences likely to be fatal to you; Consequences likely to be fatal to people in your jurisdiction) consequences of the chosen type of hazard event. Four Identical 7-point Likert scales were provided with the following anchors: 0 (Impossible), 2 (Unlikely), 4 (Somewhat Likely), and 6 (Very Likely).

Statistical Analysis

The researcher designed the survey to allow multivariate regression analysis on the data. Multivariate regression is one of the most widely used statistical procedures for both scholarly and applied research. Its popularity is fostered by its applicability to varied types of data and problems, ease of interpretation, robustness to violations of the underlying assumptions, and widespread availability (Mason & Perreault Jr., 1991). An additional benefit is the test's ability to run groups, or blocks, of variables. Multivariate regression analysis:

- reveals the combined predictive power of two or more independent variables and/or independent variable groups on a dependent variable;
- shows the relative predictive power each independent variable and/or independent variable group on a dependent variable; and,
- allows the researcher to test the influence of each of the independent variables and/or independent variable groups on the dependent variable while controlling for the influence of the other independent variables. (Blaikie, 2003, pp. 146-147)

There are some assumptions that underlie a multivariate regression test. When these assumptions are not met the results may not be trustworthy, resulting in over- or under-estimation of significance or effect (Pedhazur, 1997, p. 33). First, and most fundamental, the dependent variable is a function of a number of independent variables (Wright, 1979, p. 147). Second, it is assumed that the model correctly reflects or corresponds to the underlying or real world phenomena (Wright, 1979, p. 149). Third, the survey instrument must be unbiased. The survey instrument must also precisely measure the phenomena under study (Wright, 1979, p. 157). Fourth and finally, linear relationships between variables must exist (Osborne & Waters, 2002, p. 1).

Additionally, in order to run a multivariate regression test, the survey instrument must measure the dependent and independent variables as: 1) continuous interval variables; 2) interval alternative (e.g. a 7-point Likert scale); or, 3) dichotomous nominal variables. Dichotomous variables are typically indexed by the numerical values 0 and 1 (Wright, 1979, p. 150). In order to ensure that data are appropriate for multivariate regression testing, these assumptions and criteria will be validated to the best of the researcher's ability. Refer to Appendix I for a

checklist of how the data were prepared for multivariate regression analysis is SPSS. The checklist was adapted from Green and Salkind (2011).

Reliability and Validity

Reliability can be estimated by how consistent items are among themselves, or how well correlated they are with each other (Wright, 1979, p. 47). The reliability of each independent variable index in this study (i.e., information, uncertainy, dread, affect, availability, and training) was tested with Cronbach's Aplha. Cronbach's Alpha is an internal consistency (or reliability) technique that requires only a single test administration to measure consistency in scores among equivalent items (Green & Salkind, 2011, p. 325). In other words Cronbach's Alpha is assessed among items (e.g., variables within an index). The greater the consistency among items, the higher Cronbach's Alpha will be (p. 327). Values should range between 0 and 1.

The researcher had planned not to use values of less than .7 as is common in the social sciences. Yet, two independent variable indexes (Dread and Uncertainty), consistently tested with respect to risk perception, yielded borderline reliabilities (Cronbach's Alpha = .679 and .680 respectively), and were therefore used during data analysis. The indexes representing certification and the availability heuristic did not yield a reliable Cronbach's Alpha, therefore the variables that make up those indexes were used as individual independent variables. Additionally, the researcher originally intended to explore separate indexes of reliance on information, trust of information, and consistency of information as opposed to an overall information index. However, while these separate indexes were reliable, they were also highly intercorellated. See the multicollinearity tables in Appendixes J through L. Thus, the data would suggest that these are various aspects of the same concept and the researcher determined that the overall information index alone should be used. None of the remaining indexes were inter-

correlated. The central tendencies for each reliable independent variable index as well as the overall reliability scores for each of the indexes are presented in Table 5.

Table 5. Independent variable index means and reliability coefficients

Index	*Number of Items*	*Mean*	*Std. Deviation*	*Cronbach's Alpha*
Overall Information Index	45	3.5	.82	.933
Personal Affect Index	4	1.6	1.4	.822
Jurisdictional Affect Index	4	2.5	1.5	.910
Uncertainty Index	4	5.1	.68	.680
Dread Index	6	1.7	.65	.679
Training Index	4	64.7	140.1	.927

As part of exploring the reliability of data and the distinctness of the concepts this study sought to measure, the researcher checked the inter-correlations of each of the independent variables and independent variable indexes. Pearson's correlation test was used to test correlations of interval to interval independent variables, one-way analysis of variance (ANOVA) was used for interval to nominal independent variables, and Cramer's V was used for nominal to nominal independent variables. Appendixes J through L show the multicollinearity scores for all independent variables in the study, individual and indexes combined.

The survey instrument also demonstrated validity. A measurement instrument is valid if it in fact measures the concept under investigation (Wright, 1979, p. 48). There are four standard criteria for validity: face, content, criterion, and construct (Anastasi & Urbina, 1997; Jenney & Campbell, 1997). The survey met face validity—was sensible at face value—because it was rooted in a large body of existing research on risk perception. The survey increased content validity because of the integration of measurement indicators from disaster literature and the extension of variables in a professional sense.

Limitations

While it was the researcher's intent to produce valuable results, this study's findings are limited for several reasons. As previously mentioned, this study is cross-sectional and did not measure the change in risk perception over time. Therefore, the findings are only able to describe current risk perceptions of the county emergency managers who participate in the study. Next, the population and sampling procedure did not yield generalizable findings. This study intended to describe the influence of several variables on risk perception. Some risk perception studies investigate the influence of only one or two highly influential variables, and therefore study those variables in a more detailed manner, thereby, potentially, increasing the reliability of the findings or at least allowing more testing of the reliability of the measurement tool.

In existing research, risk perception has been defined as a combination of likelihood and consequences (Lindell & Perry, 2012; Perry & Lindell, 2008; Rayner & Cantor, 1987; Zhang et al., 2010). This study focuses largely on likelihood of hazard events. Had risk perception been measured as a combination of consequences *and* likelihood, the concept would have been measured more fully. While this is a limitation, it is also a flaw in the existing risk perception research in that studies largely address likelihood.

Yet, there is benefit in finding clues as to which independent variables and independent variable groups influence risk perception, rather than focusing on only one or two independent variables given the complex nature of risk perception. Finally, as previously mentioned, this study was not interested in the behaviors that people engage in based on their risk perceptions. That work will be left to future research.

Conclusion

This chapter introduced and justified the research design that was used to operationalize the dependent and independent variables presented and defended in Chapter Two. Limitations of this survey design were also outlined. Chapter Four presents the descriptive statistics for the variables involved in this study.

CHAPTER FOUR: DESCRIPTIVE STATISTICS

Chapter Four is comprised of three sections. The first describes the sample profile for the study. The second section presents the descriptive statistics of variables involved in county emergency managers' choices of the most likely hazard to impact their jurisdiction. The third and final section addresses the study's first research question by describing what risks county emergency managers perceive to be the most likely to manifest in their jurisdiction.

Sample Profile

County Emergency Managers

Analysis of basic demographic information revealed that the majority of county emergency managers were male (75.6%) and fifty years of age or older (Mean = 50.8, SD = 11.1). Ages ranged from 21 years old to 75 years old. The education of respondents was split nearly down the middle—48.7% had less than a Bachelor's degree and 51.3% had a Bachelor's degree or higher. Respondents had an average of nine years of experience as county emergency managers (Mean = 9.03, SD = 7.5). Years of experience ranged from 1 year to 21 years. Their personal income varied widely, however, using $50,000 per year as the mid-point, their income was split exactly down the middle with 50% earning above $50,000 per year and 50% earning below $50,000 per year. The vast majority of county emergency managers identified themselves as white (96.2%) and nearly all (92%) own their place of residence as opposed to renting. See Table 6 for the central tendencies for individual demographics.

Table 6. Central tendencies for individual demographics

		Measure of Central Tendency
Years of experience	*N* =156	Mean = 9.0 (SD = 7.5, Skew = 1.1, Kurtosis = .44)
Age	*N* = 156	Mean = 50.8 (SD = 11.1, Skew = -.51, Kurtosis = -.12)
Sex	*N* =156	Mode = Male (Male/Female)
Personal Income	*N* =156	Bi-Modal: (Less than $50,000 per year and $50,000 and above)
Highest level of education completed	*N* =156	Mode = Bachelor's or Higher (Less than Bachelor's, Bachelor's or higher)
Race/ethnicity	*N* =156	Mode = White (White, non-white)
Own or rent place of residence	*N* =156	Mode = Own (own, rent

Overall, more county emergency managers held a state level emergency management certification (66%) than a professional organization certification (29.5%). Extent of professional training was examined by asking if respondents held a state emergency management certification (Mode = Yes) and/or a professional organization emergency management certification (Mode = No). State certifications usually require a combination of Federal Emergency Management Agency online courses, state led training classes, and workshops. These courses are typically meant for individuals who have a defined government role in disasters and are not open to the public. Professional certifications are generally more difficult to obtain than state certifications and have requirements that in some cases include three years of professional experience, a 4-year baccalaureate degree, and contributions to the profession within the last ten years. See Table 7 for the distribution of responses for certification data.

Table 7. Certification data

State Emergency Management Certification				
	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Yes	103	66.0	66.0	66.0
No	53	34.0	34.0	100.0
Total	156	100.0	100.0	
Professional Organization Emergency Management Certification				
Yes	46	29.5	29.5	29.5
No	110	70.5	70.5	100.0
Total	156	100.0	100.0	

Respondents were also asked about the hours of training they had received on the following topics: existing hazards and how they work (Mean = 96.1 hours, SD = 194.6), conducting a hazard analysis (Mean = 55.6, SD = 139.1), conducting a vulnerability analysis (Mean = 52.7, SD = 139), and conducting a risk assessment (Mean = 54.3, SD = 139). County emergency managers by and large varied incredibly in the extent to which they were trained for all four types of training this study assessed. While the means are consistently above 50 hours, the standard deviations are very high, further suggesting a sizeable range in amount of training. For all four types of training, hours ranged from 0 to 1,000 hours. The four components of hours of training were tested for reliability and compiled into a training index. See Table 8 for the central tendencies related to hours of training.

Table 8. Central tendencies for hours of training

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
Existing hazards and how they work	156	96.0	194.6	4.0	16.0
Conducting a hazard analysis	156	55.6	139.1	6.2	39.7
Conducting a vulnerability analysis	156	52.7	139.0	6.2	40.4
Conducting a risk assessment	156	54.3	139.0	6.2	40.1
Training Index (# of items = 4)	156	64.7	140.1	5.4	31.5

Counties Represented

The population and budget of the counties represented in the survey varied greatly. Analysis revealed that the average population for a county was 88,618 people (SD = 174,394). County populations ranged from 3,500 people to 1,250,000 people. County budgets were measured by asking respondents to report the total budget for their county's emergency management program. Analysis revealed that the average budget for a county's emergency management program was $140,839 (SD = $227,079). County emergency management budgets ranged from $4,500 to $2,000,000. See Table 9 for the central tendencies related to population and budget data.

Table 9. Central tendencies for county population and budget data

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
What is the total population of your jurisdiction?	155	88,618	174,394.5	4.8	26.3
What is the total budget for your emergency management program?	151	$140,838.8	$227,079.1	5.8	39.3

In sum, there was minimal variance in the demographic characteristics of the county emergency managers who responded to the survey. The results did, however, display significant variance in the populations and budgets of the counties represented by respondents. This result is similar to that discovered in previous research on local level emergency management programs (Jensen, 2010, Kreuger et al., 2009).

How County Emergency Managers Think About Risk

This second section describes how county emergency managers perceive and learn about the hazards they find most likely. Specifically, this section reports the central tendencies related to the data collected on uncertainty and dread, hazard experienced, and information.

Uncertainty and Dread

The literature suggests that potential consequences play an important role in an individual's perceptions of risk of a hazard, therefore this study examined two commonly measured dimensions of consequences: uncertainty and dread. To assess uncertainty, county emergency managers were asked two questions. The first question addressed the extent to which their identified hazard was known to themselves, people in their jurisdiction, and to scientists. The second question asked the extent to which county emergency managers believed the hazard event was new.

Analysis revealed that county emergency managers rated their personal knowledge an average of 5.3 (SD = .82) on a 7-point Likert scale with values ranging from zero to six, indicating their chosen type of hazard was closer to "Known Precisely" as opposed to "Somewhat Known," as a rating of 4 would have indicated. They rated their personal knowledge slightly above people in their jurisdiction (Mean = 4.6, SD = .98), and on the same level of scientists (Mean = 5.4, SD = .90). Paired sample t-tests revealed a statistically significant

difference in the mean values of personal knowledge and jurisdiction's knowledge ($t(155) = 10.6$, $p = .000$), but not between personal knowledge and scientists' knowledge ($t(140) = -.87$, $p = .388$). The extent to which respondents believed their chosen type of hazard was a new risk was high (Mean = 5.3, SD = 1.1), indicating that on average their chosen type of hazard was closest to "Very New," as opposed to "Somewhat New" as a rating of 4 would have indicated. Overall, the analysis reflects a low level of uncertainty (Index Mean = 5.1, SD = .68). Appendix M contains the distribution of ratings related to uncertainty responses and Table 10 the central tendency data related to these measures.

Table 10. Central tendencies for uncertainty

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
Known by you	156	5.3	.82	-2.4	11.5
Known by people in your jurisdiction	156	4.6	.98	-.59	.39
Known by scientists	141	5.4	.90	-2.2	8.3
Extent to which new	155	5.3	1.1	-1.1	-.115
Uncertainty index (# of items = 4)	140	5.1	.68	-1.4	3.9

To assess dread, county emergency managers were asked two questions. The first question asked about the extent to which they believed they, and people in their jurisdiction, could control consequences—or avoid death—related to the identified type of hazard. The second question asked them the extent to which they believed the following four consequences were likely based on the identified type of hazard: 1) the hazard kills large numbers of people at once, 2) the hazard consistently kills people over time, 3) consequences are likely to be fatal to the county emergency manager personally, and 4) consequences are likely to be fatal to people in their jurisdiction.

Analysis revealed that county emergency managers believed it was closer to "Very Likely," as opposed to "Somewhat Likely" as a rating of 4 would have indicated, that they themselves and the people in their jurisdiction would avoid death related to the chosen type of hazard, with ratings of 5.9 (SD = .58) and 5.4 (SD = .92) respectively. The likelihood of death and/or fatal consequences was rated relatively low, all landing between 2 and 4, indicating a belief that death and/or fatal consequences were "Unlikely." Overall, the dread index suggests that county emergency managers have a low level of dread associated with the hazard they identified (Index Mean = 1.7, SD = .65). Appendix N contains the distribution ratings related to dread and Table 11 the central tendency data for dread responses.

Table 11. Central tendencies for dread

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
Controlled by you	156	.15	.58	4.9	26.7
Controlled by people in your jurisdiction	156	.91	.92	1.4	1.4
Kill large numbers of people at once	156	2.1	1.0	.41	.47
Consistently kill people over time	156	2.4	1.4	.55	.02
Consequences likely to be fatal to you	155	1.9	.96	.92	2.0
Consequences likely to be fatal to people in your jurisdiction	156	2.9	1.3	.34	-.45
Dread index (# of items = 6)	155	1.7	.65	.35	.05

In sum, county emergency managers had a low level of uncertainty related to their identified hazard, and believed severe or fatal consequences resulting from their identified hazard was less than "Unlikely."

Hazard Experience

Respondents who indicated that they had personally experienced their chosen hazard as an event were asked to answer several questions related to the frequency and recency of their experience with that type of hazard event, and the severity of impacts and feelings about the impacts associated with that event. Data analysis revealed that county emergency managers on average experienced their chosen hazard in event-form 69 times in their lifetime (SD = 218). The number of personal experiences ranged from 1 to 1,890. County emergency managers had experienced their chosen hazard an average of 2 years prior to taking the survey (SD = 3.8). The number of years since personal experience ranged from 0 to 25. On average, respondents indicated that the severity of impacts they experienced due to their most recent experience with that type of hazard event was a 3.0 (SD = 1.4) on a 7-point Likert scale with values ranging from zero to six, indicating "minor" to "significant" impact as opposed to "very severe" impact as values at 5 or above would have indicated. It should be noted that the researcher attempted to create an index for the availability heuristic made up of personal experience and severity of impacts. However, the reliability tests were not significant and the individual variables that would have comprised the index were used individually.

Personal affect about impact was also measured on a 7-point Likert scale and included sadness (Mean = 1.2, SD = 1.4), anger (Mean = .82, SD = 1.3), worry (Mean = 2.3, SD = 1.6), and anxiety (Mean = 2.0, SD = 1.6). These data indicate that county emergency managers experienced all feelings "Mildly," as opposed to "Not at All" as a rating of 0 would have indicated (index Mean = 1.6, SD = 1.4). See Appendix O for the distribution of ratings related to personal severity of impacts and the affect heuristic and Table 12 for the central tendencies related to personal hazard experience and the affect heuristic.

Respondents who indicated their jurisdiction had experienced their identified hazard were asked to answer the same questions related to frequency, recency, severity of impacts, and feelings pertaining to people in their jurisdiction. Data analysis revealed that people on average experienced the identified hazard 167 times (SD = 904) as far as the county emergency manager was aware. Number of jurisdictional experiences ranged from 1 to 1,000. Similar to county emergency managers personally, people in their jurisdictions experienced the identified hazard an average of 2 years prior to taking the survey (SD = 3.6). Number of years since jurisdictional experience ranged from 0 to 25 years. On average, county emergency managers indicated that the severity of impacts experienced by people in their jurisdiction was a 3.3 (SD = 1.3) on a 7-point Likert scale, indicating a minor impact.

Table 12. Central tendencies for personal hazard experience and the affect heuristic

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
# of times in your lifetime	155	69.3	218.2	5.6	36.9
# of years since you personally experienced:	154	2.1	3.8	3.4	13.2
Severity of impacts experienced	155	3.0	1.4	.06	-.17
Sadness	151	1.2	1.4	1.2	1.0
Anger	152	.82	1.3	1.6	2.1
Worry	154	2.3	1.6	.30	-.65
Anxiety	154	2.0	1.6	.57	-.32
Personal Affect Heuristic Index (# of items = 4)	151	1.6	1.4	1.8	7.5

People's feelings about impacts were measured on the same 7-point Likert scale as personal feelings, and analysis revealed the following results: sadness (Mean = 2.0, SD = 1.6), anger (Mean = 2.0, SD = 1.6), worry (Mean = 3.0, SD = 1.6), and anxiety (Mean = 2.9, 1.6). When the affect index for county emergency managers personally is compared to that of people

in their jurisdiction, it is clear that county emergency managers believe people in their jurisdiction feel more intensely about the event than they do personally (Index Mean = 2.5, SD = 1.5). County emergency managers indicated that, on average, the people in their jurisdiction experienced each of the four feelings more intensely, and experienced more severe impacts than himself/herself. A paired sample t-test revealed a statistically significant difference in the mean values of these two indexes ($t(141) = -7.01$, $p = .000$). See Appendix P for the distribution related to jurisdictional severity of impacts and the affect heuristic and Table 13 for the central tendencies related to jurisdictional hazard experience and the affect heuristic.

Table 13. Central tendencies for jurisdictional hazard experience and the affect heuristic

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
# times you are aware of	153	167.3	904.8	9.4	96.7
# of years since your jurisdiction experienced	155	2.1	3.6	3.6	15.9
Severity of impacts experienced by people in your jurisdiction	155	3.3	1.3	.14	-.28
Sadness	148	2.0	1.6	.56	-.49
Anger	147	2.0	1.6	.58	-.51
Worry	152	3.0	1.6	1.0	-.73
Anxiety	151	2.9	1.6	.08	-.73
Jurisdictional Affect Heuristic Index (# of items = 4)	146	2.5	1.5	.39	-.36

In sum, county emergency managers believe people in their jurisdiction feel more intensely about hazard events than they do personally.

Information

Respondents were asked to rate their extent of reliance, trust, and perceived consistency of a variety of information sources. The most relied-upon information source was the National

Weather Service (NWS) (Mean = 5.5, SD = .70) in addition to being among the most accessed (*N* = 156). The least relied-upon and least accessed information source was the Federal Bureau of Investigation (FBI) (*N*= 106, Mean = 2.3, SD = 2.1) indicating it was "not often" relied upon. All information sources received a reliance rating of greater than 2. Therefore, county emergency managers rely on a variety of different sources to varying degrees to get their information.

Analysis of the index created for overall information (Mean = 3.5, SD = .82) revealed that respondents rely on the given information sources closer to "Often" as opposed to "Not Often," as rating of 2 would have indicated. This suggests that at least some of the time, county emergency managers 1) rely on, 2) trust in, and 3) perceive these information sources to be consistent. The distribution tables for all three dimensions of information can be found in one master table, in Appendix Q. A distinct pattern emerged across the three characteristics of information that were measured by the survey. The most accessed information sources (e.g., NWS) were also more trusted, relied upon, and consistent, and vice-versa for the least accessed information sources (e.g., Department of State). See Table 14 for the central tendencies related to reliance on information.

Table 14. Central Tendencies for reliance on information

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
Rely on the National Weather Service	156	5.5	.70	-1.2	.11
Rely on State Department of Emergency Management	147	4.3	1.5	-1.0	1.1
Rely on internet	156	4.2	1.3	-.82	.34
Rely on television	155	4.0	1.1	-.38	.87
Rely on radio	156	3.7	1.3	-.58	.38
Rely on communication with people in my social network	147	3.6	1.7	-.28	-.59
Rely on historical archives	151	3.5	1.5	-.31	-.14
Rely on the United States Geological Survey	120	3.5	2.0	-.45	-.99
Rely on the Department of Homeland Security	124	3.4	2.0	-.52	-.93
Rely on scholars/scientists	130	3.2	1.8	-.34	-.82
Rely on newspapers	154	2.8	1.5	.05	-.32
Rely on State Fusion Centers	114	2.8	1.8	-.07	-.98
Rely on the Department of State	108	2.5	2.0	.12	-1.3
Rely on the Federal Bureau of Investigation	106	2.3	2.1	.35	-1.3
Overall Information Index (# of items = 45)	71	3.5	.82	-.01	-.22

Respondents were asked to rate how much they trusted the information sources provided on the same 7-point Likert scale with values ranging from zero to six. Analysis revealed that the most trusted and accessed information source was the NWS (*N* = 156, Mean = 5.4, SD = .76), indicating that county emergency managers trust the NWS more than "Often." Department of State (DoS) received the lowest rating for trust (Mean = 3.1, SD = 2.0) and was also the second-least accessed source (*N* = 105) next to the FBI (*N* = 102). All information sources received a trust rating of greater than 3 (Closer to "Often" than "Not Often," as a rating of 2 would have indicated) suggesting that county emergency managers place their trust, at least to some extent,

in all of these information sources. See table 15 for the central tendencies related to trust of information sources.

Table 15. Central tendencies for trust of information sources

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
Trust the National Weather Service	156	5.4	.76	-1.1	.17
Trust State Department of Emergency Management	147	4.4	1.4	-.99	1.4
Trust The United States Geological Survey	118	4.1	1.7	-1.1	.49
Trust local radio	153	4.0	1.1	-.45	.55
Trust historical archives	151	3.9	1.4	-.69	.46
Trust television	156	3.9	1.1	-.29	.67
Trust the Department of Homeland Security	122	3.9	1.7	-.87	.05
Trust internet	156	3.7	1.4	-.32	-.62
Trust State Fusion Centers	110	3.7	1.8	-.72	-.36
Trust scholars/scientists	125	3.7	1.5	-.77	.16
Trust the Federal Bureau of Investigation	102	3.5	1.9	-.55	-.77
Trust these communications	145	3.5	1.5	-.26	-.22
Trust newspapers	152	3.2	1.3	-.32	-.02
Trust the Department of State	105	3.1	2.0	-.33	-1.1
Overall Information Index (# of items = 45)	71	3.5	.82	-.01	-.22

Respondents were also asked to rate the consistency of the information sources provided on the same 7-point Likert scale. Analysis revealed very similar central tendencies to the trust variable, with the NWS receiving the highest consistency rating (Mean = 5.2, SD = .96). Department of Sate (DoS) received the lowest consistency rating (Mean = 3.1, SD = 1.9). All information sources received a consistency rating of greater than 3 indicating that all sources are perceived to be consistent closer to “Often” as opposed to “Not Often” as a rating of 2 would have indicated. See Table 16 for the central tendencies related to consistency of information.

Table 16. Central tendencies for consistency of information

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
National Weather Service is consistent	156	5.2	.96	-1.4	2.4
State Department of Emergency Management is consistent	147	4.3	1.4	-.73	.54
United States Geological Survey is consistent	119	4.1	1.7	-1.1	.54
Historical archives are consistent	146	3.9	1.2	-.48	.36
Local radio is consistent	153	3.9	1.2	-.43	.27
Television is consistent	155	3.8	1.1	-.33	.50
Department of Homeland Security is consistent	122	3.7	1.8	-.61	-.49
State Fusion Center is consistent	110	3.7	1.8	-.74	-.32
Information from scholars/scientists is consistent	123	3.6	1.5	-.68	.15
Internet is consistent	156	3.5	1.5	-.29	-.53
Federal Bureau of Investigation is consistent	101	3.4	2.0	-.46	-.88
These communications are consistent	144	3.3	1.6	-.06	-.56
Newspaper is consistent	152	3.2	1.4	-.20	-.06
Department of State is consistent	105	3.1	1.9	-.25	-1.0
Overall Information Index (# of items = 45)	71	3.5	.82	-.01	-.22

County emergency managers were also asked about whether a hazard analysis, vulnerability analysis, and/or risk assessment existed for their county and how recently they conducted each of them. The vast majority of counties *have* conducted these assessments. In fact, most of the counties represented in the study have done all three. See table 17 for the central tendencies related to the analysis/assessment data.

Table 17. Central tendencies for analysis/assessment data

	N	*Mode*	*Percent*
…hazard analysis…	156	Yes (152)	97.4
…vulnerability analysis…	156	Yes (146)	93.6
…risk assessment…	156	Yes (146)	93.6

The survey question was intended to ask them how recent their information was in an effort to understand whether or not recent information mattered. Of the counties that had completed a hazard analysis, an average of 2.3 years (SD = 1.9) passed since it had been updated. Years since last update ranged from 0 to 10 years. Of the counties who had completed a vulnerability analysis, it had been an average of 1.9 years (SD = .25) since it had been updated. Years since last update ranged from 0 to 12 years. Of the counties who had completed a risk assessment, it had been an average of 1.9 years (SD = .25) since it had been updated. Years since last update ranged from 0 to 10 years. See Table 18 for further central tendencies related to analysis/assessment data.

Table 18. Central tendencies for analysis/assessment data continued

	N	*Mean*	*Std. Deviation*	*Skewness*	*Kurtosis*
We have conducted/completed a hazard analysis. Number of years since conducted/updated:	152	2.3	1.9	1.1	1.2
We have conducted/updated a vulnerability analysis. Number of years since conducted/updated:	146	2.4	2.1	1.5	3.4
We have conducted/updated a risk assessment. Number of years since conducted/updated:	146	2.2	1.8	1.3	2.0

All of these considerations were anchored in the survey with respect to the hazard county emergency managers perceived most likely to impact their jurisdiction. It is likely of interest to

the reader what the most likely risk was. Likelihood of risks is addressed in the following section of this chapter.

Likelihood of Risks

The first research question this study intended to answer was: what risks do county emergency managers perceive to be the most likely to manifest in their jurisdiction? The survey explored this question by asking respondents to identify the single most likely hazard to impact his or her jurisdiction by choosing from a list of hazards. Survey results showed that county emergency managers perceive thunderstorms and lightning to be the most likely hazard to impact their jurisdiction (34%), followed by floods (30%), tornadoes (18%), and winter storms and extreme cold (17%). Data analysis showed that less than one percent of respondents chose a man-made hazard as opposed to a natural hazard. Chosen by no respondents were the following hazards: biological threats, cyber attack, drought, earthquake, explosions, extreme heat, hurricanes, landslides/debris flow, nuclear blast, radiological dispersion device (dirty bomb), tsunamis, and volcano. See Table 19 for the frequency with which respondents chose hazards as the most likely to impact their jurisdiction, and the related cumulative percentages of those responses relative to the whole sample.

Table 19. Frequencies and percentages of most likely hazard

	Frequency	*Percent*	*Valid Percent*	*Cumulative Percent*
Chemical Threats	1	.6	.6	.6
Floods	46	29.5	29.5	30.1
Thunderstorms and Lightning	53	34.0	34.0	64.1
Tornadoes	28	17.9	17.9	82.1
Wildfire	1	.6	.6	82.7
Winter Storms and Extreme Cold	27	17.3	17.3	100.0
Total	156	100.0	100.0	

After respondents chose the most likely hazard to impact their jurisdiction, they were asked to rate the likelihood that the identified hazard would impact their jurisdiction using a 7-point Likert scale with values ranging from zero to six. Analysis revealed that the average likelihood rating was 5.44 (SD = .85) on a 7-point Likert scale, indicating that the majority of county emergency managers believe their chosen hazard event was closest to "Will Definitely Occur," as opposed to "Likely," as a rating of 4 would have indicated.

It was deemed useful to utilize cross tabulations to explore how hazard type co-varied with likelihood of occurrence. Analysis revealed that 101 out of 156 respondents assigned a likelihood rating of 6 (will definitely occur) to their chosen type of hazard. See Table 20 for the cross tabulation of chosen hazards and likelihood ratings.

Table 20. Most likely hazard to impact jurisdictions cross tabulated with perceived likelihood of occurrence

	Likelihood							
	0 Definitely will not occur	1	2 Unlikely	3	4 Likely	5	6 Will Definitely Occur	Total
Chemical Threats	0	0	0	0	1	0	0	1
Floods	0	0	1	0	8	10	27	46
Thunderstorms and Lightning	0	0	0	0	2	3	48	53
Tornadoes	0	0	0	2	10	9	7	28
Wildfire	0	0	0	0	1	0	0	1
Winter Storms and Extreme Cold	0	0	0	0	3	5	19	27
Total	0	0	1	2	25	27	101	156

Given the range of data that was collected related to county emergency managers as people, as professionals, their county, and their perceptions related to risk, it was next of interest to explore the relationships between these various factors and the risks they chose.

Conclusion

This chapter has presented the central tendencies of the variables involved in this study. Analysis revealed that county emergency managers in this study vary greatly in terms of individual demographics. County emergency managers varied incredibly in the extent to which they were trained; nearly two thirds of them held state emergency management certifications while less than 30% held a professional emergency management certification. Interestingly, county emergency managers believed people in their jurisdiction had a more intense experience due to the identified hazard than they did personally. It appears that county emergency managers access a diverse range of information sources to varying extents. Finally, the hazards identified by county emergency managers to be the most likely to impact their jurisdiction were presented.

Chapter Five explains the results of correlation testing and regression, and evaluates the appropriateness of the independent variables used to test risk perception.

CHAPTER FIVE: CORRELATION TESTING AND REGRESSION

Chapter Five addresses the study's second research question by identifying the factors, if any, that explain the risk perception of county emergency managers. This research question was answered by identifying the relationships between the independent variables and indexes and the dependent variable through initial correlation testing and, later, regression testing.

Factors Explaining Risk Perception

This research was intended to result in the conduct of multiple regression analysis to determine the factors that best predict the risk perception of county emergency managers, but prior to this step, statistical relationships between the independent variables and indexes and the dependent variable were explored through correlation testing. Correlation testing was intended to provide the researcher with a better understanding of the variables that were tested in this research, with the ultimate goal of producing a more parsimonious model.

Independent Variables, Independent Variable Indexes, and Risk Perception

A total of 23 independent variables and independent variable indexes were assessed in this research. Two types of correlation coefficients were used to examine the relationships between the independent variables and the dependent variable. The relationship between interval level independent variables and interval level proxies and the dependent variable were tested with Pearson's r ($p < .05$) and the relationship between the dependent variable and nominal independent variables were tested with one-way ANOVA ($p < .05$).

Correlation testing evidenced significant relationships between only five of the 23 independent variables and the dependent variable of risk perception. Included in this group of five was the uncertainty index, years since jurisdictional experience, the dread index, budget, and personal hazard experience. Even though most of the statistical relationships that exist are weak,

it would appear from this data that as uncertainty, personal hazard experience, and budget increase, so too does the perceived likelihood of a hazard manifesting as an event. Yet, the data also demonstrate that as years since jurisdictional experience and dread decrease, the perceived likelihood of a hazard manifesting as an event increase, indicating a negative relationship. The five strongest statistical relationships can be found at the top of the correlation table, Table 21, and the results of correlation testing for the remaining variables are identified beneath. Two of the significantly correlated variables narrowly made it within the 95% confidence interval used for correlation testing in this study (times personally experienced and budget yielded p-values of .041 and .047, respectively), meaning the relationship between these two independent variables and the dependent variable is less certain than that of the others. The relative power of significantly correlated variables when tested in conjunction with one another was unknown, and led the researcher to regression.

Regression Results

Linear multiple regression was used to analyze the dependent variable. This type of regression does not require the researcher to enter independent variables into the multiple regression equation in a specified order. Thus, the five independent variables with a significant relationship to the dependent variable in correlation testing were entered into the regression equation (i.e., uncertainty index, years since jurisdiction experienced dread index, times personally experienced, and county emergency management budget). The first regression run indicated that the five independent variables with significant relationships to risk perception were responsible for a combined total of 18.1% of the variation in county emergency managers' risk perception ($F_{(5,126)} = 6.78$, Adjusted $R^2 = .181$, $p = .000$).

Table 21. Correlations of independent variables with dependent variable

		Likelihood
Uncertainty Index	Pearson Correlation	.357**
	Sig. (1-tailed)	.000
	N	140
Years since jurisdiction's experience	Pearson Correlation	-.182*
	Sig. (1-tailed)	.012
	N	155
Dread Index	Pearson Correlation	-.179*
	Sig. (1-tailed)	.013
	N	155
Times personally experienced	Pearson Correlation	.140*
	Sig. (1-tailed)	.041
	N	155
Budget	Pearson Correlation	.137*
	Sig. (1-tailed)	.047
	N	151
Years since personal experience	Pearson Correlation	-.112
	Sig. (1-tailed)	.082
	N	154
Personal severity of impacts	Pearson Correlation	.007
	Sig. (1-tailed)	.466
	N	155
Times jurisdiction experienced	Pearson Correlation	.099
	Sig. (1-tailed)	.113
	N	153
Jurisdiction severity of impacts	Pearson Correlation	.062
	Sig. (1-tailed)	.221
	N	155
Population	Pearson Correlation	.113
	Sig. (1-tailed)	.082
	N	155
Years of experience	Pearson Correlation	-.057
	Sig. (1-tailed)	.240
	N	156
Age	Pearson Correlation	-.128
	Sig. (1-tailed)	.056
	N	156
Personal Affect Index	Pearson Correlation	-.093
	Sig. (1-tailed)	.129
	N	151
Jurisdictional Affect Index	Pearson Correlation	-.109
	Sig. (1-tailed)	.094
	N	146
Training Index	Pearson Correlation	.103
	Sig. (1-tailed)	.101
	N	156
Information Index	Pearson Correlation	.081
	Sig. (1-tailed)	.252
	N	71

Table 21. Correlations of independent variables with dependent variable (continued)

Sex	Degrees of Freedom	155
	F	.391
	Sig.	.815
Income above/below $50,000	Degrees of Freedom	155
	F	.837
	Sig.	.504
Education above/below bachelor's	Degrees of Freedom	155
	F	1.33
	Sig.	.262
State Certification	Degrees of Freedom	155
	F	.311
	Sig.	.870
Professional Certification	Degrees of Freedom	155
	F	1.63
	Sig.	.171
Race: white/non-white	Degrees of Freedom	155
	F	.375
	Sig.	.826
Rent/Own	Degrees of Freedom	155
	F	.303
	Sig.	.876

However, it was evident that two of the independent variables (i.e., the uncertainty index and years since jurisdictional experience) had a more powerful influence on risk perception than the rest of the variables in the regression model based on their beta weights. Of all the results produced by the model, these two variables help us understand when risk perception increases the most.

A second regression run was conducted in the interest of creating a more parsimonious model. Only the variables with significant p-values from the first regression run were entered in the second regression run. The results indicated that the uncertainty index and years since jurisdictional experience alone accounted for 15.8% of the variation in county emergency managers' risk perception ($F_{(2, 136)} = 13.95$, Adjusted $R^2 = .158$, $p = .000$). See Table 22 for the results from both regression runs.

Table 22. Results from both regression runs

Regression Run 1				
Independent Variables	*B*	*Beta*	*t*	*P*
Uncertainty Index	.468	.346	4.46	.000
Years since jurisdictional experience	-.036	-.161	-1.98	.049
Budget	3.940E-7	.110	1.39	.168
Dread Index	-.115	-.087	-1.07	.289
Times personally experienced	.000	.047	.577	.565
Regression Run 2				
Independent Variables	*B*	*Beta*	*t*	*P*
Uncertainty Index	.447	.359	4.60	.000
Years since jurisdictional experience	-.046	-.204	-2.61	.010

The researcher contends that the results from the first regression run should be used as the basis for interpreting this study's results and contribution to existing research. This rationale is justified because the combined influence of the five variables accounted for more variance in risk perception than the two most influential did alone.

Conclusion

The results of statistical testing revealed that only five of the 23 independent variables and independent variable indexes had statistically significant relationships with the dependent variable. Regression testing and analysis demonstrated the variables that most powerfully predict risk perception were the uncertainty index and years since jurisdictional experience. The amount of explained variance found was small, explaining 18.1% of the variance in county emergency managers' risk perception. Chapter 6 interprets these findings and discusses their significance with respect to the literature and research questions for this study.

CHAPTER SIX: DISCUSSION AND CONCLUSION

Given the concept's complexity, understanding risk perception was a lofty goal, not only for this study, but also for past and future studies. Despite heightened interest and a growing body of literature on the topic of risk perception, there is remarkably little consensus over what is meant by the term. Not only is there a lack of a shared definition from researcher-to-researcher, there has also been a failure to synthesize existing risk perception literature simply because it comes from different bodies of research. Risk perception has been studied in psychology since the late 1960s. This vein of research has produced numerous empirical studies and schools of thought but has yielded widely varying percentages of explained variance of risk perception. Similarly, natural hazards research has produced studies that examine risk perception using different but comparable frameworks. Very rarely has existing research looked for explanatory power outside of a given framework's disciplinary boundaries. Additionally, the vast majority of these previous studies were conducted on laypeople, as opposed to experts or professionals.

The existing literature falls short in that it has not adequately explored the risk perception of experts and the existing work to date seems to lack some construct and face validity. It also has not extended traditional variables in a professional sense to more holistically explore what might influence expert risk perception uniquely. Nevertheless, the literature led the researcher to expect a significant amount of variance would be explained by operationalizing and testing the factors it suggests are related to risk perception. Unfortunately, correlation testing revealed that very few of the anticipated explanatory variables were significantly related to risk perception, and, those that were, explained little variance individually or combined when used in regression analysis. Moreover, due to operationalization issues, the value of the findings related to the

study's first research question—most likely risks facing jurisdictions—and second research question—factors explaining risk perception—may be debatable.

Chapter 6 is comprised of four sections. The initial section interprets the findings related to factors explaining county emergency managers' risk perception in light of the existing literature. The second section discusses operationalization of key terms and implications for the study's findings. The third section addresses the significance of the results of this study. Finally, the fourth section provides a conclusion and outlines suggestions for future research drawn from this study.

Factors Explaining Risk Perception

The second research question asked what factors explain county emergency managers' risk perception. Existing literature consistently measured individual socioeconomic and demographic characteristics (e.g., sex, age, income, education, occupation, race/ethnicity, and home ownership) and their influence on risk perception (see for example: Kellens et al., 2013; Lindell & Hwang, 2008; Peacock et al., 2005; Siegrist & Gutscher, 2006). While the literature made it clear that these variables would matter, *none* of these traditional demographic variables were found to be statistically related to risk perception during correlation testing and were not involved in regression testing.

This study extended the traditionally tested demographic variables in a professional sense (i.e., years of experience, emergency management program budget, emergency management certification, hours of training, and jurisdiction population) because of its focus on county emergency managers as "experts." Correlation testing indicated there was a weak, but statistically significant, relationship between county emergency management budget and the dependent variable. Thus, *all but one* (i.e., county emergency management budget) of the

traditional and extended demographic variables were dropped from further testing and analysis. Regression results revealed that county emergency management budget was not significantly influential to risk perception relative to other variables in the model while the model as a whole yielded some explanatory power.

The literature also led the researcher to expect a relationship between various aspects of hazard experience and the dependent variable (i.e., number of times personally experienced, years since personal experience, personal severity of impacts, and feelings about impacts). Variables addressing impacts were compiled into personal and jurisdictional "availability" indexes in order to represent the availability heuristic based on the literature (Kellens et al., 2013; Siegrist & Gutscher, 2006). However, the variables representing the availability heuristic did not yield a reliable Cronbach's Alpha. Although the extent of influence on risk perception was somewhat unclear, the literature stated that availability heuristics like hazard exposure and previous hazard experience had an influence on risk perception (Burningham et al., 2008; Kellens et al., 2013; Terpstra, 2011). Correlation testing indicated there was a weak, but statistically significant, relationship between one kind of availability heuristic (i.e., number of times personally experienced), and the dependent variable. Therefore, number of times personally experienced was used in the regression model. Regression results revealed that number of times personally experienced was not significantly influential to risk perception relative to the other variables in the model while the model as a whole yielded some explanatory power. Variables addressing feelings about impacts were compiled into personal and jurisdictional "affect" indexes to represent the affect heuristic based on the literature (Kellens et al., 2013; Terpstra, 2011). Correlation testing revealed that the affect indexes were not significantly related to risk perception, and were dropped from further testing and analysis.

The professionally extended variables (e.g., number of times jurisdiction experienced, years since jurisdiction's experience, severity of impacts to the jurisdiction, and jurisdiction's feelings about impacts) also yielded one of the few statistically significant relationships identified in this study. Correlation testing indicated there was a weak, but statistically significant, relationship between another aspect of the availability heuristic, years since jurisdiction's experience, and the dependent variable. It was the second strongest statistical relationship between an independent variable and the dependent variable. Therefore, years since jurisdiction's experience was used in the regression model. Regression results revealed that years since jurisdiction's experience was the second most influential variable to risk perception compared to the other variables in the model although the p-value associated with the variable in the model was marginal at .049. Thus, two of the availability heuristic related independent variables (number of times personally experienced and years since jurisdiction's experience) were run within the regression equation as stand-alone independent variables demonstrating partial support for the literature.

Reliability, trust, and consistency were three aspects of information sources identified in the literature as being key influences on risk perception (Frewer et al., 1996; Lindell & Perry, 2012; Peters et al., 1997). The individual information variables were highly intercorrelated and were compiled into an overall information index. Included in this information index were also variables representing the recency with which jurisdictions had completed or updated a hazard analysis, vulnerability analysis, and/or a risk assessment. The analysis/assessment variables served as this study's professional extension of the information variables that had been previously explored in the literature with respect to laypeople's risk perception. The findings

indicated there was not a statistically significant relationship between the information index and the dependent variable, and it was therefore dropped from further testing and analysis.

Perhaps the most consistently tested explanatory variables in the risk perception literature have been the notions of "dread" and "uncertainty." Work since 1978 has consistently tested the influence of these two variables on risk perception in conjunction with one another (Burns et al., 2012; Loewenstein et al., 2001; Slovic & Peters, 2006; Slovic 1987). This study tested each of these concepts as indexes made up of individual dimensions of the concept (i.e., multiple independent variables). The variables making up the dread and uncertainty indexes were extended logically in terms of how they applied to people in a county emergency manager's jurisdiction. These professional extensions became part of the respective overall dread and uncertainty indexes. It is worth reminding the reader that reliability for both uncertainty and dread was marginal, and there may be some debate as to whether these indexes should have been used given the fact they did not meet the .7 Cronbach's Alpha threshold for reliability. The researcher chose to use them because of the standing of these variables in the literature, and, in fact, both ended up being significantly related to risk perception in correlation testing and influential to risk perception in the regression equation.

Variables in the dread index (i.e., personal control over risk, people in your jurisdiction's control over risk, catastrophic-chronic potential, fatal consequences to you, and fatal consequences to people in your jurisdiction) assessed how much dread county emergency managers associated with the hazard they identified as most likely to impact their jurisdiction. Correlation testing indicated there was a weak, but statistically significant, relationship between the dread index and the dependent variable and therefore the dread index was used in the

regression model. Regression results revealed that dread was not significantly influential to risk perception relative to the other variables run in the equation.

Variables making up the uncertainty index (i.e., personal knowledge of risks, people in your jurisdiction's knowledge of risks, knowledge of risks by science, and newness of risk) measured how uncontrollable respondents and people in their jurisdiction's perceived hazards to be, and the uncertainty they associated with those same hazards. Correlation testing indicated there was a weak, but statistically significant, relationship between the uncertainty index and the dependent variable. It was the strongest statistical relationship between any of the independent variables and the dependent variable and was therefore entered in the regression equation. Regression results revealed that uncertainty was the most influential variable to risk perception compared to the other variables in the model. It appears, as predicted by the literature, as ambiguity associated with a hazard increases so too does the perception of risk for professionals and laypeople alike.

The findings of correlation testing indicate that five out of 23 total independent variables had a statistically significant relationship with risk perception. An initial regression run revealed that two of those five variables had the strongest influence on risk perception (i.e., the uncertainty index and years since jurisdictional experience), and a second regression run was conducted using the same two variables. Even though only two independent variables were significant relative to others in the model, when they were run alone 2.3% less of the variance was explained than when the initial regression run was conducted. Therefore, results from the stronger model (i.e., the regression equation including all 5 independent variables found to be significantly related to risk perception during correlation testing) were used.

The results from this study lend support to the literature's suggestion that uncertainty about risk influences individual risk perception. However, caution is warranted in this case. It may be beneficial to take a step back and investigate what makes up an individual's level of uncertainty before it is tested against risk perception again. Existing literature led the researcher to believe uncertainty would have a stronger basic correlation with the dependent variable than it did, and an even heavier beta weight within the regression model. Until a reliable uncertainty variable index that has a strong relationship with risk perception is better defined and consistently used, research testing the concept will continue to find that it explains wildly varying amounts of the variance in in risk perception.

An important aspect of the dread and uncertainty indexes having statistically significant relationships with the dependent variable in this study is that professionally extended variables were included within the indexes (i.e., knowledge by people in your jurisdiction, people in your jurisdiction's control over risks, and fatal consequence to people in your jurisdiction). These extended variables focused on the people in county emergency managers' jurisdictions versus only focusing on the individual's *own* knowledge and perceptions of fatal consequences to themselves. It appears that the professional expertise of people—what makes them professional—matters in risk perception. However, the importance of the extended variables goes beyond inclusion of the variables alone. The extended variables matter because they were found to be part of risk perception. Who people are and how they experience risk perception personally are part of the concept, as is how they see the world as professionals. This study's findings in this regard make a noteworthy contribution to existing risk perception research. While these extended variables did not explain a large amount of the variance, the results suggest

they do, in fact, matter in the measurement of risk perception and should be tested in future research.

Ideally, emergency managers at all levels are considering the abilities of people in their jurisdiction before and during decision-making processes, so this result is a reflection of the professionalism of the individuals who participated in this research. Additionally, without this study's attempt to extend variables logically in terms of how they apply to a professional, this result may not have existed, and therefore provides further justification for the extension of traditional risk perception variables. The next section will address some of the explanations of why certain factors may have been found to be significantly related to risk perception in this study while others were not.

Operationalization of Key Variables

As previously mentioned, the results of this study demonstrate that some of the extended professional variables tested in this study matter in the measurement of risk perception. What makes individuals uniquely professional is an important aspect of risk perception that previous literature has not investigated. Had this study not operationalized variables in this extended way, the results herein would not have been identified.

This research also found explanatory variables from the literature that were related to risk perception. Yet, these variables did not explain as much as the literature led the researcher to expect, and, most of the variables the literature suggested would be related to risk perception were not. The researcher spent considerable time reflecting on why this was the case—specifically, how this study operationalized key variables.

Many of the reasons for the results of this study may have to do with specification and operationalization issues. First, the literature may not have provided the researcher with a

comprehensive list of explanatory variables. The composition of independent variables beyond uncertainty and dread has also varied study to study. There has not been a consistent set of independent variables being tested in each study, although, several studies have found similar independent variables to be influential to risk perception. Moreover, operationalization of independent variables has varied.

Second, because of the various ways in which variables have been operationalized in previous studies, there was no obvious way to operationalize some of the key variables in this study. For example, where regression has been run in the past, the overall adjusted R^2 values have varied greatly. Kleinhesselink & Rosa (1991) note that studies testing uncertainty and dread have accounted for a clear majority (meaning an overall adjusted R^2 of greater than .50) of the variance in risk perception, but then go on to report the results of their own study as explaining 26% of the variation in risk perception. A comparison of two seminal risk perception studies (Fischhoff et al., 1978; Slovic et al., 1985) and one more recent one (Wright et al., 2000), provide us with overall adjusted R^2 values ranging from .26 to .77. It should be noted that each of these studies operationalized uncertainty and dread in similar but different ways, yet they still serve as an example of the wide range of variance explained in risk perception studies. Additionally, previous studies investigated risk perception itself in different ways, such as considering perceived benefit versus perceived risk, risk adjustment factors, and mean ratings across hazards (see for example: Fischhoff et al., 1978; Slovic et al., 1985 Wright et al., 2000).

One similarity in the previous work that this study mimicked was the use of indexes for uncertainty and dread. Therefore, the variables making up the uncertainty and dread indexes in this study were adapted from a combination of studies that operationalized them in similar ways (see for example: Burns et al., 2012; Kleinhesselink & Rosa, 1991; McCaffrey, 2004; Slovic,

2010; Slovic et al., 1985; Wright et al., 2000) with the addition of professionally extended variables. While the uncertainty index proved to be this study's most influential variable on risk perception, the dread index was not nearly as influential when tested in conjunction with other variables in the regression model. Both indexes were only marginally reliable with the extended variables included, but both were unreliable when the extended variables were removed. Perhaps if this study had operationalized these concepts in an even more detailed way, while still containing the professionally extended variables within the indexes, the results would have accounted for more variation in risk perception.

Categorical variables (i.e., income, education, race/ethnicity) were re-coded into dichotomous variables upon data collection. Correlation testing revealed that *none* of these variables had a statistically significant relationship with the dependent variable. Leaving these variables in their original categories instead of making them dichotomous may have provided a more pure measurement of each given concept. Yet, if these variables were not re-coded as dichotomous, statistical analysis would have stopped with correlation testing and regression would not have been possible. A relationship may have existed with the dependent variable and each categorical variable in isolation, but it would have been impossible to test them in conjunction with other independent variables.

Third, an absolutely critical aspect of this study was the way in which the dependent variable was operationalized. As previously mentioned, the literature has failed to truly define risk perception, and there is no question that a more holistic conceptualization is needed. Additionally, there has not been a consistent way of operationalizing risk perception in broader research. For example, disaster literature has used likelihood as a proxy for risk perception because it is easier to operationalize, while psychology presents respondents with lists of hazards

to rate, which are then rated and complied into mean ratings for each hazard. There appears to be some consensus that risk perception includes a combination of likelihood and consequences (Fischhoff et al., 1978; Rayner & Cantor, 1987; Sjöberg, 2004). Thus, the researcher explored the creation of a dependent variable index that combined likelihood with consequences, using the dread and uncertainty indexes to represent consequences. This step was undertaken because the researcher felt that using only likelihood as a dependent variable was insufficient and may be partially to blame for the low explanatory power of the independent variables. Several reliability analyses revealed that no combination of the three yielded a reliable dependent variable index. Likelihood combined with the uncertainty index yielded a Cronbach's Alpha of only .468, which was the strongest reliability score produced. Therefore, risk perception was operationalized, as suggested in the original proposal for this study, as *just* likelihood, with no component of consequences. This means that respondents were answering survey questions while considering a hazard that happens frequently, and *not* a hazard that might have serious consequences that could overwhelm the capacity of their jurisdiction to address on its own.

The researcher was interested in respondents choosing the hazard that posed the greatest risk, (i.e., one that would cause a very serious event). Instead, in keeping with the instructions they were provided (i.e., Please identify the single most likely hazard to impact your jurisdiction), we can assume respondents picked the hazard most likely to result in an impact of *any* extent in nature, not the most serious one the researcher would have wanted them to choose. Of note, the final wording of likelihood question was an attempt to fix the original wording (i.e., How likely is it that a hazard event will impact your jurisdiction?) and all of the subsequent questions were in the context of "a hazard event." It became clear in discussions with the researcher's advisor and another member of the researcher's thesis committee that this wording

was too vague and that county emergency managers' perceptions of uncertainty, risk, availability and affect heuristics, etcetera were likely to vary depending on the hazard, or risk, involved. Thus, the wording had to be changed. It was a struggle to figure out how to direct/instruct respondents in such a way that their survey responses regarding risk perception and all of the independent variables would be anchored. This struggle was increased when the researcher attempted to also direct/instruct respondents in such a way that they would make their choice based on the nature of the event that would occur were a hazard of a given type to interact with people, property, and the environment in their jurisdiction. Ultimately, the decision was made to provide respondents with a list of hazards from which to choose and follow their selection of that hazard with a question about the likelihood of its occurrence. In retrospect, had the researcher been able to direct respondents to select their hazard within the context of consequences, respondents may not have chosen some of the high frequency, low consequence events (i.e., thunderstorms and lightning, winter storms and extreme cold) with such frequency. Additionally, if the researcher had removed these frequently occurring, low consequence events from the list altogether, likelihood may have been a more sufficient proxy for risk perception.

Use of the word "disaster" may seem like an obvious choice to have avoided this situation (e.g., Please identify the single hazard most likely to trigger a disaster in your jurisdiction). Emergency management scholars and practitioners know there are differences among, but clear definitions for different types of hazard events (e.g., emergency, disaster, catastrophe) do not exist. Were there a definition for each, the researcher could have used the word "disaster" and defined it for respondents. Yet, a common consensus backed definition of disaster does not exist among scholars, rather, there is intense debate (see for example: Albala-Bertrand, 2000; Borkosheva, 2013; Cutter, 2005; Dombrowsky, 1995; Jensen, 2010b; Jigyasu,

2005). Debate revolves around whether disasters are intended or unintended (Dombrowsky, 2005), whether qualitative or quantitative factors matter more (Quarantelli, 2000), and the terms used to describe events (e.g., emergency, disaster, catastrophe) (Britton, 2005), and more.

The debate appears to be just as strong in practice as it is in academia. It is the practitioners—in this case, county emergency managers—who have to interpret definitions, circumstances, and information in order to develop strategies, policies, and procedures (Britton, 2005). However, the field of emergency management is as broad as the risks that face it (Waugh, 2000), and therefore adds to the difficulty of defining disaster. For example, there have been contrasting uses of the words "disaster" and "catastrophe" in federal policy documents (see for example: the National Response Plan, 2004 vs. the National Response Framework, 2008) (U.S. Department of Homeland Security, 2004; 2008). The Stafford Act (Federal Emergency Management Agency, 2013), which dictates the criteria for achieving a disaster status and how thoroughly it will be administered, has changed its definition of disaster over time (Rubin, 2012).

Bundy (2013) used the federal government's Presidential Disaster Declaration (PDD) process as a threshold for establishing that a disaster occurred in a given county. The author states that use of the PDD may be an imperfect means of determining whether a disaster occurred, but a request for federal assistance by county and state governments would suggest that an event of significant magnitude took place (p. 40). Bundy (2013) found that receipt of a PDD had little meaning in terms of defining a disaster. In fact, there is minimal clarity of what receipt of PDD means because a county can receive a PDD when they have received relatively minimal impacts.

Because of the lack of a universal definition or a useful government proxy for disaster, the researcher was not able to give "disaster" a label that would be equally meaningful to all who

read it. The fear of confusing respondents deterred the researcher from using a term that may not have been equally understood, and the decision to refrain from using the word "disaster" was discussed a number of times with the researcher's advisor and another member of the supervisory committee for this study. In retrospect, the researcher should not have allowed his fear of confusing respondents to impact this study. Instead, the word disaster should have been used, followed by a definition that the researcher espoused that would have at least anchored what was meant by the term, and directed the respondent to more "risky" (i.e., likelihood and consequences) hazards. Future researchers should also anchor their conceptualization of risk perception in terms of what they are investigating.

Overall Significance of the Findings for Risk Perception Research

If researchers would like to see more explained variance in risk perceptions, this study has provided them with valuable lessons to inform their future studies. In the researcher's opinion, the most important contribution this study made to existing research was the notion of extending traditional risk perception independent variables to logically apply to the unit of analysis—in this case, county emergency managers. Some of the extended variables were contained in the dread and uncertainty indexes, which both had a significant statistical relationship with risk perception. Future research should continue to logically extend variables, but must ensure the extended variables are truly representations of traditional variables.

This study showed that county emergency managers access a wide assortment of information sources to varying degrees. In order to obtain data about information, respondents were asked to answer 42 Likert-scale questions consecutively. Data analysis later revealed that the information variables were highly intercorrelated, suggesting they were various aspects of the same concept. Therefore, the information variables were compiled into an index. This result

suggests that, unlike previous research, reliance, trust, and consistency are three dimensions of a single concept. Previous studies have looked at reliance, or trust, or consistency, or some combination of them when it would have been more appropriate to test all three.

This research suggests that, intuitively, county emergency managers believe the most likely hazards to manifest in their jurisdiction are those that happen most frequently. This language was intended to anchor their choice; to give respondents a reference point from which to identify a hazard given the ambiguity of the terms previously discussed. The researcher failed to make clear to the respondents that they were to choose the hazard event that would cause a disaster, or an event with significant consequences. Thus, the hazards that respondents selected from the list were not the ones the researcher was most interested in studying the independent variables' power in relation to. Even so, it was still reasonable to expect the independent variables to have more explanatory power because of how they were operationalized. For example, because lightning is something that occurs often, it would seem that respondents would not associate great deal of uncertainty or dread with it. However, only half of the respondents chose these dominant types of events. The other half chose hazards more along the lines of what the researcher hoped would cause more uncertainty and dread.

Not all contributions to future research from this study stemmed from mistakes or changes made on behalf of the researcher. As Cutter (2001) notes, a cause of professional frustration has been the failure of the risk community (dominated by psychology and hazards and disaster researchers) to integrate knowledge, even though they have evolved along similar paths. Thus, it was the researcher's hope that by integrating similar bodies of research from different disciplines, a large portion of the variance would be explained.

Additionally, to the researcher's knowledge, this was the first study to attempt to extend traditional variables in a professional sense. Two stand-alone extended variables (i.e., years since jurisdiction's experience and budget) were included within the regression model, and one proved to be particularly influential to risk perception relative to the other variables in the regression model (i.e., years since jurisdiction's experience). The uncertainty and dread indexes—both of which made it to the regression model—also contained three extended variables (i.e., known by people in your jurisdiction, control by people in your jurisdiction, and consequences likely to be fatal to people in your jurisdiction). Given the limitations of this study, an important component of how professionals perceive risk is influenced by factors that make individuals uniquely professional as opposed to laypeople. Just as this study was built on the foundation of existing risk perception literature, so too should future researchers seek to compile a comprehensive list of explanatory variables coupled with an appropriate dependent variable in an effort to explain as much of the variance in risk perception as possible. It is unlikely that a single study will be able to achieve this immediately, but over time, with help from past results and input from different disciplines, a more robust explanation of risk perception can be developed.

Conclusion

Risk perception is an extremely complex and nuanced concept that is difficult to measure. An added complicating factor in this study is the lack of an agreed upon conceptualization of risk perception. Furthermore, there have been relatively few empirical studies that investigate the risk perception of experts or professionals as this study does with county emergency managers. Considering the long history of risk perception research, the scarcity of empirical studies on expert or professional risk perception upon which to build, and the subsequent failure to provide

an overall understanding of the topic, the findings of this study are not surprising. Additionally, the sophistication with which county emergency managers think about risk may have been overestimated. The fact that so few professionally extended variables yielded significant relationships with risk perception suggests that individuals do not consider nearly as many explanatory factors as the literature has identified as important.

Psychology and natural hazards studies have been the two chief contributors to risk perception research. However, these two disciplines, along with others that have developed parallel to them, have failed to synthesize their knowledge. This study attempted to synthesize risk perception research from different disciplines and submit new explanatory variables alongside traditional ones in an effort to understand county emergency managers' risk perception. While these new variables produced minimal success, there was enough evidence to merit further refinement and testing in future research.

Among the five independent variables with significant correlations to risk perception highlighted by this research were two that were particularly influential. This finding suggests, at the very least, the risk perception of county emergency managers is influenced by 1) their level of uncertainty about risks and 2) years since their jurisdiction's most recent experience related to a particular type of hazard. Unfortunately, the results of this study did not yield enough explained variance of risk perception to draw conclusions about why the risk perceptions of county emergency managers vary even while it did show that their perceptions of risk do vary. Recommendations for future research will now be discussed.

First, existing explanatory variables are valuable and should be used in conjunction with newly developed, logically extended variables specific to the unit of analysis. If extended variables are continually refined in future research, it is conceivable that they could explain a

greater percentage of the variance. Second, traditional variables should be tested and operationalized in the same way existing literature has *and* in different ways that may make more sense. Consistency in operationalization and methods will allow comparisons of the different methods to assess which yields a stronger statistical relationship, if any.

Third, it is imperative to be willing to go outside of one's traditional disciplinary limitations. The communication and intellectual divide that has limited previous research needs to be acknowledged and circumvented. The crossover of literature, methods, and concepts among different disciplines is vital to the advancement of research. Fourth, the dependent variable must be operationalized in a way that makes sense for the concept being measured. As previously mentioned, effective operationalization will require a full understanding of the explanatory variables involved. Fifth, survey instruments should be tested for ease of completion and cleanliness through a pre-evaluation process. Future researchers should have a general knowledge of their respondents and use clear terms that would be commonly understood among individuals asked to read them. Specific instructions should be provided as to what each question means, and what it is intended to measure.

Sixth, and perhaps the most important recommendation that can be made for future research, is the need to understand the parts before the whole. If a better understanding of a topic as subjective and complex as risk perception is to be gained, a better understanding of the explanatory variables related to risk perception (for example: uncertainty and dread) must first be developed. Until this more holistic conceptualization of risk perception is achieved, researchers can expect to see the same results that leave very little advancement of knowledge.

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APPENDIX A: IRB APPROVAL LETTER

NDSU NORTH DAKOTA STATE UNIVERSITY

June 12, 2014

Jessica Jensen
Emergency Management
428B14 Minard Hall

Re: IRB Certification of Exempt Human Subjects Research:
Protocol #HS14293, "Understanding How County Managers See the World: Threat of Terror or Natural Disaster"

Co-investigator(s) and research team: Jared Huibregtse

Certification Date: 6/12/14 Expiration Date: 6/11/17
Study site(s): varied/online
Sponsor: n/a

The above referenced human subjects research project has been certified as exempt (category # 2) in accordance with federal regulations (Code of Federal Regulations, Title 45, Part 46, Protection of Human Subjects). This determination is based on the original protocol submission (received 6/11/14).

Please also note the following:
- If you wish to continue the research after the expiration, submit a request for recertification several weeks prior to the expiration.
- The study must be conducted as described in the approved protocol. Changes to this protocol must be approved prior to initiating, unless the changes are necessary to eliminate an immediate hazard to subjects.
- Notify the IRB promptly of any adverse events, complaints, or unanticipated problems involving risks to subjects or others related to this project.
- Report any significant new findings that may affect the risks and benefits to the participants and the IRB.

Research records may be subject to a random or directed audit at any time to verify compliance with IRB standard operating procedures.

Thank you for your cooperation with NDSU IRB procedures. Best wishes for a successful study.
Sincerely,

Kristy Shirley

Kristy Shirley, CIP, Research Compliance Administrator

For more information regarding IRB Office submissions and guidelines, please consult www.ndsu.edu/irb. This Institution has an approved FederalWide Assurance with the Department of Health and Human Services: FWA00002439.

INSTITUTIONAL REVIEW BOARD
NDSU Dept 4000 | PO Box 6050 | Fargo ND 58108-6050 | 701.231.8995 | Fax 701.231.8098 | ndsu.edu/irb
Shipping address: Research 1, 1735 NDSU Research Park Drive, Fargo ND 58102

APPENDIX B: PRE NOTICE EMAIL

North Dakota State University
Center for Disaster Studies and Emergency Management
Department 2351
P.O. Box 6050
Fargo, ND 58108-6050
(701) 231-5595

Dear Sir or Madam,

North Dakota State University's Center for Disaster Studies and Emergency Management needs your help for an exploratory study of the role of local agencies in disasters. You have been selected for participation because of your role as a county emergency manager.

In approximately a week's time, you will receive an invitation email formally inviting you to participate in our survey. The invitation email will include the survey URL and the timeframe allotted for survey completion.

The survey will represent an opportunity for you to contribute to a better understanding of the way county emergency managers understand natural hazards and terrorist threats. This study will also attempt to set the foundation for future research on the connection between risk perception and the behaviors that follow.

Should you have any questions, fell free to contact me by phone at 507-215-0390 or email at jared.huibregtse@my.ndsu.edu. You may also contact Dr. Jessica Jensen, who is assisting with this project, by phone at 701 219-4293.

Thank you in advance for your participation in this research project.

Best regards,

Jared Huibregtse

APPENDIX C: PRE-NOTICE POST-CARD

NDSU NORTH DAKOTA STATE UNIVERSITY

Date: July 7th[th], 2014

From: North Dakota State University Center for Disaster Studies and Emergency Management

Purpose: I am writing in advance to inform you that a few days from now you will receive an email invitation to complete a survey for an important research project being conducted by North Dakota State University.

What it is About: It concerns the way county emergency managers understand natural hazards and terrorist threats.

Usefulness of Survey: This study intends to address the lack of research on county emergency managers' perceptions of whether natural hazards or terrorist threats constitute the greatest threat to their jurisdiction by asking you what you think.

Thank you in advance for your time spent in review of this request and the time you will spend completing this survey.

-Jared Huibregtse

jared.huibregtse@my.ndsu.edu

(507) 215-0390

APPENDIX D: INVITATION EMAIL

North Dakota State University
Center for Disaster Studies and Emergency Management
Department 2351
P.O. Box 6050
Fargo, ND 58108-6050
(701) 231-5595

Dear Sir or Madam,

North Dakota State University's Center for Disaster Studies and Emergency Management needs your help for an exploratory study of the role of local agencies in disasters. You have been selected for participation because of your role as an county emergency manager in your local jurisdiction.

To date, there has been limited research on the way experts or professionals understand risk, and none specifically on county emergency managers. This study intends to address the lack of research on county emergency managers and the individual level factors that influence their understanding of natural hazards and terrorist threats by asking you—someone we believe has relevant, personal and professional experience with disasters—what you think.

I am eager to learn about which types of hazard events you perceive are most likely to manifest in your jurisdiction, and what individual factors influence that perception. I hope that you will take some time to complete a survey about how you perceive risk as a county emergency manager. If you are able and willing, please follow the survey link to learn more about this study and begin the survey: https://www.surveymonkey.com/s/TERRORISMorNATURALDISASTER

It is expected that it will take approximately 20 minutes to complete the survey. Should you need to exit the survey prior to completing it, you can return to your survey from the same computer any time prior to August 15th, 2014 to finish by following the link above.

Your participation in this survey and your survey responses will be kept confidential; your participation is voluntary; and, you may choose not to participate in the study anytime. Please feel free to contact me at jared.huibregtse@my.ndsu.edu or (507) 215-0390. You may also contact Dr. Jessica Jensen, if you have any questions at ja.jensen@ndsu.edu or (701) 231-5762. Thank you in advance for your participation in this research project.

Best Regards,

Jared Huibregtse

APPENDIX E: INFORMATION SHEET AND SURVEY

1. STUDY INFORMATION SHEET AND CONSENT TO PARTICIPATE

DIRECTIONS: Please review the following information sheet. You will be directed to the survey after you indicate your willingness to participate at the bottom of this page.

Research Study
You are being invited to participate in an exploratory research project entitled "Understanding How Emergency Management Professionals See the World: Threat of Terror or Natural Disaster." This study is being conducted by Jared Huibregtse from the Center for Disaster Studies and Emergency Management at North Dakota State University, Department 2351, P.O. Box 6050, Fargo, ND 58108-6050, (701) 231-5595.

Purpose of Study
The purpose of this research is to explore the individual factors that influence emergency management professionals to perceive the likelihood of different types of hazard events to manifest in their local jurisdiction.

Basis for Participant Selection
You are being invited to participate in this research project because of your position as an emergency management professional in your region.

Explanation of Procedures
Should you choose to participate, you may exit the survey prior to completing it and you can return to your survey from the same computer any time prior to August 15, 2014 to finish by following the survey link.

Potential Risks and Discomforts
There should be no potential discomfort or physical, social, psychological, legal, or economic risk to you due to your participation in this study.

Potential Benefits
There is little empirical research on the risk perceptions of emergency management professionals. This research intends to address this gap in knowledge.

Your participation in this project will help provide a better understanding of the extent to which the risk perceptions of emergency management professionals vary and why. This study will also attempt to set the foundation for future research on the connection between risk perception and subsequent behavior.

Assurance of Confidentiality
If you choose to participate in this study, you are guaranteed confidentiality. Your survey and the responses you provide in the survey will not be accessible to anyone but the researchers, and once your survey is no longer relevant to this research project it will be destroyed. Analysis will occur across the data, not at an individual level. No identifying information will be included in the final reporting of the results.

Voluntary Participation and Withdrawal from the Study
Your participation is voluntary and you may quite at any time. Your decision whether or not to participate will not affect your present or future relationship with North Dakota State university or any other benefits to which you are otherwise entitled. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time.

Offer to Answer Questions
You should feel free to ask questions now or at any time. If you have any questions, you can contact me, Jared Huibregtse, at (507) 215-0390 or jared.huibregtse@my.ndsu.edu or Dr. Jessica Jensen, at (701)231-5886 or ja.jensen@ndsu.edu. If you have any questions about the rights of human research participants, or wish to report a research-related problem, contact the NDSU Institutional Research Board (IRB) Office at 855-800-6717

or by email at ndsu.irb@ndsu.edu.

***I have read the above information sheet and consent to participate in this study.**

- ◯ Yes
- ◯ No

2. Most Likely Hazard

***Please identify the single most likely natural hazard to impact your jurisdiction.**

- ◯ Biological Threats
- ◯ Chemical Threats
- ◯ Cyber Attack
- ◯ Drought
- ◯ Earthquake
- ◯ Explosions
- ◯ Extreme Heat
- ◯ Floods
- ◯ Hurricanes
- ◯ Landslides/debris flow
- ◯ Nuclear Blast
- ◯ Radiological Dispersion Device (Dirty Bomb)
- ◯ Thunderstorms and Lightning
- ◯ Tornadoes
- ◯ Tsunamis
- ◯ Volcano
- ◯ Wildfire
- ◯ Winter Storms and Extreme Cold
- ◯ Other (please specify)

***Indicate the extent to which you believe an event related to this hazard will occur in your jurisdiction in the next five years.**

	Definitely Will Not Occur		Unlikely		Likely		Will Definitely Occur	Do Not Know	Not Applicable
	0	1	2	3	4	5	6	7	8
Likelihood	◯	◯	◯	◯	◯	◯	◯	◯	◯

3. *Answer the following questions with the most likely hazard in mind.*

***Indicate the level of precision to which you believe the risk associated with this type of hazard is known.**

	Not Known at All 0	1	Barely Known 2	3	Somewhat Known 4	5	Known Precisely 6	Do Not Know 7	Not Applicable 8
By you	○	○	○	○	○	○	○	○	○
By people in your jurisdiction	○	○	○	○	○	○	○	○	○
By scientists	○	○	○	○	○	○	○	○	○

***Indicate the extent to which you believe this type of hazard is a new risk.**

	Very Old 0	1	Old 2	3	Somewhat New 4	5	Very New 6	Do Not Know 7	Not Applicable 8
Extent to which new:	○	○	○	○	○	○	○	○	○

***Indicate the extent to which you believe the following people can avoid death related to this type of hazard by virtue of the actions they take.**

	Impossible 0	1	Unlikely 2	3	Somewhat Likely 4	5	Very Likely 6	Do Not Know 7	Not Applicable 8
You	○	○	○	○	○	○	○	○	○
People in your jurisdiction	○	○	○	○	○	○	○	○	○

***Indicate the extent to which you believe the following consequences associated with this type of hazard are likely.**

	Impossible 0	1	Unlikely 2	3	Somewhat Likely 4	5	Very Likely 6	Do Not Know 7	Not Applicable 8
Kill large numbers of people at once	○	○	○	○	○	○	○	○	○
Consistently kill people over time	○	○	○	○	○	○	○	○	○
Consequences likely to be fatal to you	○	○	○	○	○	○	○	○	○
Consequences likely to be fatal to people in your jurisdiction	○	○	○	○	○	○	○	○	○

***Have you ever personally experienced an event related to this type of hazard?**

○ Yes

○ No

4. Continue to answer the following questions with the most likely hazar...

How many times have you experienced an event related to this type of hazard?

# of times in your lifetime

When did you most recently experience an event related to this type of hazard?

# of years since you personally experienced:

With respect to your most recent experience with an event related to this type of hazard, how severe were the impacts experienced?

	No Impact 0	1	Minor Impact 2	3	Significant Impact 4	5	Very Severe Impact 6	Do Not Know 7	Not Applicable 8
Severity of impacts experienced	○	○	○	○	○	○	○	○	○

Indicate the intensity with which *you personally* experienced the following feelings related to your most recent experience with an event related to this type of hazard.

	Not at all 0	1	Mild 2	3	Somewhat Intensely 4	5	Very Intensely 6	Do Not Know 7	Not Applicable 8
Sadness	○	○	○	○	○	○	○	○	○
Anger	○	○	○	○	○	○	○	○	○
Worry	○	○	○	○	○	○	○	○	○
Anxiety	○	○	○	○	○	○	○	○	○

5. *Continue to answer the following questions with the most likely hazar...*

***As far as you are aware, has the jurisdiction you serve ever experienced an event related to this type of hazard?**

- ◯ Yes
- ◯ No

6. *Continue to answer the following questions with the most likely hazar...*

As far as you are aware, how many times has your jurisdiction experienced an event related to this type of hazard?

times you are aware of

When did the jurisdiction you serve most recently experience an event related to this type of hazard?

# of years since your jurisdiction experienced

With respect to your jurisdiction's most recent experience with an event related to this type of hazard, how severe were the impacts experienced?

	No Impact 0	1	Minor Impact 2	3	Significant Impact 4	5	Very Severe Impact 6	Do Not Know 7	Not Applicable 8
Severity of impacts experienced by people in your jurisdiction	○	○	○	○	○	○	○	○	○

Indicate the intensity with which you perceive *the people in your jurisdiction* to have experienced the following feelings related to your most recent experience with an event related to this type of hazard.

	Not at all 0	1	Mild 2	3	Somewhat Intensely 4	5	Very Intensely 6	Do Not Know 7	Not Applicable 8
Sadness	○	○	○	○	○	○	○	○	○
Anger	○	○	○	○	○	○	○	○	○
Worry	○	○	○	○	○	○	○	○	○
Anxiety	○	○	○	○	○	○	○	○	○

7. Continue to answer the following questions with the most likely hazar...

Indicate your ratings regarding the exent to which you first, rely on, second, trust, and, third, perceive as consistent the following *sources of information about this type of hazard.*

	Never 0	1	Not Often 2	3	Often 4	5	Always 6	Do not Know 7	Not Appliable 8
Rely on **HISTORICAL ARCHIVES**	○	○	○	○	○	○	○	○	○
Trust historical archives	○	○	○	○	○	○	○	○	○
Historical archive information is consistent	○	○	○	○	○	○	○	○	○
Rely on **RADIO**	○	○	○	○	○	○	○	○	○
Trust local radio	○	○	○	○	○	○	○	○	○
Local radio information is consistent	○	○	○	○	○	○	○	○	○
Rely on **TELEVISION**	○	○	○	○	○	○	○	○	○
Trust television	○	○	○	○	○	○	○	○	○
Television information is consistent	○	○	○	○	○	○	○	○	○
Rely on **NEWSPAPERS**	○	○	○	○	○	○	○	○	○
Trust newspapers	○	○	○	○	○	○	○	○	○
Newspaper information is consistent	○	○	○	○	○	○	○	○	○
Rely on **INTERNET**	○	○	○	○	○	○	○	○	○
Trust internet	○	○	○	○	○	○	○	○	○
Internet information is consistent	○	○	○	○	○	○	○	○	○
Rely on **FEDERAL BUREAU OF INVESTIGATION (FBI)**	○	○	○	○	○	○	○	○	○
Trust FBI	○	○	○	○	○	○	○	○	○
FBI information is consistent	○	○	○	○	○	○	○	○	○
Rely on **DEPARTMENT OF HOMELAND SECURITY (DHS)**	○	○	○	○	○	○	○	○	○
Trust DHS	○	○	○	○	○	○	○	○	○
DHS information is consistent	○	○	○	○	○	○	○	○	○
Rely on **DEPARTMENT OF STATE (DoS)**	○	○	○	○	○	○	○	○	○
Trust DoS	○	○	○	○	○	○	○	○	○
DoS information is consistent	○	○	○	○	○	○	○	○	○

8. *Continue to answer the following questions with the most likely hazar...*

Indicate the exent to which you rely on, trust, and perceive as consistent the following ***sources of information about this type of hazard.***

	Never 0	1	Not Often 2	3	Often 4	5	Always 6	Do not Know 7	Not Appliable 8
Rely on **STATE FUSION CENTER (SFC)**	○	○	○	○	○	○	○	○	○
Trust SFC	○	○	○	○	○	○	○	○	○
SFC information is consistent	○	○	○	○	○	○	○	○	○
Rely on **STATE DEPARTMENT OF EMERGENCY MANAGEMENT (SDEM)**	○	○	○	○	○	○	○	○	○
Trust SDEM	○	○	○	○	○	○	○	○	○
SDEM information is consistent	○	○	○	○	○	○	○	○	○
Rely on **NATIONAL WEATHER SERVICE (NWS)**	○	○	○	○	○	○	○	○	○
Trust NWS	○	○	○	○	○	○	○	○	○
NWS information is consistent	○	○	○	○	○	○	○	○	○
Rely on **UNITED STATES GEOLOGICAL SURVEY (USGS)**	○	○	○	○	○	○	○	○	○
Trust USGS	○	○	○	○	○	○	○	○	○
USGS information is consistent	○	○	○	○	○	○	○	○	○
Rely on **COMMUNICATION WITH PEOPLE IN MY SOCIAL NETWORK**	○	○	○	○	○	○	○	○	○
Trust these communications	○	○	○	○	○	○	○	○	○
These communications are consistent	○	○	○	○	○	○	○	○	○
Rely on **SCHOLARS/SCIENTISTS**	○	○	○	○	○	○	○	○	○
Trust scholars/scientists	○	○	○	○	○	○	○	○	○
Information from scholars/scientists is consistent	○	○	○	○	○	○	○	○	○

9. County Demographic Information

***What is the total population of your jurisdiction?**

***What is the total budget for your emergency management program?**

***How recently did your county conduct/update a hazard analysis?**

- ◯ We have not conducted a hazard analysis.
- ◯ We have conducted/completed a hazard analysis. *Number of years since conducted/updated:*

***How recently did your county conduct/update a vulnerability analysis?**

- ◯ We have not conducted a vulnerability analysis.
- ◯ We have conducted/updated a vulnerability analysis. *Number of years since conducted/updated:*

How recently did your county conduct/update a risk assessment?

- ◯ We have not conducted a risk assessment.
- ◯ We have conducted/updated a risk assessment. *Number of years since conducted/updated:*

10. Individual Demographic Information

***How many years of experience do you have as a county emergency manager?**

Years of experience

***How old are you?**

Age

***Please identify your sex.**

- ◯ Male
- ◯ Female

***Please identify the category in which your personal income fits.**

- ◯ No income
- ◯ Under $25, 000
- ◯ $25, 000-$49, 999
- ◯ $50,000-$74, 999
- ◯ More than $75, 000

***Please identify the highest level of education you have completed.**

- ◯ Less than high school
- ◯ Regular high school diploma or GED
- ◯ Some college
- ◯ Associates degree
- ◯ Bachelor's degree
- ◯ Master's degree
- ◯ Professional degree beyond a bachelor's degree
- ◯ Doctoral degree

***Do you hold the following types of emergency management certification?**

	Yes	No
State emergency management certification	◯	◯
Professional organization emergency management certification	◯	◯

***Identify the total number of hours of training you have had related to the following areas.**

Existing hazards and how they work	
Conducting a hazard analysis	
Conducting a vulnerability analysis	
Conducting a risk assessment	

***Please identify the option that best describes your race/ethnicity.**

- ◯ Black, African American, or Negro
- ◯ Hispanic, Latino, or Spanish Origin
- ◯ White
- ◯ American Indian or Alaska Native
- ◯ Asian Indian
- ◯ Chinese
- ◯ Filippino
- ◯ Guamanian or Chamoro
- ◯ Japanese
- ◯ Korean
- ◯ Native Hawaiian
- ◯ Somoan
- ◯ Vietnamese
- ◯ Other (please specify)

***Do you own or rent your place of residence?**

- ◯ Own
- ◯ Rent

11. WHY NATURAL OR TERROR

You indicated that a natural disaster or act of terror was the greatest risk to the jurisdiction you serve. Use the space provided to describe why you chose one or the other.

12. THANK YOU

Thank you for your time and participation in this survey.

Please identify the county you serve as an emergency manager so that we do not send you further reminders regarding the opportunity to participate in this study. The county name you provide will not be used in any reports related to the data gathered through this survey.

APPENDIX F: REMINDER EMAIL

North Dakota State University
Center for Disaster Studies and Emergency Management
Dept. 2351
P.O. Box 6050
Fargo, ND 58108-6050

Dear Sir or Madam,

Approximately a week ago, a formal invitation to participate in a study on the way county emergency managers understand natural hazards and terrorist threats was sent to you along with a link to the survey. To the best of our knowledge, your survey has not yet been completed.

This survey represents an opportunity for you to help provide a better understanding whether county emergency managers perceive natural hazards or terrorist threats as the greatest threat to their jurisdiction by asking you what you think. The results of this survey will benefit students and faculty in emergency management higher education as well as county emergency managers across the United States. Please do not allow the chance to share your experience to pass. You can complete the survey now at:

https://www.surveymonkey.com/s/TERRORISMorNATURALDISASTER

The survey should take about 20 minutes to complete and you can stop and return the survey any time before August 15th, 2014 from the computer on which you started the survey.

Should you have just completed the survey, thank you for your contribution to the emergency management community's knowledge about the way county emergency managers understand natural hazards and terrorist threats. If you have any questions, feel free to contact Jared Huibregtse at (507)-215-0390 or email at jared.huibregtse@my.ndsu.edu. You may also contact Dr. Jessica Jensen by phone at (701) 219-4293 or by email at ja.jensen@ndsu.edu.

Best Regards,

Jared Huibregtse

APPENDIX G: REMINDER POST-CARD

NDSU NORTH DAKOTA STATE UNIVERSITY

Date: July 18th, 2014

From: North Dakota State University Center for Disaster Studies and Emergency Management

Purpose: Approximately a week ago, a formal invitation to participate in a study on the way county emergency managers understand natural hazards and terrorist threats was sent to you along with a link to the survey. To the best of our knowledge, your survey has not yet been completed.

What it is About: This survey represents an opportunity for you to help provide a better understanding of whether natural hazards or terrorist threats constitute the greatest risk to your jurisdiction by asking you what you think.

Usefulness of Survey: The results of this survey will benefit students and faculty in emergency management higher education as well as county emergency managers across the United States.

Thank you in advance for your time spent in review of this request and the time you will spend completing this survey.

-Jared Huibregtse

APPENDIX H: FINAL REMINDER EMAIL

North Dakota State University
Center for Disaster Studies and Emergency Management
Dept. 2351
P.O. Box 6050
Fargo, ND 58108-6050

Dear Sir or Madam,

Approximately a week ago, a formal invitation to participate in a study on the way county emergency managers perceive natural hazards and terrorist threats was sent to you along with a link to the survey. To the best of our knowledge, your survey has not yet been completed.

Your participation in the survey is needed to ensure that survey results meet the scientific standards for research. Thus, if you have the time to complete the survey, we would be most grateful.

I hope that you will take this opportunity to participate in this research endeavor by completing the survey at: https://www.surveymonkey.com/s/TERRORISMorNATURALDISASTER. Should you have just completed the survey, thank you for your contribution to the emergency management community's knowledge of how county emergency managers perceive risk.

Should you have any questions, fell free to contact me by phone at 507-215-0390 or email at jared.huibregtse@my.ndsu.edu. You may also contact Dr. Jessica Jensen, who is assisting with this project, by phone at (701) 219-4293 or by email at ja.jensen@ndsu.edu.

Thank you in advance for your participation in this research project.

Sincerely,

Jared Huibregtse

APPENDIX I: STEPS LEADING UP TO MULTIPLE REGRESSION

Defining Variables

- Variables were defined along the following parameters:
    - Name- names were provided for each variable
    - Label- labels were questions that appeared on the survey
    - Values- labels were defined that corresponded to certain numerical values (e.g., 0 for male and 1 for female)
    - Missing- missing values were set where appropriate (e.g., 7 = Do Not Know, 8 = Not Applicable)
    - Measure- defined the scale of measurement that best characterizes the variable (nominal, ordinal, or interval)

Entering Data

- Survey Monkey Data was downloaded into and SPSS Spreadsheet

Skip Pattern

- Where there is was a skip pattern built into the survey, the value of zero was inserted in order to make completed surveys appear so within SPSS

Descriptive Statistics

- Identify central tendencies of independent and dependent variables using descriptive statistics as appropriate given the level of measurement
    - Includes:
        - Frequency distributions (histogram and/or table)
        - Mean
        - Median
        - Mode
        - Minimum/Maximum/Range
        - Standard Deviation
        - Skewness/kurtosis

Check Reliability of Variable Indexes

- Ensure all items are measured on the same scale
- Reverse code variables if necessary
- Reliability checks include:
    - Chronbach's Alpha
    - This step helps to ensure goodness of fit between the data and the assumptions for regression
    - If an outlier causes a significant skew, that outlier will be dropped if it violates assumptions for regression

Creating Variable Indexes

- Necessary for variables that require multiple survey questions (e.g., dread, uncertainty, and feelings)

- Must be done for both personal and professional level
- Recoded into dichotomous variables as necessary (e.g., 1=white, 2=non-white)
    - This includes:
        - Dread
        - Uncertainty
        - Feelings related to hazard impact
            - Personal and jurisdictional
        - Information sources as a whole
        - Reliability, Trust, and Consistency separately
        - Information sources separately

Multicollinearity

- Multicollinearity means that multiple independent variables are highly correlated with one another. A high level of multicollinearity makes it difficult to determine the relationship between IV1 and DV when controlling for IV2, and vice versa.
    - It might make sense to combine these two components by conducting a principle component analysis

One-way Correlation Testing

- Pearson Correlation Coefficient (*r*)
- One-Way Analysis of Variance (ANOVA)
- Cramer's V

Regression

- Linear

What to look for after Regression is run

- *R*
    - Ranges in value from 0-1. A value of 1 means that the IVs perfectly predict the DV. A value of 0 means there is no relationship between the IVs and DV.
- R^2
    - Computed by squaring *R* (R^2). For example, an R^2 of .25 for a block of IVs means that 25% of the variance of the DV can be accounted for by its relationship with that block.
        - R^2 may be higher if a certain variable is dropped
- R^2_{adj}
    - Adjusted R^2 accounts for the increased effect IVs have on the DV in a small sample.

      This will be particularly important to pay attention to in this study

APPENDIX J: MULTICOLLINEARITY TABLE USING PEARSON CORRELATION FOR INTERVAL TO INTERVAL INDEPENDENT VARIABLES

		Times personally experienced	Years since experience	Personal severity of impacts	Times jurisdiction experienced	Years since jur. experienced	Jurisdiction severity of impacts	Population	Budget
Times personally experienced	Pearson Correlation								
	Sig. (1-tailed)								
	N	155							
Years since experience	Pearson Correlation	-.156*							
	Sig. (1-tailed)	.027							
	N	154	154						
Personal severity of impacts	Pearson Correlation	-.192**	.139*						
	Sig. (1-tailed)	.008	.043						
	N	155	154	155					
Times jurisdiction experienced	Pearson Correlation	.553**	-.091	-.075					
	Sig. (1-tailed)	.000	.131	.180					
	N	152	152	152	153				
Years since jur. Experience	Pearson Correlation	-.145*	.528**	.100	-.089				
	Sig. (1-tailed)	.036	.000	.109	.136				
	N	154	154	154	153	155			
Jurisdiction severity of impacts	Pearson Correlation	-.111	.055	.591**	-.112	.139*			
	Sig. (1-tailed)	.085	.248	.000	.085	.043			
	N	154	153	154	152	154	155		
Population	Pearson Correlation	-.020	-.107	-.014	-.022	-.105	.010		
	Sig. (1-tailed)	.404	.094	.432	.393	.098	.452		
	N	154	153	154	152	154	154	155	
Budget	Pearson Correlation	.000	-.125	.042	.027	-.097	.004	.857**	
	Sig. (1-tailed)	.500	.064	.305	.371	.120	.481	.000	
	N	150	149	150	148	150	150	150	151

		Times personally experienced	Years since experience	Personal severity of impacts	Times jurisdiction experienced	Years since jur. experienced	Jurisdiction severity of impacts	Population	Budget
Years of experience	Pearson Correlation	.125	.092	.142*	.062	-.010	.257**	.054	.041
	Sig. (1-tailed)	.061	.129	.038	.222	.452	.001	.252	.307
	N	155	154	155	153	155	155	155	151
Age	Pearson Correlation	-.108	.211**	.220**	.084	.143*	.267**	-.006	.048
	Sig. (1-tailed)	.090	.004	.003	.152	.038	.000	.471	.280
	N	155	154	155	153	155	153	155	151
Personal Affect Index	Pearson Correlation	-.155*	.121	.407**	-.144*	.059	.241**	-.147*	-.088
	Sig. (1-tailed)	.029	.070	.000	.040	.237	.002	.037	.146
	N	151	150	151	148	150	150	150	146
Jurisdictional Affect Index	Pearson Correlation	-.175*	.075	.317**	-.175*	.066	.567*	-.051	-.084
	Sig. (1-tailed)	.018	.186	.000	.018	.216	.000	.272	.161
	N	145	144	145	143	145	145	145	141
Uncertainty Index	Pearson Correlation	.163*	-.017	-.131*	.105	.003	-.018	.029	.008
	Sig. (1-tailed)	.028	.421	.062	.110	.486	.418	.386	.464
	N	139	138	139	138	139	140	139	135
Dread Index	Pearson Correlation	-.028	.119	054	.081	.126	.082	-.028	-.056
	Sig. (1-tailed)	.364	.071	253	.161	.059	.155	.365	.248
	N	154	153	154	152	154	154	154	150
Training Index	Pearson Correlation	.018	.053	097	-.012	-.080	.155*	.277*	-.228*
	Sig. (1-tailed)	.412	.258	115	.442	.162	.027	.000	.002
	N	155	154	155	153	155	155	155	151
Information Index	Pearson Correlation	.195	-.018	-.115	.045	-.039	-.084	-.047	-.332**
	Sig. (1-tailed)	.052	.442	171	.353	.374	244	.348	.003
	N	71	71	71	71	71	71	71	68

		Years of Experience	Age	Personal Affect Index	Jurisdictional Affect Index	Uncertainty Index	Dread Index	Training Index	Information Index
Years of experience	Pearson Correlation								
	Sig. (1-tailed)								
	N	156							
Age	Pearson Correlation	.322**							
	Sig. (1-tailed)	.000							
	N	156	156						
Personal Affect Index	Pearson Correlation	.058	.141*						
	Sig. (1-tailed)	.241	.042						
	N	151	151	154					
Jurisdictional Affect Index	Pearson Correlation	.195**	.065	.506**			.		
	Sig. (1-tailed)	.009	.219	.000					
	N	146	146	142	153				
Uncertainty Index	Pearson Correlation	.046	-.072	-.048	-.029				
	Sig. (1-tailed)	.295	.200	.289	.371				
	N	140	140	135	133	156			
Dread Index	Pearson Correlation	.120	.118	.079	.154*	-.182			
	Sig. (1-tailed)	.069	.072	.170	.032	.016			
	N	155	155	150	145	139	156		
Training Index	Pearson Correlation	.188**	-.083	-.118	.142*	.049	.183*		
	Sig. (1-tailed)	.009	.152	.075	.043	.231	.011		
	N	156	156	151	146	140	155	156	
Information Index	Pearson Correlation	-.190	-.197	.100	.204*	.130	.068	.173	
	Sig. (1-tailed)	.056	.050	.206	.047	.145	.235	.74	
	N	71	71	69	68	68	70	71	156

APPENDIX K: MULTICOLLINEARITY TABLE USING ONE-WAY ANOVA FOR NOMINAL TO INTERVAL INDEPENDENT VARIABLES

		Times personally experienced	Years since experience	Personal severity of impacts	Times jurisdiction experienced	Years since jur. experienced	Jurisdiction severity of impacts	Population	Budget
Sex	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.032	.000	.000	.321	.604	.033	3.83	1.2
	Sig.	.859	.987	.395	.572	.438	.856	.052	.275
Income above/below $50,000	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.312	.007	.014	.115	.196	.962	10.44	7.95
	Sig.	.577	.933	.906	.735	.659	.328	.002**	.005**
Education above/below bachelor's	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	1.97	3.76	1.69	.159	.093	.001	2.33	3.64
	Sig.	.162	.054	.196	.690	.761	.981	.129	.058
State Certification	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.381	.509	11.38	.014	.694	10.74	.017	.062
	Sig.	.538	.477	.001**	.906	.406	.001**	.898	.804
Professional Certification	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.229	.028	.766	.632	.096	.005	.955	1.19
	Sig.	.633	.867	.383	.428	.757	.944	.330	.276
Race: white/non-white	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.165	.265	1.38	.128	.246	.392	.008	.079
	Sig.	.685	.608	.243	.721	.621	.532	.928	.778
Rent/Own	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	1.80	2.01	.498	.013	1.80	.895	.092	.340
	Sig.	.181	.158	.481	.908	.182	.346	.763	.561

		Times personally experienced	Years since experience	Personal severity of impacts	Times jurisdiction experienced	Years since jur. experienced	Jurisdiction severity of impacts	Population	Budget
Sex	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.032	.000	.000	.321	.604	.033	3.83	1.2
	Sig.	.859	.987	.995	.572	.438	.856	.052	.275
Income above/below $50,000	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.312	.007	.014	.115	.196	.962	10.44	7.95
	Sig.	.577	.933	.906	.735	.659	.328	.002**	.005**
Education above/below bachelor's	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	1.97	3.76	1.69	.159	.093	.001	2.33	3.64
	Sig.	.162	.054	.196	.690	.761	.981	.129	.058
State Certification	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.381	.509	11.38	.014	.694	10.74	.017	.062
	Sig.	.538	.477	.001**	.906	.406	.001**	.898	.804
Professional Certification	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.229	.028	.766	.632	.096	.005	.955	1.19
	Sig.	.633	.867	.383	.428	.757	.944	.330	.276
Race: white/non-white	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	.165	.265	1.38	.128	.246	.392	.008	.079
	Sig.	.685	.608	.243	.721	.621	.532	.928	.778
Rent/Own	Degrees of Freedom	154	153	154	152	154	154	154	150
	F	1.80	2.01	.498	.013	1.80	.895	.092	.340
	Sig.	.181	.158	.481	.908	.182	.346	.763	.561

APPENDIX L: MULTICOLLINEARITY TABLE USING CRAMER'S V FOR NOMINAL TO NOMINAL INDEPENDENT VARIABLES

		Sex	Income above/below $50,000	Education above/below bachelor's	State Certification	Professional Certification	Race: white/non-white	Rent/Own
Sex	N							
	Cramer's V							
	Sig.							
Income above/below $50,000	N	156						
	Cramer's V	.149						
	Sig.	.062						
Education above/below bachelor's	N	156	156					
	Cramer's V	.135	.077					
	Sig.	.092	.337					
State Certification	N	156	156	156				
	Cramer's V	.066	.068	.005				
	Sig.	.411	.398	.952				
Professional Certification	N	156	156	156	156			
	Cramer's V	.170	.112	.017	.286			
	Sig.	.033*	.160	.836	.000**			
Race: white/non-white	N	156	156	156	156	156		
	Cramer's V	.113	.000	.005	.073	.090		
	Sig.	.156	1	.949	.361	.261		
Rent/Own	N	156	156	156	156	156	156	
	Cramer's V	.045	.162	.062	.127	.144	.060	
	Sig.	.574	.043*	.440	.114	.072	.451	

APPENDIX M: DISTRIBUTION FOR UNCERTAINTY

Statement	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
...known by you…	.6	0	.6	0	9.0	41.7	48.1	0	0
…known by people in your jurisdiction…	0	.6	3.2	4.5	39.1	34.6	17.9	0	0
…known by scientists…	.6	0	0	1.9	10.3	27.6	50.0	7.7	1.9
…extent to which hazard is new…	0	0	1.3	4.5	23.7	7.7	62.2	0	.6

APPENDIX N: DISTRIBUTION FOR DREAD

Statement	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
…controlled by you…	0	0	1.3	0	2.6	4.5	91.7	0	0
…controlled by people in your jurisdiction…	0	0	1.3	1.9	16.7	17.3	62.8	0	0
…kill large numbers of people…	4.5	17.9	51.9	14.7	9.6	1.3	0	0	0
…consistently kill people over time…	7.1	17.9	38.5	13.5	16.0	3.8	3.2	0	0
…consequences likely to be fatal to you…	4.5	25.6	54.5	7.7	4.5	2.6	0	.6	0
…consequences likely to be fatal to people in your jurisdiction…	.6	9.6	32.7	23.7	21.8	9.0	2.6	0	0

APPENDIX O: DISTRIBUTION FOR PERSONAL SEVERITY OF IMPACTS AND THE AFFECT HEURISTIC

Statement	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
…how severe were the impacts experienced…	3.8	5.8	30.1	19.2	30.1	5.1	5.1	0	0
…you personally experienced sadness…	42.3	17.9	21.8	6.4	5.1	1.9	1.3	0	1.3
…you personally experienced anger…	58.3	17.3	10.3	7.1	1.9	2.6	0	0	.6
…you personally experienced worry…	17.3	13.5	29.5	13.5	16.0	6.4	2.6	0	0
…you personally experienced anxiety…	23.7	15.4	28.8	13.5	9.0	5.8	2.6	0	0

APPENDIX P: DISTRIBUTION FOR JURISDICTIONAL SEVERITY OF IMPACTS AND THE AFFECT HEURISTIC

Statement	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
…how severe were the impacts experienced…	1.3	2.6	27.6	20.5	32.7	8.3	6.4	0	0
…people in your jurisdiction experienced sadness…	18.6	22.4	21.2	11.5	14.1	3.8	3.2	3.8	1.3
…people in your jurisdiction experienced anger…	18.6	21.2	23.7	10.3	11.5	6.4	2.6	4.5	1.3
…people in your jurisdiction experienced worry…	6.4	10.9	25.6	14.1	23.7	8.3	8.3	1.9	.6
…people in your jurisdiction experienced anxiety…	5.8	14.1	20.5	19.2	21.2	9.6	6.4	2.6	.6

APPENDIX Q: DISTRIBUTION FOR INFORMATION

Statement	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
…rely on historical archives…	3.8	4.5	14.1	21.2	31.4	11.5	10.3	1.3	1.9
…trust historical archives…	1.9	3.8	7.7	14.7	35.9	21.8	10.9	1.3	1.9
…historical archive information is consistent…	.6	3.2	7.7	16.7	37.2	18.6	9.6	4.5	1.9
…rely on radio…	1.9	3.8	12.8	12.2	45.5	15.4	8.3	0	0
…trust local radio…	0	3.2	5.1	16.0	44.2	20.5	9.0	.6	1.3
…local radio information is consistent…	0	3.8	7.1	16.7	42.3	19.9	8.3	1.3	.6
…rely on television…	.6	.6	7.7	17.3	46.8	19.2	7.7	0	0
…trust television…	.6	1.3	7.1	25.0	41.7	17.9	6.4	0	0
…television information is consistent…	.6	1.9	9.0	22.4	41.7	17.3	6.4	0	0
…rely on newspapers…	7.1	7.1	30.8	17.9	25.6	5.8	4.5	1.3	0
…trust newspapers…	3.2	9.6	12.8	28.8	31.4	7.7	3.8	0	2.6
…newspaper information is consistent…	3.2	9.6	11.5	30.8	28.8	7.7	5.8	0	2.6
…rely on internet…	1.3	1.9	12.2	7.7	29.5	32.7	14.7	0	0
…trust internet…	.6	4.5	17.9	14.1	30.8	23.1	9.0	0	0
…internet information is consistent…	2.6	5.1	19.2	19.2	25.0	21.2	7.7	0	0
…rely on FBI…	21.8	6.4	10.9	4.5	10.9	6.4	7.1	1.3	30.8
…trust FBI…	9.6	2.6	6.4	6.4	19.2	10.3	10.9	1.3	33.3
…FBI information is consistent…	9.6	2.6	7.7	7.1	16.7	10.3	10.9	1.9	33.3
…rely on DHS…	12.2	3.8	8.3	8.3	17.9	17.9	10.9	0	20.5
…trust DHS…	6.4	2.6	5.1	10.9	19.2	20.5	13.5	0	21.8
…DHS information is consistent…	6.4	4.5	7.1	12.2	17.9	16.7	13.5	0	21.8
…rely on DoS…	18.6	5.8	9.6	8.3	12.8	7.7	6.4	1.3	28.8
…trust DoS…	11.5	4.5	6.4	10.9	14.7	11.5	7.7	1.3	31.4
…DoS information is consistent…	10.9	4.5	7.7	11.5	14.7	9.6	8.3	1.3	31.4
…rely on SFC…	11.5	7.1	13.5	10.9	17.3	7.7	5.1	5.1	21.2

…trust SFC…	6.4	3.8	6.4	7.1	20.5	16.0	10.3	5.8	23.7
…SFC information is consistent…	6.4	3.8	7.1	5.1	21.8	16.0	10.3	6.4	23.1
…rely on SDEM…	3.8	1.3	5.1	10.3	30.1	22.4	21.2	.6	4.5
…trust SDEM…	2.6	1.3	2.6	13.5	28.8	23.7	21.8	.6	5.1
…SDEM information is consistent…	2.6	1.3	5.1	16.0	26.3	22.4	20.5	.6	5.1
…rely on NWS…	0	0	0	0	12.2	21.2	66.7	0	0
…trust NWS…	0	0	0	1.3	12.8	28.2	57.7	0	0
…NWS information is consistent…	0	.6	1.3	1.9	17.3	28.2	50.6	0	0
…rely on USGS…	10.3	3.2	12.8	5.1	16.7	15.4	13.5	5.1	17.9
…trust USGS…	6.4	1.3	4.5	6.4	19.2	20.5	17.3	6.4	17.9
…USGS information is consistent…	6.4	1.3	3.8	7.1	20.5	19.2	17.9	6.4	17.3
…rely on communication with people in my social network…	6.4	1.9	17.9	18.6	19.9	13.5	16.0	.6	5.1
…trust communication with people in my social network…	5.1	1.9	16.0	25.6	19.9	15.4	9.0	.6	6.4
…these communications are consistent…	5.1	3.8	23.7	18.6	19.9	12.8	8.3	1.3	6.4
…rely on scholars/scientists…	10.3	4.5	14.7	10.9	21.8	13.5	7.7	2.6	14.1
…trust scholars/scientists…	5.1	1.9	9.6	12.8	24.4	19.2	7.1	2.6	17.3
…information from scholars/scientists is consistent…	5.1	1.9	9.0	17.3	22.4	17.3	5.8	3.8	17.3