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Trust and Contexts: A Conceptual Framework for Understanding Coastal Household Preparedness

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TRUST AND CONTEXTS: A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING COASTAL HOUSEHOLD PREPAREDNESS

by

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A Dissertation Submitted to the Faculty of Old Dominion University in Partial Fulfillment of the Requirements for the Degree of

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May 2024

Approved by:
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ABSTRACT

TRUST AND CONTEXTS: A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING COASTAL HOUSEHOLD PREPAREDNESS

Ogechukwu M. Agim Nwandu-Vincent
Old Dominion University, 2024
Director: Dr. Juita-Elena (Wie) Yusuf

Despite research findings that show the benefits of being prepared for increasingly tumultuous natural and coastal hazard events, studies on hazard preparedness indicate that low levels of preparedness may occur in vulnerable areas due to the uncertainty around hazard risks, expected hazard onset and impact strength, as well as associated effects. Study findings indicate that trust may impact the uncertainty and complexity faced by people dealing with unfamiliar, infrequent, and complex hazards, as well as contexts such as factors such as age, gender, prior hazard experience, and homeownership.

While studies have looked at the relationship between trust and compliance (desired protective behaviors) and the various contexts and conditions in which households prepare for natural and coastal hazards, very few studies have conceptualized trust as a tool used by households when dealing with uncertainty about coastal hazards.

The purpose of this study is to provide a household-level understanding of the influence of trust and contexts on coastal household hazard preparedness. This was accomplished through a systematic review of 52 peer-reviewed studies using rigorous search, screening, and selection processes that were guided by the PRISMA 2020 Protocol. The study produced a preliminary and expanded conceptual framework, seven (7) research propositions, and a comprehensive answer to the research question: How do contexts and trust influence household preparedness for coastal hazards?

This study provides significance to emergency management stakeholders and enhances overall preparedness efforts by developing an ordered and systematic approach to
understanding the nuances that influence household preparedness for coastal hazards. The resulting framework and research propositions can be applied by emergency preparedness stakeholders to enhance the adaptive capacities of coastal households and communities through various concerted strategies, especially in communities that are disparately affected by the effects of coastal hazards.
I dedicate this dissertation to my Lord and Savior, Jesus Christ, the One who granted me the grace, strength, and courage to persevere throughout this doctoral program.

Dedicated to my parents, George and Juliet Agim, with a heartfelt acknowledgment to my late father - thank you both for sowing the seeds of curiosity, determination, discipline, faith, and focus. They have sprouted in the most profound ways.

To Stefan, my husband, and partner in all things—thank you for being my rock. I could not have undertaken this journey without you. I dedicate this to you and to us.

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KEY DEFINITIONS

**Coastal hazard:** The occurrence of a phenomenon (e.g., a tropical storm, hurricane, tsunami), which has the potential for causing damage to, or loss of, natural ecosystems, buildings, and infrastructure (Cambers, 2001).

**Coastal resilience:** The ability of both human and natural communities to "bounce back" to normalcy after events like coastal storms, hurricanes, and flooding, rather than merely reacting to their impact (Meerow et al., 2016; Lloyd et al., 2013).

**Contexts:** Preparedness antecedents or background factors that can impact coastal hazard preparedness and can predispose household susceptibility to loss or disruption from hazard activity (Cope et al., 2018; Paton & Johnson, 2001).

**Disasters:** The processes that happen when collective social routines are disrupted, resulting in unplanned actions and decisions that must be undertaken to cope with the unforeseen crisis (Quarantelli, 2000).

**Preparedness:** The application of knowledge, competencies, efforts, resources, and actions of governments, professional response agencies, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of potential, imminent, or current hazard events or conditions (UN/ISDR & UN/OCHA, 2008).

**Trust:** Described as a social glue that consists of three parts: trustors’ beliefs, the trustee’s perceived trustworthiness, and the context in which the trust relationship occurs (Robbins, 2016; Hardin, 2002).

**Vulnerability:** The combination of social conditions and root causes that can exacerbate people’s exposure to hazards. These social conditions are made up of socioeconomic, geographic, and political realities (Espia & Salvador, 2018; Patterson et al., 2010; Blaikie et al., 1994).
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1. INTRODUCTION

Coastal communities persistently face escalating hazard risks posed by both human-made and natural hazards. The encroachment of human activities into restricted coastal areas exacerbates the vulnerability of these communities, heightening the likelihood of exposure to various coastal hazards (Almutairi et al., 2020). Coastal communities face significant risks from catastrophic events like hurricanes, tropical storms, and tsunamis, as these have the potential to cause damage, loss of natural ecosystems, buildings, and infrastructure (Cambers, 2001). Even smaller and less intense storms, bringing flooding and high winds, pose substantial dangers for those residing along the coast.

Due to geographic isolation and sometimes having fewer resources than urban areas, many coastal communities suffer disproportionately from coastal hazards and need more time to recover and bounce back – a critical component of coastal resilience (Hart, 2022; Beatley, 2012). Lloyd et al. (2013) and Meerow et al. (2016) define coastal resilience as the ability of both human and natural communities to "bounce back" to normalcy after events like coastal storms, hurricanes, and flooding, rather than merely reacting to their impact. Preparedness enhances the likelihood of coastal communities rebounding from climate and weather-related events.

Preparedness is described by the United Nations as the application of knowledge, competencies, efforts, resources, and actions of governments, professional response agencies, communities, and individuals to effectively anticipate, respond to, and recover from the impacts of potential, imminent, or current hazard events or conditions (UN/ISDR & UN/OCHA, 2008). Cutter et al. (2014) emphasize that preparedness can speed up recovery and reduce negative impacts on safety and the economy. Meerow et al. (2016) suggest that evaluating community resilience not only deepens understanding of disasters but also informs evidence-based strategies to minimize their impact and accelerate recovery.
Studies have found that despite the largely publicized benefits of preparedness, many coastal households report being underprepared or completely unprepared for frequently occurring hazards such as nuisance flooding, to more severe coastal hazard events such as cyclones, hurricanes, and tornadoes. FEMA estimated that less than 5% of homeowners purchase flood insurance, even though flooding is one of the most deadly and costly natural disaster to affect the United States (FEMA, 2019). In fact, the 2019 FEMA National Report estimated that even in areas that are most prone to flooding (designated as Special Flood Hazard Areas), only about 30% of homes have flood-related insurance coverage, causing significant financial distress to uninsured homeowners who eventually experience such events (FEMA, 2019).

Several studies have determined that various factors and contexts play an important role in determining how a household prepares for and responds to such hazards, especially when there is uncertainty about the hazard risk (Wachinger et al., 2013, Lindell and Perry, 2012; Paton, 2007). According to Paton & Johnson (2001) and Cope et al. (2018), contexts are described as preparedness antecedents or background factors that can impact coastal hazard preparedness and from a social vulnerability perspective, are those factors that can predispose household susceptibility to loss or disruption from hazard activity. Studies have found that to manage the risk of uncertainty, trust is often used, along with other factors such as prior hazard experience, household size, and socioeconomic factors, to facilitate coastal households’ preparedness planning and decision-making. This study develops and expands a conceptual framework and produces a set of testable research propositions to answer the following research question: How do contexts and trust influence household preparedness for coastal hazards?

To answer the research question, this study explores how institutional and interpersonal trust (trust in government institutions and trust in peer and social networks,
respectively) may lead to desired preparedness actions such as evacuation, securing belongings, developing household preparedness plans, etc. Inversely, this study also explores how lower trust levels may interact with other factors (social, communication, household etc.) to cause low levels of engagement and compliance in at-risk communities (Wachinger et al., 2013).

As sea levels continue to rise, tropical cyclones and hurricanes pose greater and greater risks of extreme flooding, likely to inflict the most significant damages on highly populated coastal communities (DeLorme et al., 2021; Reguero et al., 2018). Hazards and vulnerability research have found that people who live in disaster-stricken areas are not affected proportionately, and vulnerability factors occur in such complex combinations. Findings suggest that people who are living in poverty are the most vulnerable at the beginning, during, and after a catastrophic event (Flanagan et al., 2011). Low-income communities often lack the resources to prepare and take protective action in anticipation of imminent hazards or may lack the awareness of the need to do so (Bolin 2007; Enarson et al., 2007; Rodríguez et al., 2007; Underhill 2009; Williams 2009, as cited in Mizrahi et al., 2019; p. 1-2). These findings are consistent with those for other vulnerable groups – racial and ethnic minorities, children, elderly, people with disabilities, and residents of high-rise apartments or mobile homes (Flanagan et al., 2011).

When faced with these types of hazard events, households are variably equipped to prepare for and recover from resulting disasters and hazard events (Cope et al., 2018). Preparedness actions include evacuation, developing plans, stockpiling of food, water, and supplies, performing exercises and drills, and staying informed - actions that aim to reduce the impact of the disaster (Bronfman et al., 2019). Preparedness is essential to resilience, which involves the mitigation of impacts and the ability to fully recover from the aftermath of a short- or long-term event (Cope et al., 2018). Experts opine that major catastrophic events
serve as functioning events and reveal gaps in community preparedness (Birkland, 1998; Birkland, 2008; Rubin, 2012, as cited in FEMA, 2019). Therefore, understanding the contexts, or the antecedents of preparedness is crucial to the success of community disaster mitigation, recovery, and resilience outcomes (Cope et al., 2018).

Understanding the gaps in hazard preparedness can help with mitigating the potential impact of disasters and hazard events. These gaps provide opportunities for policy learning and change in emergency management policy, practices, organizations, and processes. The gaps also highlight the importance of increasing readiness, service delivery capacity, and resilience across all levels of government and community. Communities and localities are better equipped to prepare for and overcome hazards and potential disasters when they band together, at both communal and governmental levels. Without such connections, disconnections are likely to occur, along with misconceptions, heightened tensions, and the erosion of trust (Seabrooks, 2021).

**Hazards and disasters**

The International Emergency Events Database (EM-DAT) classifies hazard events into two categories: 1). natural, i.e., geophysical, hydrological, climatological, biological), and 2). technological, i.e., industrial and transport accidents, hazardous waste spills and other man-made incidents. Global trends indicate increased and more severe impacts of such events. This proliferation of hazard events subsequently increases the potential for disruptions to daily life and heightens uncertainty as well (Cope et al., 2018). The degree of uncertainty not only exists around the fact that an event might occur, but also exists around what will happen should such an event occur. Quarantelli (2000) conceptualizes disasters in terms of the processes that happen when collective social routines are disrupted, resulting in unplanned actions and decisions that must be undertaken to cope with the unforeseen crisis. This view considers the social, environmental, cultural, and other demographic contexts or
factors that predispose household susceptibility to loss or disruption from hazard activity (Paton & Johnson, 2001).

**Trust and coastal hazard preparedness**

Trust is often described as the “social glue” that holds relationships, groups, and societies together, in the way it connects people, and facilitates thoughts and behaviors to promote collective goals (Van Lange, 2015). Several studies have communicated the impact of trust across communities on preparedness and recovery efforts (Alexander 2018; Jones and Murphy 2009; Kapuco and Van Wart 2006; Moynihan 2008, as cited in Mizrahi et al., 2019; p. 1). Previous studies have found that personal hazard experience and trust in authorities or experts are the strongest predictors of risk perception of natural and coastal hazards such as floods, tsunamis, hurricanes, droughts, earthquakes, and wildfires (Barberi et al, 2008; Wachinger et al, 2013; Houston et al., 2019). Study findings on individual factors such as age, gender, education level, and homeownership indicate that these factors also influence risk perception (Houston et al., 2019; Wachinger et al., 2013).

The Pew Research Center findings showed that levels of interpersonal trust were associated with race and ethnicity, age, education, and household income (Rainie et al., 2019). For example, findings showed that respondents from majority racial groups held levels of trust twice as high as minority groups, and older respondents held higher trust than younger ones, as did those who were more financially stable and better educated, compared to their less financially stable and less educated counterparts (Rainie et al., 2019). These findings provide a sense of the varying levels of personal trust and other personal attributes and how unequally they are often distributed in society. Those with greater advantages in society are more likely to have higher levels of generalized trust in others (including institutions), compared to those with fewer advantages (Rainie et al., 2019).
Low-income communities often lack the resources to prepare and take protective action in anticipation of imminent hazards or may lack the awareness of the need to do so (Bolin 2007; Enarson et al., 2007; Rodríguez et al., 2007; Underhill 2009; Williams 2009, as cited in Mizrahi et al., 2019; p. 1-2). Trust becomes critical when knowledge of a hazard is low, and when there is risk uncertainty (Wachinger et al., 2013). In such situations, trust reduces the uncertainty and complexity faced by people dealing with unfamiliar, infrequent, and complex hazards. Information is then evaluated based on personally held beliefs and trust in the institutions providing said information (Paton, 2007).

Trust in institutions, interpersonal trust, and risk perception are critical components of community preparedness and public response in societies, and in health and disaster contexts (UNICEF, 2020; Bronfman et al., 2016; Han et al., 2017). While research on critical response following disasters has studied the geophysical, environmental, and political attributes of communities and their local governments, community risk perceptions and trust in local institutions, emergency management and preparedness planning agencies have not been studied as much (Leal, 2020).

This study aims to conceptualize trust as 1) a factor within hazard preparedness and vulnerability research that can drive or discourage the adoption of desired adaptive behaviors, and 2) a determinant of citizen compliance with established regulations and mandates. Social trust in this study’s context assumes a form of relational trust that consists of three parts: trustors’ beliefs, the trustee’s perceived trustworthiness, and the context in which the trust relationship occurs (Robbins, 2016; Hardin, 2002). This conceptualization of social trust will be used in this study to examine the influence of interpersonal trust and institutional trust in community compliance or noncompliance with regulations and recommended protective actions when preparing for coastal hazards and impending risks. Trust, as used throughout this study, refers to this relational concept of social trust as outlined above.
Statement of the Research Problem

Increasing coastal hazard events continue to threaten the lives, property, and livelihoods of coastal US communities, necessitating a different approach by emergency management officials and public authorities responsible for ensuring preparedness (Finkl, 2013). Despite research findings that show the benefits of being prepared for natural and coastal hazard events, studies on hazard preparedness report that individuals, households, communities, and businesses are often poorly prepared (Wachinger et al., 2013; Finkl, 2013).

While studies have looked at the relationship between trust and compliance (desired protective behaviors) and the various contexts in which households make decisions to prepare for natural and coastal hazards, very few studies have conceptualized trust as a tool used by households when dealing with uncertainty about coastal hazards.

Purpose of the Study

The purpose of this study is to develop a conceptual framework and set of testable research propositions on the influence of trust and contexts on household preparedness for coastal hazards. The study aims to provide a household-level understanding of trust and other contextual factors that can influence coastal hazard preparedness, with research propositions that can be applied to multi hazard settings, that may be relevant to emergency management and preparedness planning agencies and researchers. Trust is an important factor that will be studied due to its influence in decisions to evacuate, get vaccinated, shelter in place, purchase flood insurance, store emergency food and water supplies, and make household emergency plans (Witvorapong et al., 2015; Wachinger et al., 2013; Lindell and Perry, 2012; Paton, 2007).

The study is underpinned by the Lindell and Perry (2012) Modified Protective Action Decision-Making Model (PADM) and Paton’s (2007) Risk Communication Model and is guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol
The PRISMA 2020 Protocol is an evidence-based systematic review protocol that ensures the transparency of the review process using checklists that elaborate all sections of a systematic review report, and a flow diagram that elaborates the screening, selection, and inclusion of data into the systematic review. This Protocol aims to clarify and demystify the systematic review process to audiences from various walks of life.

**Study Significance and Contributions**

This study provides significance to emergency management and preparedness research, emergency planning agencies and overall preparedness efforts in the following ways:

- It develops a conceptual framework and set of testable research propositions that can be tested and applied to multi-hazard settings in practice, extending the knowledge in those areas.

- This study adds value to Public Administration values and theory in two ways:
  
  o Firstly, it adds value through the development of insights that enhance New Public Governance values such as citizen trust and collaboration between public institutions and members of the public.
  
  o Secondly, this study enhances the subfield of behavioral public administration through its focus on increasing knowledge about the socio-behavioral factors that influence decision making within the emergency management and coastal hazard preparedness domains, which are primarily public service functions.

- When used in tandem with social vulnerability indices, the conceptual framework may provide insights into other nuanced socio-behavioral influences that may exist below the surface and could be used by emergency and risk managers to establish evacuation priorities, educate community members, and address identified areas of deficiencies before an emergency.
This study contributes to the emergency management and hazard preparedness literature by extending knowledge on two hazard preparedness concepts that are interconnected yet not studied enough when looking at coastal preparedness: the influence of contexts and the use of trust in managing the uncertainty of coastal hazard risks, at the household level. This study builds upon the theoretical underpinnings of Lindell and Perry’s modified (2012) Protective Action Decision Model, Paton’s (2007) Risk Communication Framework, and the extant literature to develop a preliminary conceptual framework that elaborates typical human decision-making when faced with uncertainty around coastal hazards, and what factors can influence those decisions. Using the well-established PRISMA 2020 Protocol and a pre-established selection criteria that is supported by literature, this study utilizes a systematic review methodology to examine the literature on trust, contexts, and household preparedness for coastal hazards to refine the preliminary conceptual framework into an expanded evidence-based conceptual framework with testable propositional statements rooted in the extant literature. The study consists of a preliminary literature review that develops the preliminary conceptual model which will be expanded and modified during data analysis.

**Structure of the Study**

The dissertation is organized as follows: Chapter 1 consists of the research introduction and provides a background on trust, contexts, and household decision-making as it pertains to coastal hazard preparedness. It also discusses the study’s problem statement, purpose, significance and contributions to research and practice. Chapter 2 consists of a preliminary literature review on relevant concepts such as coastal hazard preparedness, trust, risk perception, environmental, social, and environmental contexts, and introduces the two theoretical frameworks that underpin the research. This chapter also establishes and discusses the preliminary conceptual framework which serves as the basis for the expanded model that is developed via the systematic review methodology in Chapter 3.
Chapter 3 focuses on the study’s research design and methodology and contains an elaboration of the research methods utilized in this study, as well as the steps taken to ensure study reliability, trustworthiness, and replicability. Chapter 4 consists of the results and findings that will be presented in both tabular and narrative forms, with an extensive discussion to ensure that all relevant themes are expanded upon. The final chapter, Chapter 5 provides a summary of the study findings and discusses the implications and significance of study findings to research and practice. Further discussion on the expanded conceptual framework are found in this chapter as well as the research propositions. Lastly, this final chapter discusses study limitations, outlines recommendations and policy implications for preparedness stakeholders, and discusses opportunities for future research.
2. REVIEW OF THE LITERATURE AND RELEVANT FRAMEWORKS

Overview of the Current Literature

This literature review consists of a discussion of relevant concepts and introduces the two theoretical frameworks that underpin the study – the Protective Action Decision Making Model (PADM) developed by Lindell and Perry (2012) and Paton’s (2007) Risk Communication model. Concepts such as environmental, social, and communication contexts are clarified in the context of household coastal hazard preparedness, using the PADM and Risk Communication frameworks and the extant literature. Following this, the study develops and discusses some major themes developed from the PADM and Risk Communication models and expand the themes using other extant literature. The discussion of the abovementioned themes flows directly into the introduction and discussion of the preliminary conceptual framework.

Coastal hazards and the social construction of risk

Flooding has been recognized as the third most damaging natural hazard globally (Houston et al., 2019; Kellens et al., 2013). The impact of flooding events due to sea level rise is expected to become greater and costlier, with NOAA predicting future flooding events occurring more than 10 times more often than it does presently (NOAA, 2022). This projection indicates a significant uptick from single minor or disruptive events every two to five years, to multiple events every year in some places (NOAA, 2022). NOAA projects that by 2030, coastal communities nationwide will experience seven to fifteen days of high tide or nuisance flooding yearly. By 2050, high tide flooding is likely to occur between 25 and 75 days out of the calendar year, depending on the location (NOAA, 2020).

Another coastal hazard that can impact an already fragile coastal environment fraught with various types of flooding hazards is a hurricane. Hurricanes develop from low-pressure weather disturbances in the atmosphere, and when the water warms up in tropical oceans, a
huge amount of energy is developed, which allows tropical storms to perpetuate, sometimes bringing along with them, tornados, and other related phenomena (Mickens, 2010). This kind of activity causes coastal communities to be more prone to coastal flooding and erosion due to heightened storm surges. For those communities that are living at or below sea-level, the issue is further compounded by drainage issues or infrastructural inadequacies (Mickens, 2010).

Most of the coastal hazard research has focused on the physical features of coastal vulnerability, such as the determination and analysis of physical and structural characteristics such as target populations’ housing situations, physical distance from the hazard, the structural integrity of safety mechanisms such as levees and dams with little attention paid to the social features (Houston et al., 2019; Wachinger et al., 2013; Lindell and Perry, 2012; Patterson, 2010; Paton, 2007). Risk communication of coastal and natural hazards has traditionally focused on getting information to residents of vulnerable communities (Houston et al., 2019; Paton, 2007). Newer studies are finding that understanding how people perceive risk could help improve risk communication, gauge people’s willingness to support government policies and take protective action, enhance public knowledge about risk, encourage attitudinal changes, increase confidence in civic authorities, and support the development of effective mitigation and preparedness strategies (Houston et al., 2019; Wachinger et al, 2013; Kellens et al., 2013).

With the proliferation of coastal populations and structures worldwide and nationwide, more people and infrastructure are at risk of a wide range of coastal hazards (Finkl, 2013). While some effects of disaster events have been enormous and impactful to economic and social activities, studies report that many coastal dwellers forget the trauma of severe coastal impacts within two years (Wachinger et al., 2013; Finkl, 2013). Coastal hazards contain distinct themes that relate to the perception of potential dangers. How a
hazard is perceived is dependent on several factors, particularly if it tends to happen quickly and with more apparent consequences. Some of these factors include protective factors like having a supportive social network and having greater resources (financial, intellectual, and material) and inhibitive factors like mobility and transportation limitations, and having fewer resources (Patterson et al., 2010). This has implications for hazards that are not as easily observed, happen at a slower rate, or not as widely discussed in the media (Finkl, 2013).

Perceived risk can be looked at from two perspectives: 1). a person’s assessment of a hazard (based on prior hazard experience, proximity to hazard, available resources, etc.) and 2). their vulnerability to the hazard (Wachinger et al., 2013; Patterson et al., 2010).

Vulnerability is defined broadly as the combination of social conditions and root causes that can exacerbate people’s exposure to hazards. These social conditions are made up of socioeconomic, geographic, and political realities (Espia & Salvador, 2018; Patterson et al., 2010; Blaikie et al., 1994).

**Coastal hazards: Contexts and outcomes**

Studies have examined factors influencing hazard preparedness and have identified how intra-individual factors such as coping, control beliefs, self-efficacy influence a person’s level of preparedness (Paton et al., 2005; Paton et al., 2008). Paton et al. (2008) discuss the interpretive process through which people understand things, construct meaning around them, and subsequently act. They state that “how people interpret differs from person to person, changes over time, depends on context, and reflects the unique experiences they have accumulated during their lives” (p. 28). This ability to interpret things and meaning enables people to adapt as easily as possible to environmental changes (Paton et al., 2008). It is important to note, however, that contexts drive the interpretive lens through which people see and assess situations and meanings (Paton et al., 2008). For example, social contexts influence people’s interpretations and actions as people experience everyday life, and these
contexts can either constrain or facilitate said interpretations and actions, such as actions to prepare for hazards.

Some studies have pointed out that disasters are not necessarily the consequences of cataclysmic events, but of the vulnerability of communities that experience them (Brinkely, 2006, & Perrow, 2007, as cited in Lee, 2019; Wisner et al, 2004). According to Wisner et al., (2004), geophysical or biological events act as catalysts that accelerate disastrous aftermaths caused by social factors and vulnerabilities. Those social factors then trigger or exacerbate the damage that follows disasters (Lee, 2019). Due to these findings, the approach to disaster and hazard mitigation is becoming increasingly community-based, with greater effort being directed towards incorporating mitigation strategies into the development and management of communities. Furthermore, with the notable shift from post-disaster recovery to disaster preparedness and mitigation, local governments are becoming increasingly empowered and non-governmental organizations and civil societies are becoming better integrated into decision-making processes (Lee, 2019).

Communities are more vulnerable to the negative effects of disasters due to the type and intensity of the hazard and population growth and density, rising rates of poverty and homelessness, climate change, and increased globalization (UNISDR, 2004; as cited in Levac et al., 2011). The magnitude of resulting human and economic losses necessitates the need for risk vulnerability reduction (Levac et al., 2011) and a paradigm shift from response and recovery activities to preparedness activities (FEMA, 2014). Vulnerability depicts the degree to which an individual or community is susceptible to loss or disruption which arises from a given hazard (Levac et al., 2011). The concept of vulnerability recognizes that an individual or community’s decisions and actions can impact their vulnerability, in addition to demographic, socio-economic, cultural, and historical contexts (Levac et al., 2011). Contexts
can increase or decrease vulnerability, so Paton & Johnston (2000) caution that it is important to note what contexts impact vulnerability, and how (Levac et al., 2011, p.726).

Vandecar-Burdin et al. (2020) reported that if a major hurricane was forecast to hit Hampton Roads (a region in southeastern, coastal Virginia), over half of the survey respondents (55%) reported that they would not consider evacuating (29%) or were unsure about evacuating (26%). Hampton Roads is a coastal area that is very prone to coastal storm surges, densely populated (it is home to more than 1.7 million residents) and is the physical location from which this dissertation research originates. Over half of the Vandecar-Burdin et al. (2020) study respondents cited concerns about potential exposure to COVID-19, with some respondents refusing public sheltering as an evacuation option (Vandecar-Burdin, 2020, p.66). As a follow-up question, respondents were asked about their reasons for choosing not to evacuate to a public shelter, and over a quarter of survey respondents cited COVID-19 as a reason. Vandecar-Burdin et al. (2021) postulate that “it appears that fears relative to sheltering amid the pandemic may have eased from last year.” (p. 49).

**Environmental and social factors**

Studies have tried to explain the processes through which people respond to environmental cues or socially transmitted hazard and disaster messaging (Lindell & Perry, 2012). These processes have been explained by social influence theories, behavior theories, motivation theories, and protective action theories to adapt risk communication to influence immediate disaster response and long-term hazard adaptive behaviors (Lindell & Perry, 2012). Protective action decision-making is a process that is preceded by various events, experiences, contexts, and cues that are influenced by individual behaviors, experiences, beliefs, and interactions (Paton et al., 2008; Paton, 2007; Wachinger et al., 2013). Lindell & Perry (2012) state that this decision-making process starts with environmental cues, social cues, and warnings. They describe environmental cues as “sights, smells, or sounds that
signal the onset of a threat,” while describing social cues as “cues that arise from the observations of others’ behavior.” (p. 617). Furthermore, warnings are described as messages which are transmitted from an information source to a receiver which results in effects (i.e., changed behavior) that depend on the receiver’s characteristics. Some of these characteristics are physical, such as strength, psychomotor (sight and vision), cognitive, and socio-economic.

The social perspective considers the relationship among community members (work, social, sporting, religious settings) via the community participation and collective efficacy branches. This perspective also considers the relationship between community members and civic sources of hazard information (as evident in the empowerment and trust branches). When people are faced with uncertainty, they often turn to others to help them make sense of the situation and help them to decide (Paton et al., 2008). Others in this case may be government agencies such as emergency management agencies, or family members, neighbors, or other community members with whom they have frequent interaction (workplaces, social, religious, and sporting environments). As a result of this, both “others” can significantly influence interpretative processes (Paton et al., 2008). In hazard situations, civic agencies often play roles greater than information dissemination, and people are often more willing to accept risk and take responsibility to their own safety if they perceive the agency as trustworthy and acting in their best interest. When agencies are perceived as unfair or untrustworthy, the consequence is a loss of trust as the source of information (Paton et al., 2008; Paton, 2007; Johnston et al., 2005).

Trust influences how people’s motives are perceived, as well as their competence and credibility of information provided (Paton et al., 2008). Trust is therefore “a very important determinant of the quality of any relationship in which information is exchanged, appraised, and decisions made” (p. 29). Therefore, people’s willingness to use information to guide their
actions is largely influenced by the amount of trust they have in its source (Paton et al., 2008).

**Communication factors**

Pursuant to the social context are the overlapping elements of communicative factors. People often have social networks through which they receive information, and as it relates to an impending hazard and prescribed protective action, many factors come to play. For example, authorities, media outlets, and peers (friends, neighbors, relatives, classmates) can provide information about environmental threats. Civic authorities transmit information via multiple media sources and can communicate transportation information to residents to assist those without alternate means of transportation and help set up temporary lodging (Lindell & Perry, 2012). This dissemination of information via formal and informal channels has implications on the implementation of protective action. Lindell and Perry (2012) stated that “even when peers do not explicitly transmit warning messages, their behaviors - especially obvious behaviors can serve as social cues for protective action” (p. 618).

Wachinger et al. (2013) describe the mental models and other psychological mechanisms through which people judge risks (i.e., cognitive heuristics and risk images). These models and mechanisms are then internalized through social and cultural learning, and moderated and modified by media reports, peer influences and other communication processes. Risk perceptions depend largely on the type of risk, the risk context, individual personality, and the social context. Their study reviewed articles from a wide array of disciplines focusing on natural hazards. It found that information from external sources, level of information, and involvement of experts in risk management were linked to indirect experience. Whenever the study respondents lacked direct experience with the hazard, they tended to put more trust in experts and civil authorities to guide their decision-making (Wachinger et al., 2013).
**Individual and household factors**

Individual and household factors such as gender, educational level, personal knowledge, world views, household size, home ownership status, trust in authorities, and trust in experts were seen to have varied influence on risk perception, with Wachinger et al. (2013) stating that “there is no consistent understanding of these factors, and they are mediated by other factors” (p. 1051). Contexts that consist of economic factors, vulnerability factors, size of community, and area of living were investigated in conjunction with personal factors, showing varied effect strengths. Direct experience with the natural hazard and media coverage as a form of indirect experience appeared to be the two most crucial factors in the Wachinger et al. (2013) study. Wachinger et al. (2013) stated, “communities with prior flood experience were more likely to consider themselves better prepared for another such event than communities that have not had experience of any major flood.” (p. 1052).

**Perceptions**

Lindell & Perry (2012) stated that environmental cues, social cues, and socially transmitted warnings trigger a series of pre-decisional processes that impact core perceptions about environmental threats, alternative protective actions, and relevant stakeholders. Lindell et al. (2012) also found that environmental cues such as the shaking caused by an earthquake, combined with the knowledge of tsunamis sometimes being a by-product of earthquakes, was a major source of information about an incoming tsunami that motivated evacuation intentions. The combination of these perceptions with situational facilitators (having a strong support system, trusting information source and messaging, and financial resources) and impediments (lack of access to a vehicle, a lack of personal mobility due to physical disability, or language barriers) culminates in protection action decision-making and behavioral responses (Lindell & Perry, 2012; Andrulis et al., 2012).
Paton et al. (2008) discussed how outcome expectancy beliefs drive preparedness actions. Outcome expectancy is a construct that describes the interpretive process people go through when assessing their risk to a hazard. When people expect their protective actions to lead to a positive outcome, then they will be more likely to act, compared to the likelihood of an action leading to a negative or inconsequential outcome. For example, people may be more likely to install window shutters, seek hazard information, raise their yard levels, lay down sandbags to protect their property, and secure loose items in their yards if they believe that it will keep their homes from flooding, high winds, and other related hazards (Elrick-Barr et al., 2022; Bollettino et al., 2020; Buchanan et al., 2019; Linnekamp et al., 2011; Peacock, 2003).

Outcome expectancy is a construct that connects with trust to the extent that it allows people to rely on (expert) information sources to adopt certain behaviors that are said to improve preparedness outcomes. Within the context of public education around pandemic preparedness, Paton et al., (2008) discuss that civic agencies may advise the public to adopt a particular behavior to increase safety outcomes. However, people receive the information and recommendations and apply it through their interpretive lens (outcome expectancy) and the level of trust in the information being received, to estimate the likelihood of the incident occurring.

Wachinger et al. (2013) elaborate on the risk paradox, stating that there are various reasons why people continue to live in areas that are hazardous to their lives and property. One possible reason could be that the benefit of living there outweighs the (perceived) risks of moving. For example, socio-economic or security constraints may factor in such mental assessments of the risk of a hazard. Individuals who have determined that the risk of a natural hazard to their means of livelihood or lifestyle is low, are likely to have reduced risk
perceptions as they channel their energy on other salient issues of daily living (Martins et al., 2019; Haynes et al., 2018).

A second possible reason is trust in scientific experts and authorities and confidence in protective measures. Wachinger et al. (2013) described these two factors as important factors to risk perception. Trust is used by individuals to manage personalized risk, by selecting trustworthy experts whose opinions are considered accurate, to reduce the need to make rational, judgment-based decisions. Trust is used as a shortcut to obtain necessary information about a hazard, since individuals are unable to inform themselves of all the threats they face in our increasingly complex world. While this can reduce uncertainty, in situations where trust is fractured or eroded, individuals can often feel more at risk. We see here, the importance of trust to an individual’s risk perception. When people have high levels of trust in management performance and structural protections, they are less likely to be willing to take the necessary preparedness actions (Basolo et al., 2017; Wachinger et al. 2013; Nepal et al., 2012; McIvor & Paton, 2007; Paton, 2007)

Studies have shown that direct or indirect experience with a hazard impacts the way individuals form risk perceptions and make decisions. For example, Wachinger et al. (2013) and Martins et al (2018) found that positive or negative feelings associated with personal flood experience had effects on trust, risk perception, and the intention to prepare. The studies found that negative feelings associated with previous experience decreased trust in official flood protection measures and created a greater propensity to take preparedness action to secure life, belongings, and source of livelihood, while positive feelings increased trust in authorities and in flood protection (Martins et al., 2018; Wachinger et al., 2013). This increased trust in authorities and structural and/or governance structures shifts responsibility to those entities and can lead to the reduced likelihood of the individual taking protective action in the face of floods (Wachinger et al., 2013). Trust is used in this context, not only as
a shortcut to obtain information on hazards but is also employed by the individual as a tool to transfer responsibility for action to someone else.

The significance of direct and indirect experience to risk perception cannot be overemphasized, as both are key aspects of hazard preparedness. Managers and agencies planning to communicate warning and social messaging need to consider the salience and strength of personal experiences and ensure that relevant elements are in place prior to the communication of warning messages (Wachinger et al., 2013). For example, safeguarding the legitimacy and credibility of the agency is critical to encouraging the adoption of preparedness actions. After that, agencies can use “windows of opportunity” or time frames immediately following a disaster, to evoke feelings of compassion and a sense of responsibility to ensure that individuals take the right protective action to protect themselves and those around them.

Threat perceptions, alternative actions, and stakeholder perceptions involve broader associations which are embedded in mental models and schema and separate from comprehension of a warning message (Huang et al., 2017; Lindell & Perry, 2012). Probability and consequences are essential attributes of people’s perceptions of environmental threats, along with some well-known approaches to perceived risk, such as dread and unknown risks (Pan, 2020; DeYoung et al., 2016a). People make decisions based on the likelihood or probability of the said event occurring, and then they also assess the consequences to their immediate environments (Pan et al., 2020; Lindell & Perry, 2012). Most hazard and disaster research has found that risk perception predicts warning responses such as evacuation and long-term hazard adjustments (Haynes et al., 2018; Lindell & Perry, 2012). Prior beliefs about the hazard event, along with information from environmental cues and social warnings, produce a situational perception of personal risk that is characterized by beliefs about how environmental conditions can produce specific personal impacts (Harries,
One of the major contributions of the PADM research to risk management is the finding that although risk perception is important to understanding motivations for taking protective action, there are other similarly important perceptions (Grover et al. 2022; Cannon et al., 2021; Lindell & Perry, 2012).

**Resource constraints**

Lindell and Perry (2012) elaborate on the influence of impediments on protective behavior, stating that the implementation of behavioral responses stems from people’s intentions to act as well as the social and physical conditions in their environments, which allows them to do so (p. 624). For example, in cases where people wanted to evacuate, but had nowhere to go, or lacked a safe way to travel, evacuation was considerably hampered. Other impediments include a lack of alternative means of transportation, or a lack of mobility due to a physical disability. In cases where the impending hazard is emergent, the separation of family members or loved ones could be an impediment to evacuation. Findings from the Behr et al. (2020) study showed that participants’ ability to evacuate or seek shelter during a COVID environment in the face of an impending hurricane was dependent on variables like household vulnerability, household income, evacuation zone, prior experience of property loss or injury, direct experience with the hazard (COVID infection in household/frequency of street hazard), and evacuation zone or evacuation zone awareness. Preparedness and recovery of such groups - particularly the older population, those living with disabilities and those experiencing homelessness - are also often impeded by a limited or deficient support system, considered to be a preparedness resource (Sasaki et al., 2019; Chan et al., 2015; Lowe et al., 2010).

The role of social support systems, sometimes framed as a part of social capital, is not widely studied in preparedness literature as it is in recovery literature (Reininger et al., 2013, Aldrich, 2012; Bolin, 1982; Kaniasty et al., 1990; Mutch, 2015, as cited in Han et al., 2020).
While research on social capital typically lauds its ability to facilitate the adoption of collective actions to stimulate protective behaviors, some studies show that they can impede self-protective actions due to the tendency to over rely on others, particularly government (Han et al., 2017; Aldrich, 2012, as cited in Han et al., 2020). Trust is also discussed throughout the literature as a salient factor in determining people’s risk perception and sense of responsibility in preparing for a hazard or disaster. Some studies have concluded that trust in government could discourage individual preparedness intentions while other studies conclude that trust in government could lead to high levels of perceived preparedness (not to be confused with actual preparedness).

Outcomes (Protective actions)

Emergency preparedness consists of actions that ensure the availability of resources needed to respond effectively to a potentially (or threatened) disastrous event. Such actions include storing food and water, preparing household emergency plans, preparing emergency kits, and other activities that mitigate the risks of danger, death, damage, and loss of property (Najafi et al., 2017). Many studies have been conducted on emergency preparedness and have found that there are several factors which have significant impact. Some are: critical awareness, risk perception, preparedness perception, previous disaster experience, societal norms, sense of community, community participation, social trust, perceived responsibility, and available resources (Lindell & Prater, 2000; Paton, 2003; McIvor & Paton, 2007; Miceli et al., 2008; Lindell & Whitney, 2000; Dooley et al., 1992; Russell et al., 1995; Paton et al., 2000; Paton, 2007; Paton et al, 2006; Paton, 2006; Najafi et al., 2017).

Despite the best efforts of emergency planners, managers and public authorities, some people living in hazard-prone communities continue to show a lack of risk mitigation practices and a hesitancy to adopt protective measures (Paton et al, 2009; Paton, 2007). Some of these efforts have been done based on the assumption that providing people with
information about a hazard will motivate them to adopt protective actions (Paton, 2007). Studies have shown that action is not determined by information alone, but how the receiver of the information interprets it, within the context of their experiences, circumstances, beliefs, and expectations and how the latter are developed and sustained by the community and society where they live (Alam et al., 2023; Teo et al., 2019.

Looking at not just the information itself, but also the source of information, becomes therefore crucial to understanding what factors come into play in risk perception and protective action (Huang et al., 2017; DeYoung et al., 2016b; Paton, 2007). The greater the uncertainty surrounding a hazard, the greater the likelihood that people will trust those with proven expertise (Wachinger et al., 2013). Trust influences the perception of other people’s motives, as well as their competence, and the credibility of information they provide (Adjei et al., 2022; Earle, 2004; Paton, 2007). This trust can also be built in non-hazard environments (i.e., through dealings in other civic environments and capacities) and can be influenced by familiarity with hazards, availability of hazard information, and communities’ knowledge of hazard risks (Bostrom et al., 2019; Basolo et al., 2009; Paton, 2007).

Flooding is considered one of the most frequent and costliest natural hazards in the United States (Kousky et al., 2020). Climate predictions paint a grim picture: even more serious flood issues should be expected in the future due to the combined forces of increased development in areas subject to flooding, along with the impacts of climate change such as changing storm and precipitation patterns and sea level rise (Kousky et al., 2020). Researchers have hypothesized for some time, that previous experience with a natural disaster such as flooding may make some individuals more likely to perform protective actions. Empirical findings have also shown that previous experience with floods significantly influenced property owners’ willingness to perform protective actions (Yusuf et al., 2017; Bubeck et al., 2012). Studies from cognitive psychology and behavioral economics
revealed that individuals make decisions concerning risk and uncertainty based on rules of thumb that stem from firsthand experiences, which can be subject to systematic biases (Kahnemann & Tversky, 1982; Meyer & Kunreuther, 2017; Kousky et al., 2020).

**Coastal hazards: Trust as a shortcut to manage risk**

Various researchers have defined trust in a variety of ways, to accomplish myriad objectives and to explain specific contexts. For this study, social trust is defined as the belief in other people’s honesty, integrity, and reliability. It denotes having faith in the good in people (Taylor et al., 2007). It extends beyond *interpersonal trust*, which is the trust that exists among individuals, *generalized trust*, which is the trust that people have in other people in general, or *particularized trust* which is trust that exists among families and close friends (Robbins, 2016; Van Lange, 2015). Social trust is critical to the functioning of any society: it is the foundation of relationships among individuals, groups, and other components of a society (Kwon, 2019; Robbins, 2016). Interpersonal trust, trust in public institutions, and trust in our leaders are important elements of social trust that affect socio-economic progress (Perry, 2021). Trust allows people to cooperate, collaborate, and express solidarity. It also allows public officials to plan, implement policies, and deliver services to communities (Perry, 2021).

Trust is a critical element of public perception of the legitimacy of actions carried out by the social agencies and authorities that oversee implementing policies designed to reduce risks. Trust in institutions such as government agencies, public health agencies, and community service institutions is important for individuals because institutions have more resources than individuals (Storopoli et al., 2020). The organizations that deal with the various aspects of disaster planning, response, and recovery are defense organizations such as the police and army, health emergency organizations such as the Red Cross, fire services, coordinating agencies, public sector organizations that provide services for preparing for,
dealing with, and recovering from emergency events, local government, and third-sector aid organizations (Mizrahi et al., 2019). If institutions function appropriately, they can help individuals achieve their goals (Storopoli et al., 2020; Khodyakov 2007).

When looking at people’s confidence in key institutions based on their perception of institutional transparency, Pew Research Center found that those who perceived institutions to withhold necessary information, had greater concerns about trust. A respondent of the 2019 Pew Research Survey stated that “everything is impacted by the lack of trust... trust cannot be repaired without truth, which is in short supply” (Rainie et al., 2019). When people do not have faith in government agencies’ ability to manage risk, it can amplify community concerns and increase public hesitancy to adopt preventive and avoidant behaviors in the face of hazard events. This hesitancy may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation (Storopoli et al., 2020; McComas 2004; Slovic 2000).

Trust and institutional legitimacy are interconnected aspects of political science that are seen throughout the social sciences field (Robinson et al., 2017). In a simple sense, legitimacy is the acceptance of the right of a government to do its job (often including using the use or threat of force). Trust is a common lens through which legitimacy is examined due to the similarities both concepts share. If a government is deemed legitimate, it is likely to be trusted (Robinson et al., 2017). Legitimacy is important because it reduces transaction costs in political relationships through the acceptance of vulnerability by the governed. This means that because citizens trust the government to do what it says it will do, they will allow them to function as they are intended (Robinson et al., 2017). This type of trust is dependent on the kind of relationship that exists between the trustor and the trustee institution and how much self-imposed vulnerability is predicated on this trust. For example, choosing to move to a new city or county based on positive thoughts and considerations of local area policies and laws
implies that a choice has also been made to become vulnerable and trust the institution. In this context, legitimacy can be seen as an antecedent of initial trust and is strengthened through subsequent interactions with the institution (Schoorman et al., 2015).

There are other theoretical considerations of the role of trust in social relations, as it is embedded in the actions and decisions of people looking to make the best decision when faced with a hazard. It is also embedded in the actions and decisions of public authorities who approach hazard preparedness from either a compliance, zero-sum lens, or a participatory, win-win one. According to public administration scholars, individual trust in government may help explain the variations in residents’ compliance and cooperation with government policies and recommendations (Chanley et al., 2000; Kim, 2005; Ricucci et al., 2016, as cited in Choi & Wehde, 2020).

In his study, Paton (2007) describes the importance of trust as being inversely related to familiarity with the hazard and the availability of hazard information. He stated that in technological hazard contexts, “as frequency and experience increase, the more information will be directly available to the person or accessible from within their community, negating the need to acquire and evaluate the information from other sources” (p. 372). On the other hand, in unfamiliar situations, trust becomes a component of disaster mitigation decision making when the reliance on external expert sources is greater. His study respondents consisted of those whose community had experienced bushfires and earthquakes. His respondents who had experienced bushfires stated that sharing their hazard stories and how to deal with them, with members of their community provided necessary information on the hazard and informed them of what protective action to take. They also stated that they believed that sharing these stories helped normalize protective actions within the culture of their community. His study respondents who experienced earthquakes reported low levels of
trust attributed to dissatisfaction with the quality and inaccuracy of available information (Paton, 2007).

Paton’s (2007) Risk Communication model builds on Kee and Knox (1970) and Mayer et al., (1995) conceptual models and opines that “levels of social trust will be predicted by community characteristics that reflect the community members’ capacity to acquire information and use it to confront the uncertainty they face” (p. 376). Empowerment is a community characteristic that is described as citizens’ capacity to become adept at matters that concern them and being able to confront environmental issues without being led by external sources of authority or having solutions “thrown at them.” (p.376). Study findings supported the empowerment community characteristic as having an impact on the quality of relationships between residents and civic agencies, to the extent that their mastery over their community issues causes more responsibility to be devolved to them. The more residents perceive that their needs are being adequately met in their relationships with the civic agencies, they become more likely to trust them and the information they provide, using the information to develop and implement their own household plans (Paton, 2007). This study finding has considerable implications for more community-centric risk communication that focuses on discourse that empowers communities around hazard issues.

Marenco-Escuderos et al. (2020) stated that community empowerment stems from the decision-making process and the level of involvement that people have in their day-to-day lives. They also observed that empowerment is inextricably linked to community participation; when people participate in activities that affect them and their environment, they begin to develop a sense of control and belonging over what happens there and can feel directly involved in the actions and consequences of situations that arise in their community (Marenco-Escudero et al., 2020). Wachinger et al. (2013) discuss actions that can be taken to address the risk perception paradox from an institutional perspective. Firstly, by promoting
participatory processes between authorities and community members, people become more aware of floods, become more motivated to take protective action, and build trust in authorities and experts. These actions build personal agency and allow the individual to take back control of taking protective action when faced with hazardous conditions. These actions also allow authorities to gain knowledge from the “lay experts” and can integrate their feedback into implementable action plans. Lastly, these actions will allow trust to be built so that warnings and other critical information will be adhered to, if issued in emergent situations (Wachinger et al., 2013).

Studies have found that perception of flood events changes because of participation processes, and findings indicate that people become more aware of flood hazards and become more motivated to take protective action if they are involved in public participatory exercises such as hazard risk awareness campaigns, citizen townhalls, and emergency preparedness drills. This increased motivation appears to be connected to increased trust in public authorities as well as a realization of the ability to protect oneself from harm (Wachinger et al., 2013). Collaborative preparedness planning between citizens and public authorities creates an environment where citizens “have a better idea what authorities are able to do and what each resident can do to improve protection and crisis management” (Wachinger et al., 2013, p. 1061). As a result of successful participatory exercises, Wachinger et al (2013) reported that citizens, public authorities, and disaster experts expressed their willingness to learn from each other. Citizens became more willing to adjust their perceptions and behavior when presented with reliable information on hazard exposure, consequences, and options for protective measures (p. 1061). Wachinger et al. (2013) further opined that the connection between participatory engagement, trust, and protective action is hence strengthened in the natural hazard risk context in various ways:

- When citizens gain knowledge and personal agency on how to take protective action.
• When public authorities gain knowledge from the lay expert-residents who experience
  the hazards first-hand and can collect ideas for effective measures for a given
  population.
• When both conditions are met, trust is built so that warnings and other types of
  important information are taken seriously in emergencies.

Discussion of the Theoretical Frameworks

A theoretical framework is used to provide a well-articulated lens on how a study will
produce new knowledge (Collins & Stockton, 2018). This framework leans on existing
knowledge and previously formed ideas as well as on the researcher’s epistemological
disposition and experience and will be executed through a methodologically analytic
approach. An existing theoretical framework will be built on to guide this study and will
serve as the theoretical lens through which observational statements will be made (Collins &
Stockton, 2018).

The Protective Action Decision Model (PADM) was developed by Lindell and Perry
in 2004 to help clarify the process of decision-making in response to imminent hazards and
threats and is a model that is useful in all phases of a disaster management cycle, and
especially in preparedness. The model was expanded in subsequent years to account for the
long-term hazard adjustments people make in such situations (Lindell & Perry, 2000, 2004,
2012). The modified PADM theory (Lindell & Perry, 2012) is based on the findings from
research on public response to environmental hazards and integrates information obtained
from messaging with social and environmental cues with messages transmitted through
communication channels to at-risk populations (Lindell & Perry, 2012).

The Modified PADM (2012) provides the most useful elements for understanding
how contexts – consisting of environmental and social cues, warning messages, receiver
characteristics, etc., interact with pre-decision processes, perceptions, and situational
facilitators or impediments to influence behavioral responses. Contexts are elaborated in this model to delineate how environmental, social, communication, and demographic factors can influence the way an individual processes and perceives risks. Contexts are characterized by environmental and social cues, warning messages, individual demographic characteristics, access to information, experience with the hazard, quality, and accuracy of information about the hazard, and the perceived credibility and expertise of information sources. Environmental and social cues in this model are described as tangible indications of impending hazards and the tendency of people to follow others’ direction in taking protective action, and receiver characteristics such as gender, household status, and socio-economic status, influence individuals’ adoption of protective actions.

Demographic and communication factors consist of age, income level, education status, frequency of hazards, warning message modalities, hazard experience, social support, and trust in public authorities and experts involved in emergency management and preparedness. These factors interact with social cues and can have an influence on people’s willingness to take protective actions (Wachinger et al., 2013). This model helps us to understand how community contexts interact with pre-decision processes such as exposure to hazard information, which determines the steps people take (protective actions) when they have sufficient information (Lindell & Perry, 2012; Wachinger et al., 2013). When residents trust authorities and institutions, the way they process and integrate information presented by those sources may have notable impacts on their perception of the specific risk, as well as their decision-making processes.

The PADM can be used to examine perceptions and decision-making in response to a disaster or hazard event, or prior to the events occurring (Liddell et al., 2019). This theory offers an alternative way to examine human behavior in the aftermath of disasters and differs from protective motivation and the theory of planned behavior. PADM combines information
from an individual’s specific societal and environmental context, available social information, and personal experience with a hazard. Applications of this model to research often produce findings about how individuals perceive threats, where to find additional information about a hazard threat if there is a need, what protective action(s) need to be taken, and when.

Most PADM research has focused on natural disasters and has found somewhat consistently that there is a connection between disaster experience and heightened risk perception (Liddell et al., 2019) while the research findings on demographic variables and the PADM show that there is a need to further investigate the linkages. Lindell and Perry (2012) stated that the process of protective action decision making starts with contexts which include environmental cues, social cues, and warnings. Environmental cues are described as tangible elements such as “sights, smells, or sounds that signal the onset of a threat” (p.617), whereas social cues are described as cues that come about through observing others’ behavior. Warnings are messages which are transmitted from a source to a receiver through a channel of communication, which results in effects or actions that are dependent on receiver characteristics. Effects or actions resulting from such warnings include changes in the receiver’s beliefs or behaviors, whereas receiver characteristics include physical, cognitive, mental, and socio-economic resources and abilities such as physical strength, vision and hearing, money and vehicles, and friends, relatives, neighbors, and coworkers (p. 617).

The stages in the PADM describe how people typically make decisions about taking actions to protect themselves and others, however, the researchers admit that “few people are likely to follow every step in the model in the exact sequence” (p. 617). The authors state that one reason is that high levels of credibility or power of a warning source can bring about immediate and unquestioning compliance, with no explanations. This form of interruption or neglect of the PADM stages can lead to ambiguity, and when repeated often, can cause
warning recipients to spend more time researching and processing information related to the protective action, rather than on the preparation for and implementation of the protective action. Figure 1 below outlines the PADM decision-making stages that typically occur during the transmission of hazard information.

**Figure 1**

*Information Flow in the PADM*

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Paton’s (2007) Risk Communication model was developed in response to a plethora of social cognitive and motivational theories that aimed to explain behavior, motivations for behaviors and actions, and reasons for their choices when faced with hazards. He noted that while these theories succeeded at accomplishing what they were designed to do, there was a need to further pull back the layers to understand the relationships that exist within individual and community levels, and how they interact to bring about risk reduction. He establishes the framework to examine relationships between people and sources of information and how those relationships influence hazard preparedness. The framework also examines how trust in civic planning agencies and risk messaging impacts preparedness decisions. It also provides an opportunity for agencies to approach risk communication and management from a
collaborative and engaging perspective that improves preparedness and resiliency outcomes (Paton & McClure, 2013). This model responds to the notable lack of preparedness of communities and the demonstration of poor knowledge of risk mitigation procedures and “reticence to adopt protective measures” (Paton, 2007, p. 370). Prior communication models have assumed that providing information about a hazard event would be sufficient to encourage the adoption of risk mitigation measures. However, the interpretation of information is determined by a person’s experiences, beliefs, and expectations that are developed in the community, and sustained by the societal contexts in which they exist and function. Figure 2 highlights the predictors of hazard preparedness adoption, that are influenced by people’s generalized trust beliefs towards institutions that provide public hazard risk information.

Figure 2

Predictors of Hazard Preparedness Adoption

Source: Paton, 2007

It has been discussed earlier in the introduction of this study, that when faced with unfamiliar, infrequent, and complex hazard situations in which knowledge is low, people tend to attribute weight to their trust beliefs to help them cope and reduce the uncertainty and
complexity they face. Information is then evaluated based on those personally held beliefs and trust in the institutions providing said information (Wachinger, 2013; Paton, 2007). The Risk Communication model studies the relationship between the community and the source of information on hazard preparedness, which tends to be civic emergency management agencies.

This Risk Communication model leans on the Kee and Knox (1970) model that views trust as a process that is influenced by familiarity and information availability (or situational factors), and community competence (structural factors). In relation to the ability to predict the adoption of protective measures, the model studies two relationships in relation to the adoption of protective measures. First, it examines the relationship between situational factors and trust, and secondly, it examines the relationship between community characteristics and levels of social trust as predictors of the effectiveness of risk communication in encouraging the adoption of protective measures (Paton, 2007).

Paton’s (2007) study found that situational and structural factors influenced the adoption of protective measures for natural hazards, as did trust in civic agencies as a determining factor in the adoption of protective measures. Paton’s (2007) model serves as the basis for understanding community contexts and provides opportunities for public agencies and risk management authorities to better understand the social construction of risk, community contexts, and improve risk communication and community engagement practices. By examining how trust in emergency management and preparedness planning agencies impacts hazard preparedness decisions, Paton’s model delineates the importance of trust in hazard preparedness and risk communication and allowed me to develop a preliminary conceptual model to examine the influence of trust and socio-behavioral contexts on preparedness outcomes.
The PADM and Risk Communication frameworks were selected to underpin this proposed research due to the distinct functions they have in the explanation of preparedness behavior. For example, the PADM framework exists to delineate via a multistage process, various “social influences, persuasion, behavioral decision-making, attitude-behavior relationships, protective action, and innovative processes” (Lindell & Perry, 2012, p. 616). These processes are useful in identifying how risk communication can influence immediate disaster response, long-term and short-term hazard adjustments, and the adoption of protective actions (Lindell & Perry, 2012, p. 616). Paton’s (2007) model serves as the basis for understanding community contexts and provides opportunities for public agencies and risk management authorities to better understand the social construction of risk, community contexts, and improve risk and community engagement practices. Both models also help me to place trust within the continuum of contextual and situational factors that influence household preparedness to coastal hazards, with implications for research and practice. Put together, both models, along with other literature identified during the preliminary literature review, allowed for the development of the preliminary conceptual model. This model provides the basis in this study for the examination of the interactions between contexts and mental processes to produce protective decisions and actions.

**The Preliminary Context Aware Conceptual Framework**

The focal question that is answered by this study is: *how do contexts and trust influence household preparedness for coastal hazards?* My preliminary conceptual model was developed to answer the research question above and develop testable research propositions about household preparedness. It was also used as an interpretive lens to investigate how specified contexts and trust interact to bring about coastal hazard protective actions such as evacuation to safe places, the purchase of hazard insurance, making household emergency plans, storing food and water supplies, or becoming vaccinated
(Witvorapong et al., 2015; Wachinger et al., 2013; Lindell and Perry, 2012; Paton, 2007). To understand how people make risk assessments, it is crucial to remember that human beings are social entities with beliefs that determine their response behaviors and actions (Ayeb-Karlsson et al., 2019).

The preliminary conceptual model outlines how factors (social, individual/household, environmental, and communication) influence how hazard risk is communicated, perceived, interpreted, and translated into decision-making for protective action, as it relates to coastal households faced with current or expected coastal hazard threats. The model was used then as a frame to guide the thematic coding process, and through the systematic review of the data on coastal hazard preparedness, additional factors were used to expand the preliminary model. This was done to produce a “final product that is a revised framework which may include both modified factors and new factors that were not considered in the original model (Xiao & Watson, 2017, p. 102).

The preliminary conceptual framework, titled the “Context Aware” framework, highlights the contexts that interact with mental processes, behaviors, and decisions leading up to the adoption of protective actions, and place trust as a factor of note in coastal hazard preparedness. It is also expected that the expanded model can be applied to facilitate the study of contextual and situational factors that influence household preparedness for coastal hazards. When applied appropriately, the expanded model could help emergency preparedness officials set priorities in outreach efforts, understand how to harness the nuances of community contexts, and engage within those nuances to customize and communicate information to impacted or at-risk communities to improve preparedness outcomes. Figure 3 below proposes relationships between contexts, processes, facilitators or impediments, and outcomes.
The preliminary conceptual framework was used in conjunction with the extant literature to guide the literature search and screening process, streamline the data collection and thematic analysis, and flesh out the themes to produce testable propositions and answer the research question. To address the research question, my conceptual framework did two things in the study. First, in its preliminary stage, along with the extant literature on coastal hazard preparedness, the framework was used in the first coding stage (open coding) to develop initial codes. During the selective coding stage (final coding stage), it was expanded.
by the final themes and used along with the extant literature to develop testable propositions and answer the research question. The systematic review methodology expanded the preliminary conceptual model to articulate the ways contexts and trust impact household risk perceptions, perceptions of the legitimacy and trustworthiness of public officials, propensity to adopt desired behaviors, and impediments to taking protective action (described as situational impediments in Lindell and Perry (2012) and situational factors in Paton (2007)), among other elements delineated in the framework.

In Chapter 3, I will discuss the research methodology and design, to include the PRISMA 2020 Protocol-directed eligibility criteria for the data search, screening, selection, and integration stages, as well as the thematic analysis and expansion of the preliminary conceptual framework.
3. METHODOLOGY

In this chapter, I elaborate on the study methodology, research design, data sources, study contexts, data search, screen, and selection, processes, as well as the criteria for selection, and the strategies utilized to ensure the trustworthiness and transparency of the research process. The selected methodology for this study is a qualitative systematic review consisting of the hybrid systematic review method which is made up of the framework synthesis and thematic analysis methods (Xiao & Watson, 2017). The systematic review worked in a variety of ways to produce the preliminary conceptual model, research propositions, and to eventually expand the conceptual model into a finished product that can be applied to a variety of hazard settings.

The development of the research question is one of the most important steps to planning scholarly research. For this study, my research question asks, “how do contexts and trust influence household hazard preparedness for coastal hazards?” This question guided the review process and directed the subsequent identification of research items via the selection criteria and search strategies (Hiebl, 2021; Stern et al., 2014; Petticrew & Roberts, 2006). While the development of the research question, selection criteria, and search strategies were based on researcher discretion, utmost transparency and openness throughout the research process were critical to producing a review that is of high transparency, trustworthiness, and integrity (Hiebl, 2021; Hulland & Houston, 2020; Booth et al., 2016; Petticrew & Roberts, 2012; Jesson et al., 2011, as cited in Hiebl, 2021).

Based on study findings and my expanded conceptual framework, I developed seven (7) research propositions. These propositions investigate the associations and relationships between influences like trust and psychological sense of safety, on evacuation intentions or
heightened self-efficacy beliefs. I anticipate that these propositions will produce insights about influences of household preparedness for coastal hazards that can be tested in a variety of multi-hazard settings by public agencies and experts involved in emergency management and preparedness.

**Discussion of the Chosen Methodology**

Systematic reviews are widely used to synthesize research to take stock of the existing research landscape, inform policy and practice decisions, and generalize research findings to a wider population (Brunton et al., 2020). This is done through the identification, selection, critical assessment, and synthesis of the most relevant research across individual primary studies, using transparent, replicable, and rigorous methods (Brunton et al., 2020). A systematic review differs from a traditional literature review because it is conducted in a methodical and systematic manner, following a pre-specified protocol to minimize bias to the extent possible, with the objective of synthesizing information and reconciling the evidence to generate new insight on a subject matter (Hanley & Winter, 2013; Dempster, 2011; Petticrew & Roberts, 2006). Hanley and Winter (2013) in their study specify the following characteristics for a rigorous systematic review:

- A clearly specified set of objectives with predefined eligibility criteria;
- An explicit, reproducible methodology;
- A systematic approach that attempts to identify all studies that meet the eligibility criteria;
- A critical examination of study findings to determine validity, through the assessment of bias risk, and;
- A systematic analysis, interpretation, and analysis of study characteristics and findings.
I selected the hybrid review due to its flexibility in using a combination of review methods to provide a systematic examination of extant literature on coastal hazard preparedness.

My use of the hybrid review method consisted of the framework synthesis review method which provides a way to test, reinforce, and build on an existing conceptual model that has been published in previous literature focusing on “a potentially different but relevant population” (Caroll et al., 2013, p. 1). This method involves establishing an a priori conceptual model to help answer a research question, that helps to structure the coding of the literature (Xiao & Watson, 2017). The collection and analysis of the selected literature will be used to modify the conceptual model. In this case, “the revised framework is the final product that may include both modified factors and new factors that were not anticipated in the original model” (Dixon-Woods, 2011, as cited in Xiao & Watson, 2017, p. 102). My use of the hybrid review method also consisted of the thematic synthesis method that uses a three-step process to extract themes from the literature, clusters them, and synthesizes them into themes and then used to answer the research question using the application of a higher-level theoretical framework (Thomas and Harden, 2008).

This hybrid review allowed me to develop and examine emerging themes and codes, develop a conceptual framework and testable propositions, and present study findings in a cohesive manner that is replicable and transparent (Xiao & Watson, 2017). The expectation is that the resulting conceptual framework and testable propositions can be tested and applied to various multi-hazard settings and extend the knowledge on other lesser-known influences of household preparedness for coastal hazards. In the next section of this chapter, I discuss the various literature search strategies, screening processes, selection criteria, and evaluation methods that were used in this study to ensure a rigorous and methodical review. The relevant
figures and tables will be elaborated upon in the subsequent sections, subsections, and in the Appendices Section, to ensure that all information is presented in a clear manner.

**Sampling Strategy**

The data collection, analysis, and synthesis consisted of several replicable processes, starting with the search process. This process consisted of pre-defining selection criteria and entering specified keyword searches in online scholarly search engines. The screening process started with the skimming of peer-reviewed study titles and abstracts (described as the Abstract or ABS level review) to determine studies with a good fit. The next stage of the screening process consisted of the verification, refinement, and expansion of the search criteria to ensure that a broad range of literature was captured. The selection process included the review of articles at the Full-Text level (FT) to verify content and applicability to the review, ending with textual analysis and coding of each article to the appropriate study groupings and the production of a cohesive narrative (Gazely et al., 2019, Drucker et al., 2016; Okoli et al., 2015).

All research processes were guided by the PRISMA 2020 Protocol which was published in 2021 (Page et al., 2021). The PRISMA 2020 Protocol is a valuable evidence-based resource that defines and describes search strategies, data sources, eligibility criteria, screening and selection methods, outcomes, and any planned analyses (Shamseer et al., 2015, as cited in Drucker et al., 2016). It consists of the PRISMA Flowchart and the 27-item PRISMA Checklist. The Flow Diagram delineates the flow of information throughout a systematic literature review while the Checklist addresses the introduction, methods, results, and discussion sections of a systematic review report. This Protocol guides the systematic review process, refines research questions, enhances the rigor of selected research methodologies, focuses empirical inquiry, and promotes study replicability by elaborating the methodology (Page et al., 2020; DeCarlo, 2018; Drucker et al., 2016). The Authorization to Replicate documents and PRISMA Protocol
Flowchart and Checklist can be found in the Appendices section of this document (p. 190-247).

*Search process and selection criteria*

Before delving into my search process, I would like to elaborate on the selection criteria for my proposed study as well as requisite justifications. Firstly, I included studies that discuss preparedness influences and outcomes that occur at the household level for coastal hazards. This allowed me to pare my search to focus on literature that is relevant to this process and that will help answer my research question about how trust and contexts influence household hazard preparedness for coastal hazards (Hiebl, 2021; Rousseau et al., 2008). Secondly, I will only select articles from journals that are peer-reviewed to be included in my proposed review.

Gray literature such as reports, technical papers, conference papers, dissertations and theses will be excluded in the review of the literature. This will ensure to an extent, that the selection of literature will consist of high-quality work that has gone through verification and confirmation of methodological soundness and structural integrity through the peer-review process that determines the validity, significance, and originality of the study before it is published (Lu & Daugherty, 2022; Kelly et al., 2014).

Also, because technological advancement changes methods for archiving and retrieving information, I limited eligible publication dates for the proposed systematic review to between 2002 and 2022 (articles published in the past twenty years), so that the review will be built on the recent literature considering information retrieval and synthesis in the digital age (Xiao & Watson, 2017). Following this format will help make sure that there is a relevance of selected literature to current events and to enhance the overall research credibility (Xiao & Watson, 2017).
The search process for my study consisted of the consultation, study, and archiving of peer-reviewed journal articles, books, and book chapters from relevant journal databases such as Web of Science, ScienceDirect (Elsevier), Google Scholar, and the limited use of the Old Dominion University (ODU) Monarch OneSearch database. I began my search in the Web of Science database, focusing on the Core Collection and the Social Science Citation Index (SSCI) and applying the relevant filters as specified in Table 1 (found on page 46), per the selection criteria for studies based on the PRISMA 2020 Protocol. As I identified relevant and potentially relevant studies through (ABS) level assessments, I catalogued relevant references into the MyBib bibliography and citation generator, and this method helped me manage references using the appropriate citation formats, in a way that made the references easily to download and use as needed.

I utilized the backward and forward citation tracing techniques to find related journal articles. The citation tracing technique allows researchers to discover what articles have been cited by what authors, and if there is a relationship among the cited articles (Pacheco-Vega, 2018). This technique allows researchers to find a gap in the literature, facilitates the comprehension of relevant concepts, and creates opportunities to map out existing research concepts and frameworks to determine where the researcher's literature review and research might fit in (Pacheco-Vega, 2018).

The backward citation tracing technique consists of searching for related articles through the reference list of a journal article of interest. The forward tracing technique consists of searching for the most recent articles, books, and book chapters that cite an article, book, or book chapter of interest (Pacheco-Vega, 2018). Google Scholar offers a feature that allows the user to see how many people cited the article, and a referenced link will usually take the user to an exhaustive reference list.
Lastly, I applied another strategy to conduct further citation tracing, called *literature mapping*. Literature mapping can be used to discover scholarly articles by exploring connections between publications (Princeton University Library, 2022). To conduct literature mapping, I used the visual data mapping tool Connected Papers which helps researchers find and explore research papers that are relevant to their work by mapping out connections between related papers via graphs. I used the same keywords that I had used for my other database searches “trust + coastal hazards + household preparedness” and selected the most relevant article and used it as a map to guide me to other related studies. The sampling strategy for my study is based on the selection criteria outlined in Table 1 below.

**Table 1**

*Selection criteria for selected studies.*

<table>
<thead>
<tr>
<th>Selection Criteria</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N= 52)</td>
<td></td>
</tr>
<tr>
<td>Peer review</td>
<td>Literature will include only peer-reviewed works to ensure rigor of the research process and enhance research credibility (Okoli, 2015).</td>
</tr>
<tr>
<td>Age of publication</td>
<td>No older than 20 years old, to ensure relevance of scope and to maintain high technological storage and dissemination standards (Xiao &amp; Watson, 2017); rule excludes seminal works that help conceptualize study RQs and propositions.</td>
</tr>
<tr>
<td>Phenomenon of interest</td>
<td>Influencers of household preparedness for coastal hazards.</td>
</tr>
<tr>
<td>Participant focus</td>
<td>Households</td>
</tr>
<tr>
<td><strong>Language</strong></td>
<td>English</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td><strong>Geographic location of study</strong></td>
<td>Studies conducted in US coastal areas; studies targeting households in coastal areas; studies in countries with similar demographic or socio-economic factors with target population.</td>
</tr>
<tr>
<td><strong>Reported outcomes</strong></td>
<td>Adoption of adaptive behaviors, coping behaviors, participation in mitigation activities, hindrances to effective preparedness, public education on effective preparedness, adjustments in risk communication.</td>
</tr>
<tr>
<td><strong>Research methods</strong></td>
<td>Qualitative; quantitative; mixed methods.</td>
</tr>
<tr>
<td><strong>Type of publication</strong></td>
<td>Original works only: book chapters, books, articles.</td>
</tr>
<tr>
<td><strong>Key words</strong></td>
<td>Trust; household decision-making, hazard preparedness; coastal hazards; vulnerability; warning messages; risk perception; risk communication.</td>
</tr>
</tbody>
</table>

*Source: Adapted from Okoli (2015)*

**Screening and selection processes**

An ideal screening technique to ensure a structured and transparent examination of content fit is the A/B/C logic postulated by Pittaway et al. (2004). To begin the systematic review screening process, I screened citations and read the abstracts of selected studies to determine relevance to the research questions, research propositions, and the overall methodology of the review (Okoli, 2015). Throughout this process, every extracted research item was categorized as follows: A (particularly relevant items), B (potentially relevant items, or C (items with little or no relevance). During this first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion.
Only A-rated research items were screened at the full-text (FT) level. B and C-rated were assessed early on for relevance, and B-rated items were assessed at the ABS level and used to support the overall literature review as needed. I also placed relevant or potentially relevant systematic reviews in the B category for a review of their reference lists to extract relevant or potentially relevant studies and categorized findings according to the A/B/C method. For example, for systematic reviews such as by Bowser and Cutter, 2015 and Huang et al. (2016), I conducted a backwards tracing search for the studies they investigated and placed those studies within the appropriate relevance category (A/B/C) depending on content fit and eligibility for selection. PRISMA 2020 systematic reviews like those by Pérez-Gañán et al. (2023), Shaffril et al. (2021) and Tyler et al. (2019) were also helpful in structuring this study and were in a separate category for reference purposes. I focused on studies that provided a general understanding of the phenomena of interest, particularly of the focal phenomena within the United States context. However, I included eligible foreign studies that described similar characteristics as the United States context - geographic location, response patterns, risk perception precipitators, etc.

**Data Analysis**

One of the methods of analysis used in this study is the *thematic analysis*. Thematic analysis has been defined as a qualitative method for identifying, analyzing, organizing, describing, and reporting the themes found within a data set (Nowell et al., 2018; Braun & Clarke, 2006). Boyatzis (1998) argue that thematic analysis can be best described as a tool that can be used across different methods and is not a specific method. Braun and Clarke (2006) state that thematic analysis minimally organizes and describes data in rich detail, and often interprets various aspects of the research topic. In thematic analysis, the discovery of emerging themes and codes and the interpretation therein, are dependent on the researcher’s worldviews and perspectives. This is because the researcher determines what codes and
themes are most salient and relevant to the research topic. This analytic process therefore requires an openness about processes and procedures, decisions, and steps taken to ensure the trustworthiness of the research (Nowell et al., 2018).

Thematic analysis is a useful and powerful method that helps researchers to understand a set of experiences, thoughts, or behaviors across a given data set, by searching for common or shared meanings across the data (Kiger & Varpio, 2020; Braun and Clarke 2006). Finally, because of its relevance to other methods of qualitative research, the steps of thematic analysis “echo those of grounded theory, ethnography, and other qualitative methodologies that also rely on coding and searching data sets for themes as part of their processes” (Kiger & Varpio, 2020, p. 3).

The thematic synthesis review method consists of a thematic analysis that extracts themes from the literature, clusters them, and synthesizes them into themes and then used to answer the research question. Thomas and Harden (2008) opine that thematic synthesis occurs across three stages, to include the line-by-line coding of study findings into themes, the construction of those codes into descriptive themes, and finally, the development of analytical themes through the application of a higher-level theoretical framework.

The framework synthesis or “best fit” framework synthesis is an extending review method offers a way to test, reinforce, and build on an existing conceptual model that has been published in previous literature focusing on “a potentially different but relevant population” (Caroll et al., 2013, p. 1). This method involves establishing an a priori conceptual model to help answer a research question, that helps to structure the coding of the literature (Xiao & Watson, 2017). The collection and analysis of the selected literature will be used to modify the conceptual model. In this case, “the revised framework is the final product that may include both modified factors and new factors that were not anticipated in the original model” (Dixon-Woods, 2011, as cited in Xiao & Watson, 2017, p. 102). This method
may be best suited for answering urgent policy questions where the need for quick answers outweighs the need for a fully developed framework (Dixon-Woods, 2011). This method consists of five stages, which cut across the familiarization of the review landscape, selection of the initial framework, the extraction, selection, and analysis of the data based on the initial conceptual model, the categorization and derivation of themes from the selected studies, and finally, the mapping, interpretation, and presentation of those themes in response to the research question(s) or to an audience (Brunton et al., 2020).

Lastly, Xiao and Watson (2017) describe hybrid reviews as an acceptable way to combine various review methods. The authors state that hybrid reviews allow researchers to combine elements that best answer the research question (Xiao & Watson, 2017, p. 102). This study is best described as a hybrid systematic review that combines the thematic analysis and framework synthesis review methods.

**Coding process**

Coding is a process that allows data to be collected to be assembled, categorized, and thematically organized, in a way that provides an organized platform for text data to be disassembled, investigated, and reconstructed in a meaningful way (Creswell, 2013; Williams & Moser, 2019). Coding is necessary as it provides a way to make sense of dense text data, by indexing and mapping data to produce an overview of the data in a way that relates to the study’s research questions (Elliott, 2018; Creswell, 2013).

Themes are described as “broad units of information that consist of several codes aggregated to form a common idea” (Creswell, 2013, as cited in Elliott, 2018, p.2853). Themes are typically developed based on the researcher’s interpretation, which then gives rise to the deeper meanings that are found in categories. *Themes and subthemes*, as used in my study, refer to the more implicit and abstract level data based on the preliminary conceptual framework, which requires interpretation through more specific and descriptive
codes to provide greater specificity. Qualitative software programs such as NVivo also use the term *node* to refer to such themes or categories. Miles et al. (2014) define codes as labels that assign symbolic meaning to the descriptive information that is compiled during a study.

The process of coding involves the assessment of manifest content (also known as surface information) and latent content, (also known as below the surface information). A major aspect of the coding process is ensuring that “coding procedures are defined, rigorous, and consistently applied in order to conform with validity and reliability standards that are associated with qualitative research” (Williams and Moser, 2019, p. 47). The coding process is broken down into 3 stages: *open*, *axial*, and *selective*. Open coding is the first coding stage that is characterized by the identification and categorization of concepts and themes (Williams & Moser, 2019). At this stage, the first level of data is organized by creating “initial broad thematic domains for data assemblage (Williams & Moser, 2019, p. 48).

Approaching the thematic fragments and concepts that are identified during data collection in a systematic and organized way is a critical component of effective open coding. Axial coding has historic origins in grounded theory research and consists of the refinement of elements identified in the open coding process. This process relates data points together, revealing the codes, categories, and subcategories enmeshed within data findings, which provide insights into participant voices (Simmons, 2017). Finally, selective coding is a process that enables the researcher to develop and consolidate categories of organized data from axial coding into cohesive and meaning-filled expressions (Williams and Moser, 2019).

Open and axial coding were done using the Lumivero NVivo 14 statistical analysis software. Emerging themes and codes were developed using elements identified in the extant literature, the Context Aware Conceptual Model, and the PADM and Risk Communication frameworks. For example, codes like “describing household members,” “reliability and trustworthiness…and information sources,” “risk messaging affects…take protective action”
and “experience is the best teacher” were derived based on the individual/household factors, trust, communication factors, and stakeholder perceptions elements in my preliminary framework.

As I worked across the fifty-two (52) selected articles for this study, I highlighted and coded relevant portions of text to corresponding nodes using the Code function in NVivo. The nodes were created following some reflection on how the selected portion of the text related to the research question “how do contexts and trust impact household preparedness for coastal hazards?” Using my preliminary conceptual framework as a guide, I considered how the selected text related to the contexts, pre-decisional processes, situational impediments and facilitators, outcomes, and other elements described in the preliminary conceptual framework. This deliberative process thus produced meaningful themes and concluded my selective coding process. My choice of the thematic analysis and coding methods was consistent with systematic review study methods identified in the risk perception and natural or coastal hazard preparedness literature (Wachinger et al., 2013; Kellens et al., 2013; Paton, 2007).

**Intercoder Reliability (ICR) Results**

O’Connor and Joffe (2020) state that ICR is optimally conducted on 10-25% of randomly selected data to ensure the representativeness of the entire dataset. For this study, 20% of the reviewed studies \( (n = 10) \) were randomly selected. Two studies each were assigned to five independent coders with experience in the emergency management, coastal hazard, environmental safety, and civil engineering fields and provided assessments of their agreements ranging from 0.1 (extremely low agreement) to 1.0 (very high agreement).

Training was provided to coders as needed, especially for those in a different field who needed more context-specific guidance. I provided each coder with a coding frame that included emerging themes and codes, along with descriptions, and relevant references. I also
provided a data collection form to allow them to qualitatively discuss dissonances and agreements, along with a table to quantitatively capture coder agreement, with values ranging from 0.1 to 1.0 (lowest to highest). I used coder feedback to refine themes and codes and circled back with each coder to discuss coding results and iron out any issues and discrepancies.

I calculated the ICR by using Microsoft Excel. For each agreement rate higher than 0.8, I rated as 1 (Agreement) and any agreement rate between 0.5 and 0.79, I rated as 0.5 (Partial agreement). For agreements lower than 0.5, I rated as 0 (No agreement). Most agreement rates fell between 0.8 and 1, with two coders providing two agreement rates between 0.5 and 0.79. Using a simple calculation, with a calculated match of 41.5 out of a total match of 50, the percentage agreement was 83%, indicating an acceptable measure of ICR agreement, according to ICR studies (Miles and Huberman, 2014; O’Connor and Joffe, 2020).

**Explanation of Study Validity**

After my screening and selection processes had been completed, I began my analytical process by categorizing selected studies and assessing levels of validity and risk of bias. Studies with low validity were those with a high risk of bias, methodological flaws, and/or significant undisclosed limitations. Studies with medium validity had some limitations in their methodology, justifiable low response rates, a moderate risk of bias, and/or some undisclosed limitations. Studies with high validity had rigorous methodology, high transparency and replicability, and reliability, a low risk of bias, and disclosed any limitations. Validity was also assessed based on the sample size of the study, with larger sample sizes generally considered to be more representative and therefore having higher validity.

I had 43 High validity studies, 8 Medium validity studies, and 1 Low validity study. I decided to include the low validity study (Linnekamp et al., 2011) because it was a very interesting and useful study for understanding how coastal households from different socio-
economic communities in coastal Suriname and Guyana take measures to prevent flooding. The study also explores how social capital and institutional trust affects decision-making in those two areas, making it a very eligible, useful, and applicable study. Also, I noted that authors like Bollettino et al. (2020), Bott and Braun (2019), Combest-Friedman et al. (2012) (3 out of the 8 medium validity studies) did not explicitly discuss their studies’ limitations and possibility of bias. However, I saw that they had potential issues with sample representativeness and self-reporting biases that could be introduced during the data collection process. Therefore, I still selected and included those studies due to the highly relevant insights they provided to my overall study and noted my assessment of the studies’ risk of bias possibility. Figure 4 below outlines the percentage of High, Medium, and Low validity studies, and Table 6 contains this study’s validity and bias risk assessment results, which can be found on page 220.

Figure 4

Validity of Selected Studies
**Point of Saturation**

I knew that I had reached a point of saturation in the literature search process when I began to see repeated patterns of the same peer-reviewed studies. For example, during my ScienceDirect search, I observed an overlap of 10 duplicate records of studies found in the Web of Science database. My backward and forward citation tracing also reached a point of saturation when I started seeing upwards of ten references that had been included or excluded from my study. During the final round of screening and backwards/forwards tracing, I found four new studies that were relevant to the study and met all my selection criteria, and notated reasons for inclusion in my working tracker document.

I knew that I had reached a point of saturation in thematic analysis when I could no longer find new codes that could bolster thematic development for this study. For example, six out of the twelve studies that I excluded due to redundancy addressed areas that had been already heavily investigated during my thematic analysis and were no longer able to provide new insights. I excluded them from the review but referenced them as needed to substantiate my thematic findings. I began to consolidate codes and continued connecting developing themes to my initial framework, while considering ways in which the new findings could expand the framework. The expanded framework, along with the research propositions that were developed from the thematic analysis, will be discussed in Chapter 4.
4. RESULTS

This chapter begins with a summary of the processes related to the search, screening, and selection of the relevant data, according to the PRISMA 2020 Protocol, including justifications for selection. Afterwards, I discuss the results of the coding, organize findings in a table, provide detailed discussions on findings, expand the conceptual framework, and develop propositional statements based on findings.

Search, Screening, and Selection

To ensure the consistency and reliability of the research process, I consistently used the keywords “trust,” “coastal hazards” and “household preparedness” across the Web of Science (WoS), ScienceDirect, Google Scholar, and the ODU Monarch OneSearch databases, as well as for my citation tracing activities. 1041 studies were identified via the abovementioned sources with 109 studies removed before screening. The application of various rigorous searching and screening processes provided the studies that were selected for inclusion in this study.

I entered the keywords in this format: "coastal hazards or hazards and trust and preparedness and household and factors and influence" into the Google Scholar search bar. My Google Scholar search returned a total of 111 articles that were classified as follows: 54 Category A, 45 Category B, and 12 Category C studies. During the screening of the Category C studies, I skimmed through the article abstracts and discarded 8 of them due to a lack of relevance to the research topic and a failure to meet the selection criteria. I upgraded 4 Category C articles to Category B due to their potential relevance to the research topic. At the point of filtering the Category C studies, I decided to focus on relevant (Category A) and potentially relevant (Category B) studies moving forward for better time management purposes. This brought my Google search study count to 103 – with 55 Category A studies and 48 Category B studies. After the removal and upgrade of Category C studies, I merged
the Category A studies into one Excel worksheet and merged the Category B studies into another worksheet. I did this to make the screening, selection, and thematic analysis processes easier to manage. As I read through the Category A and B study abstracts, I searched through their reference lists to find studies that could be relevant to my study. Two Category B studies, Bowser and Cutter, 2015 and Wachinger et al. (2013) stood out to me and were used as the basis for my literature mapping activity using Connected Papers. Both studies mapped 42 studies; comprised of 32 Category A and 10 Category B studies. I then conducted my forward and backward citation tracing which produced 7 Category A studies that met the selection criteria for Full-Text (FT) review.

I entered the same keywords in this format: “coastal hazards or hazards and trust and preparedness and household and factors and influence” in WoS Core Collection. The search returned 9646 results. After applying filters for publication year (2003-2023), document types (articles), language (English), and the Social Science Citation Index (SSCI), 404 results were produced. After applying the keyword “trust” within the subset of the 404 returned studies, 10 studies were produced. Three articles were removed due to their focus on a different type of hazard (1), a focus on adaptation change and not factors that influence adaptations (1), and a focus on systematic disaster risk reduction (1). I returned to my original search of 404 results and entered the keyword “household”. This search returned 24 results, 13 of which were removed due to their lack of focus on the phenomena of interest (8) and reported outcomes (5). The keyword “preparedness” was used in the general search results with the 404 studies, and it returned 31 results. After excluding duplications and irrelevant studies, 13 studies were removed due to duplication/intersection with previous searches (4), or irrelevance to the participant focus (2), reported outcomes (2) or phenomena of interest foci (5). 38 studies were selected from the WoS database to be screened at the FT level.
I entered the same keywords “coastal hazards or hazards and trust and preparedness and household and factors and influence” to begin a new search on ScienceDirect. The search returned 484 results. After applying relevant filters, the results went down to 297. I then began a sweep of the data and noted some overlap between some of the studies in ScienceDirect and those in WoS and Google Scholar. I took note of the overlapping studies (10) and skimmed titles and abstracts of the 297 studies. I attributed the overlapping studies to the ScienceDirect search since it was done more recently than WoS or Google Scholar. Twenty ScienceDirect studies were selected for review at the FT level. ScienceDirect does not have an indexing system that allowed me to store the references, like WoS does, so I manually downloaded each reference as an .ris file and uploaded into the MyBib repository.

In the process of screening text at the FT level and conducting simultaneous backward and forward tracing, I included four new studies, based on their relevance to my study and their adherence with all my PRISMA 2020-based selection criteria. After reviewing the 214 studies at the ABS level, I further eliminated two duplications (2), studies without relevance to the participant focus (24), reported outcomes (39), and phenomena of interest (30). This brought the number of studies moving to an FT review to 119. The FT review consisted of careful skimming and noting of relevant aspects of studies such as relevance to the research question, a focus on the phenomena of interest, a clearly elaborated methodology, and a deliberate risk bias assessment. Further details on my bias risk assessment can be found in the Appendices on page 217. I removed 4 studies and stored them for future analysis and to use them to substantiate the study’s literature review, if needed. At the last minute, I added a new special issue study (Nepal et al., 2012) that met all the selection criteria and was very relevant to the introduction of and understanding of a novel concept in this study and was found through backwards tracing. This brought my total Category A studies to 116. After careful screening of the 116 studies, 52 studies were selected, to the exclusion of 64 studies. Figure
11 (p. 194) shows the screening and selection processes for these studies via the PRISMA 2020 Flowchart, and clearly outlines the reasons for the exclusion of the 64 studies. The 64 studies were excluded for the following reasons:

- Study focus
- Phenomena of interest
- Study outcomes
- Study participant focus
- Redundancy
- Duplication error
- Publication type

**Figure 5**

*Characteristics of Excluded Studies During Full Text-Level Screening*

![Bar chart showing frequencies of excluded study characteristics]

Figure 5 above delineates the frequencies of excluded study characteristics, with *participant focus* being the highest; 29 out of the 64 studies (45%) focused on participant groups outside the realm of relevance to my study (i.e. tourists, fishermen, neighborhoods), and *study focus* being second highest; 17 out of 64 studies (27%) focused on other aspects of coastal hazards that did not relate directly with my study (i.e. vulnerability assessment
mapping, (individual) migrant experiences with natural hazards, community indices of coastal vulnerability). Twelve studies (19%) were excluded due to redundancy: 6 were excluded because they originated from one data source, and 6 were excluded after I reached a point of saturation during thematic analysis. To mitigate the risk of potential selection bases, I selected the most recent study from the author that met all selection criteria and still referenced the excluded studies. I also referenced the studies after I reached a point of saturation, in related thematic discussions. This brought the total count of studies to be included in my final review, to 52 (n=52).

**Discussion of Results**

This section highlights the methodologies and descriptive statistics of the selected studies, describes the coding process, and elaborates on the emerging and developed themes, and eventually discusses the expansion of the preliminary conceptual framework and the development of research propositions.

**Methodologies of studies reviewed**

While not all the selected studies focused solely on coastal hazard preparedness, all studies included aspects of coastal hazard-related household decision-making in their sample (n=52). 69% of the reviewed studies employed quantitative methodologies (n=36), 17% used qualitative methodologies (n=9), and 14% used mixed methodologies (n=7). The studies consisted of surveys, interviews, and focus group discussions that were distributed to heads of households and adult household members (age 18 and older) using a variety of distribution methods.

30 quantitative studies used surveys (mailed, online, door-to-door, and cross-sectional surveys) as their major data collection method (Adjei et al., 2022; Martins et al., 2018; Cuite et al., 2017; Huang et al., 2017; Wei et al., 2014; Basolo et al., 2009). 5 quantitative studies used secondary data such as weather forecast databases, existing survey datasets, and agent-
based model simulation (Landry et al., 2021; Bollettino et al., 2020; Harries, 2012; Natarajan et al., 2012; Czajkowski, 2011). 1 quantitative study used semi-structured surveys and in-depth interviews for data collection (Buchanan et al., 2019). 7 of the qualitative studies utilized interviews for data collection, including face-to-face, structured, and semi-structured interviews (Gowhar et al., 2022; Kammerbauer and Minnery, 2019; Haynes et al., 2018; Bostrom et al., 2018; DeYoung et al., 2016; Wilson and Tiefenbacher, 2012; Harvatt et al., 2011). 2 qualitative study used focus group discussions as the major data collection method (Bott & Braun, 2019; Nepal et al., 2012). 6 mixed studies used surveys (including telephone and structured questionnaires), while 1 mixed study used structured interviews and secondary GIS datasets for data collection (Alam et al., 2023; DeYoung et al., 2016a; Ahsan et al., 2016; Linnekamp et al., 2011).

Majority of the quantitative studies employed statistical analysis approaches such as bivariate/multivariate regression and correlation analyses, non-parametric tests, and predictive modeling approaches (Adjei et al., 2022; Teo et al., 2019; Huang et al., 2017; Cope et al., 2017; Nagarajan et al., 2012; Basolo et al., 2009; Lindell et al., 2005). 8 qualitative studies utilized a thematic analysis method, with 2 studies using a conceptual framework development and content analysis approaches in combination with the thematic analysis approach, and 1 study employing an exploratory case study approach (Gowhar et al., 2022; Kammerbauer and Minnery, 2019; Bott & Braun, 2019; Haynes et al., 2018; Bostrom et al., 2018; DeYoung et al., 2016; Wilson and Tiefenbacher, 2012; Nepal et al., 2012; Harvatt et al., 2011). 2 of the mixed methods studies combined statistical analysis approaches with thematic or deductive analysis approaches (Parvin et al., 2019; DeYoung et al., 2016a), while 2 mixed studies combined both qualitative and quantitative data collection and analyses methods (Alam et al., 2023; Meyer, 2018). 3 mixed methods studies utilized case study
approaches with statistical analyses methods and semi-structured interviews and focus group discussions (Elrick-Barr & Smith, 2022; Ahsan et al., 2016; Linnekamp et al., 2011).

26 quantitative studies used random sampling methods, including stratified, cluster, and systematic sampling methods (Grover et al., 2022; Adjei et al., 2022; Castenada et al., 2020; Bollettino et al., 2020; Buchanan et al., 2019; Huang et al., 2017; Brody et al., 2017; Lindell et al., 2015). 10 quantitative studies used the purposive sampling methods, including snowball sampling methods (DeYoung et al., 2020; Brodar et al., 2020; DeYoung et al., 2016; Lazo et al., 2015; Czajkowski, 2011). Out of the 9 qualitative studies, 5 used random sampling methods (Gowhar et al., 2022; Bott and Braun, 2019; Haynes et al., 2018; Bostrom et al., 2018; DeYoung et al., 2016b), 2 used purposive sampling methods (Kammerbauer and Minnery, 2019; Harvatt and Chilvers, 2011), 1 used convenience sampling (Nepal et al., 2012), and 1 used a snowball sampling method (Wilson and Tiefenbacher, 2012). Out of 7 mixed studies, 3 mixed methods studies utilized random sampling methods, including stratified random sampling methods (Meyer et al., 2018; DeYoung et al., 2016a; Ahsan et al., 2016). 3 mixed studies utilized systematic and purposive sampling methods, while 1 mixed methods study utilized a combination of random and purposive sampling methods (Alam et al., 2023; Elrick-Barr and Smith, 2022; Parvin et al., 2019; Linnekamp et al., 2011). Figures 6 and 7 provide details on the selected study methodologies and the most used data collection methods respectively.

Studies were selected from peer-reviewed journals. The highest percentage of reviewed studies (22%) were published in the International Journal of Disaster Risk Reduction, followed by the Journal of Natural Hazards (15%), the Environmental Hazards and Weather, Climate, and Society (7.7% respectively). See Figure 8 for further descriptions of the peer-reviewed journals that studies were retrieved from. Lastly, Figure 9 outlines the geographical study areas for each of the selected studies.
Figure 6

Methodology of Studies Reviewed

Figure 7

Most Used Data Collection Method of Selected Studies
**Figure 8**

*Journal Sources of Selected Studies*

![Journal Sources of Selected Studies diagram]

**Figure 9**

*Geographical Locations of Selected Studies*

![Geographical Locations of Selected Studies diagram]
Discussion of Thematic Findings

This study’s thematic findings were developed using the preliminary Context Aware Conceptual Model (which is underpinned by Lindell and Perry’s 2012 PADM and Paton’s 2007 Risk Communication models) as a baseline. This approach allowed my research to be situated within the PADM and Risk Communication frameworks, while allowing research findings to extend our knowledge and understanding of the preparedness drivers (trust and contexts) under investigation. Findings consequently expand the preliminary framework, answer the research question, and produce research propositions.

As I reviewed the 52 studies within the context of household preparedness, I thought about Lindell and Perry’s (2012) discussion as they highlight the PADM’s contributions to understanding individual protective behaviors, through the development of stages that people typically use to make decisions to protect against hazards. They however state that “These stages are sequential, as are those within the information-seeking process. However, few people are likely to follow every step in the model in the exact sequence listed in Fig. 1 (Lindell and Perry, 2012; p. 617).

Because my study applies the PADM and Risk Management models to households rather than individuals, I expected to see some convergences and divergences in the way people follow the PADM stages when they must protect themselves, their households, and their property. It is worthy to note, that in each theme, findings describe preparedness outcomes, such as protective actions (evacuation or relocation), adaptive strategies (installation of reinforced materials during construction and green/grey infrastructure) and coping strategies (purchasing flood information and seeking out hazard information). This point is relevant to the expansion of the preliminary conceptual framework, since it extends knowledge on how protective actions, along with coping and adaptive strategies, impact preparedness outcomes.
Findings from the initial literature review and preliminary conceptual framework suggest that contexts consisting of environmental, social, and communication factors (such as environmental cues, social cues, and warnings respectively), drive pre-decisional processes, which impact an individual’s threat and protective action perceptions, which is then facilitated or impeded by situational factors or impediments respectively (Wachinger et al., 2013; Lindell and Perry, 2012; Paton, 2007). These situational factors and/or impediments then trigger behavioral responses that lead to protective action outcomes.

From my systematic study review findings, Adaptive capacity as a theme describes the nuanced factors that affect individuals’ and households’ ability to prepare for coastal hazards. Some of these factors include demographic, communication, social and household factors that ultimately impact preparedness outcomes through the influence they have on individual/household decision-makers’ perceptive processes. For example, the study found that a heightened risk perception is what likely prompts evacuation, as studies show that females may personalize evacuation warnings, leading to heightened risk perceptions and a higher likelihood of intention to both immediately evacuate and to engage in pre-milling evacuation behavior. (Buylova et al. 2020; Lindell & Perry, 2012). Also, for households with children, having one or more children at home increases risk perceptions and creates a personal motivation to take protective measures by preparing for and taking preparedness actions (Alam et al., 2023; Casteñada et al., 2020; Buylova et al., 2020; Brodar et al., 2020; Haynes et al., 2018; Lazo et al., 2018).

When those risk perceptions and assessments (found within the perceptive processes theme) interact with situational facilitators (i.e., trust, social influences), they can make households more risk sensitive and likely to carry out protective actions, adaptive modifications, or adopt coping strategies if they trust local authorities to provide public protective measures. When these perceptive processes interact with situational impediments
(i.e., resource constraints and invisible needs), the study found that it can impede households’ adaptive capacity when it comes to evacuating or making structural modifications. For example, the study found that non-evacuee households did not evacuate during high-impact hurricanes like Hurricane Irma, Ike, and Rita due to challenges such as high traffic, cost of evacuation, the risk of evacuation, limited evacuation notice, limited access to gasoline and shelter, and logistical difficulties related to traveling with pets and small children (Brodar et al., 2020; Pham et al., 2019; Wei et al., 2014; Wilson and Tiefenbacher, 2012).

The findings that produced the social influence theme were quite salient and required a separate section from the Adaptive capacity and Preparedness Enablers and Inhibitors themes, to allow me to appropriately explore and express the influence of social networks and relationships on household preparedness levels and behaviors. For example, in the DeYoung and Peters (2016) study, participants who reported feeling a sense of connectedness, belonging, and social responsibility in what they perceived as their community, showed higher levels of preparedness for future events. Martins et al. (2018) found that strong social bonds enabled preparedness in the study area before Superstorm Sandy. Study findings suggest that when households are well integrated into informal networks such as friends, neighbors, coworkers, and church members that they can rely on, they are more likely to engage in preparedness activities. The study results indicated a strong, positive association between evacuation capacity and network assistance. Similarly, Teo et al. (2019), Lindell et al. (2015), and Alam et al. (2023) found that social connections, comprising friends, relatives, and neighbors were the leading sources of hazard information.

I found that the theme perceptive processes can make up the sum of thought processes related to risk identification, personalization, and protective action (Kammerbauer and Minnery, 2019; Meyer et al., 2018, Lindell and Perry, 2012). They may not be differentiated from pre-decisional processes, as outlined in the PADM or my Preliminary Conceptual
framework. These perceptive processes can stem from individual factors such as gender, age, and minority status (Cannon et al., 2021; Buylova et al., 2020; Huang et al., 2017; DeYoung et al., 2016b; Lindell and Perry, 2012). They can also stem from household factors such as ages or disability status of household members (Alam et al., 2023; Adjei et al., 2022; Pan, 2020; Buylova et al., 2020; Brodar et al., 2020; Haynes et al., 2018; Wilson and Tiefenbacher, 2012). Prior experience with hazards, proximity to hazard risk, and a psychological sense of safety, along with situational facilitators like perceived certainty and trust, were found in the study to affect how households perceived expected and future flooding events. These issues can also affect households’ decisions to evacuate or shelter in place, and their ability to deploy evacuation logistics (adaptive capacity), ultimately impacting their preparedness outcomes (Gowhar et al., 2022; Elrick-Barr and Smith, 2022; Adjei et al., 2022; Lee et al., 2021; Combest-Friedman et al., 2012).

The theme preparedness enablers and inhibitors covered aspects of trust such as interpersonal and institutional trust and focused on the various ways trust and confidence in government, social networks, and information sources (peers, family, friends, media, experts, government officials, etc.) can affect household decisions to take preventive, adaptive, and protective measures in response to flooding, hurricanes, tsunamis, and other coastal hazards (Nepal et al., 2012). Study findings indicated that unnecessary evacuation experience (or false alarms) was positively related to perceived evacuation impediments, leading to a departure from compliant or desirable behaviors such as evacuation or relocation to save lives and ensure the safety of property, to more coping strategies that may not be as effective. It is likely that memories of previous false alarms may discourage people from evacuating. Invisible needs (i.e. information gaps due to language barriers and social isolation) and resource constraints, (such as high costs of evacuation and structural modifications, transportation challenges, and lack of accommodation during evacuation) were highlighted as
major impediments to evacuation intentions and actions, causing difficulty in achieving desired evacuations (Martins et al., 2018; Wilson and Tiefenbacher, 2012; Nepal et al., 2012).

On the other hand, the belief that governments had the expertise and responsibility to keep citizens safe, influenced higher risk perceptions in households who had received official and explicit evacuation notices, leading to more desirable behaviors and preparedness outcomes. These findings highlight the ways trust can facilitate and, in some cases, impede desired preparedness behaviors and outcomes.
### Table 2

#### Study Themes and Subthemes

<table>
<thead>
<tr>
<th>Themes and subthemes</th>
<th>Codes</th>
<th>Descriptions</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td><strong>Adaptive capacity</strong></td>
<td>Logistics and supports; intention to act; sufficient warning time; delay inducers; mobility concerns; language and communication barriers; environmental cues; social cues.</td>
<td>This theme encompasses the entirety of factors that can affect households’ ability to act when faced with coastal hazards. Studies explore the role of household factors, adequate hazard warning time, cultural factors, demographic factors, mobility concerns, and communication barriers, in households’ ability to act when faced with coastal hazards.</td>
<td>Adjei et al. (2022); Cannon et al. (2021); Lazo et al. (2015); Meyer et al. (2018); Huang et al. (2017); Buylova et al. (2020); DeYoung et al. (2016b); Wilson and Tiefenbacher (2012); Lindell et al. (2015); Grover et al. (2022); Peacock (2003); Basolo et al. (2017); Adjei et al. (2022); Alam et al. (2023); Koerth et al. (2013); Pham et al. (2019); Wei et al. (2014); Cuite et al. (2017); Bollettino et al. (2020); Twerefou et al. (2019); Bostrom et al. (2019); Grothmann and Reusswig (2006); Bott and Braun (2019); Wilson and Tiefenbacher (2012); Brodar et al. (2020); Brody et al. (2017); Buchanan et al. (2019); Bukvic et al. (2015); DeYoung et al. (2016); Gowhar et al. (2022);</td>
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Table 2 (Continued)

<table>
<thead>
<tr>
<th>Social influences</th>
<th>Perceptive processes</th>
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<tbody>
<tr>
<td>Sense of belonging, community and place attachment</td>
<td>Information sources; Planning/preparing for future hazards;</td>
</tr>
<tr>
<td>Community participation</td>
<td>This theme covers the social aspects of household protective action decision making. Studies that center around this theme explore factors such as residents’ place attachment, sense of belonging, and the influence of peers on households’ decisions to evacuate, purchase flood insurance, purchase window shutter protection, or in deciding to shelter in place.</td>
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<tr>
<td>Culture, religion, and worldviews</td>
<td>This theme encapsulates findings that focus on the factors that</td>
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<table>
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<tr>
<th>Social influences</th>
<th>Perceptive processes</th>
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<tbody>
<tr>
<td>Social capital; peer influence; flood culture; collective action; cultural considerations; social disconnect.</td>
<td>Importantly, a comprehensive understanding of household protective action decision making requires the consideration of various social influences. This theme covers the social aspects of household protective action decision making. Studies that center around this theme explore factors such as residents’ place attachment, sense of belonging, and the influence of peers on households’ decisions to evacuate, purchase flood insurance, purchase window shutter protection, or in deciding to shelter in place.</td>
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| Bott and Braun (2019); Gowhar et al. (2022); Linnekamp et al. (2011); Buylova et al. (2020); DeYoung et al. (2016); Lindell et al. (2005); Buchanan et al. (2019); Lindell et al. (2015); Grover et al. (2022); Peacock (2003); Harvatt et al. (2011); Haynes et al. (2018); Kammerbauer and Minnery (2019); Wei et al. (2014); Wilson and Tiefenbacher (2012); Nepal et al. (2012). | Huang et al. (2012); Huang et al. (2017); Basolo et al. (2009);
<table>
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<tr>
<th>Preparedness enablers and inhibitors</th>
<th>Accuracy and timeliness of information, perceived expertise and trustworthiness of information sources; protective responsibility; message comprehension</th>
<th>The theme broadly covers interpersonal or social and institutional trust and explores how these kinds of trust can impact risk perception, intention to act, and decisions to (not) evacuate, take mitigative and adaptive measures, and participate in public education initiatives. This theme also covers the influence of false alarms.</th>
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<tr>
<td>Trust in others’ protective ability and expertise</td>
<td></td>
<td>Alam et al. (2023); Bostrom et al. (2020); Huang et al. (2017); Buylova et al. (2020); Brodar et al. (2020); Huang et al. (2017); Lazo et al. (2015); Cannon et al. (2021); DeYoung and Peters (2016); Kammerbauer and Minnery (2019); Nepa et al. (2012)</td>
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<tr>
<td>Perceived certainty</td>
<td></td>
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<tr>
<td>Impediments to evacuation</td>
<td></td>
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<td>Invisible needs</td>
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<tr>
<td>False alarms and eroding trust</td>
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- Proximity to hazard source
- Warning messaging modalities
- Self-efficacy preparedness beliefs
- Perceived certainty

Individual/household risk assessment; Risk perception; knowledge of hazard features; information, residency tenure; maps; environmental cues.

Influence people’s decision-making thought processes. These studies explain or explore socio-cognitive factors: how risk perception, hazard experience, hazard education, risk communication, socio-environmental cues, and certainty about hazard risk can affect how households perceive, assess, and personalize hazard risk. These studies report on the consequent outcomes of households taking minimally invasive adaptive actions, structural and non-structural protective actions, or decisions to not act.

DeYoung et al. (2016b); Basolo et al. (2017); Wilson and Tiefenbacher (2012); Lee et al. (2021); Adjei et al. (2022); Elrick-Barr and Smith (2022); Bostrom et al. (2019); Bukvic et al. (2015); Martins et al. (2018); Lazo et al. (2015); Cannon et al. (2021); Lindell et al. (2015); Peacock (2003); Brody et al. (2017); Bollettino et al. (2020); Alam et al. (2023); Bott and Braun (2019); Mishra et al. (2010); Buchanan et al. (2019); Brodar et al. (2020); Landry et al. (2021); Linnekamp et al. (2011); Harris et al. (2012); Haynes et al. (2018); DeYoung and Peters (2016); Kammerbauer and Minnery (2019); Nepa et al. (2012)
perceived certainty, and invisible needs on households’ decisions to self-protect or engage in coping strategies from coastal hazard impacts.

et al. (2019); Martins et al. (2018); Wilson and Tiefenbacher (2012); Nepal et al. (2012)

| Table 2 (End) |
Adaptive Capacity

This theme encapsulates the household, socioeconomic, demographic, communication, and environmental factors that affect a household’s ability and intention to take protective action (such as evacuation, having an emergency preparedness plan, purchasing federal flood insurance, shelter in place, relocating belongings to higher ground, etc.) when faced with coastal hazards. This theme relates back to the Preliminary Conceptual framework because it conveys those contexts (such as demographic and household factors like age, gender, disability status of household members) that are critical to people’s ability to adapt, self-protect, and cope when dealing with the uncertainty of coastal hazards. The subthemes *adaptation strategies, household factors, demographic factors, exposure to hazard preparedness activities, and hazard risk messaging considerations* also highlight the impact of factors like homeownership, household composition/size, and demographic factors, on households’ ability to take protective actions, adapt to current or expected impacts, or engage in preparedness training and outreach efforts. In the preliminary framework, contexts drive pre-decisional processes, which drive perceptions, which are then facilitated or impeded by facilitators or impediments respectively. Finally, these facilitators or impediments activate behavioral responses that can lead to outcomes such as protective actions, adaptive strategies, or coping mechanisms.

For example, Pan (2020) found that adaptive capacity was an important decision-making factor for survey respondents. For example, people with poor mobility may often need help from others. Before, during, and even after a storm happens, people with disabilities may experience challenges above what others may face when it comes to disaster evacuation, shelter, and recovery. They may also need personal services that intersect with critical social, medical, and
civic agencies to allow them to effectively respond to disasters, making evacuation considerably more challenging for them.

Relating to socio-economic characteristics and adaptation behavior, Koerth et al. (2013) found low significant correlations. For example, the authors found that residents with higher education levels were taking more adaptive measures than those with lower education levels. They found that males took more adaptive measures than females. They did not find signification correlation between adaptive behavior and age or having children in the home respectively. For housing variables, the authors also found low significant correlations as it related to adaptive behavior. Specifically, they found that urban residents took more adaptive measures than those in rural settings (Koerth et al., 2013).

This theme extends knowledge and therefore expands the Context Aware conceptual framework through its elaboration of the impact of demographic, communication, and environmental factors on people’s risk perceptions and other perceptive processes. For example, the theme highlights the influence of household factors (such as mobility issues of family members or having young children), on household decisions to take protective actions such as evacuation and relocation, adaptive strategies such as structural modifications, and coping strategies such as gathering hazard information or the purchase of federal flood insurance. Findings distinguish preparedness actions such as protective, adaptive, and coping strategies, and describes how household factors can influence household decisions to engage in coping behavior such as securing loose items and sheltering in place, instead of expensive and logistically cumbersome protective actions such as evacuating.
Adaptation strategies

The Bott and Braun (2019) study discusses the protect-retreat-accommodate strategies that are adopted by households exposed to coastal hazards. They describe these strategies as those that households use to protect themselves and property, such as the use of hard structures; retreating from unsafe areas and making adaptations to coexist with identified hazards. However, their study found that retreat was not an option of choice in their study area, despite the high exposure households faced to multiple and frequent coastal hazards. In fact, 95% of surveyed households stated that they did not plan to relocate within the next five years. The authors noted that this finding was consistent with the research findings that physical hazard events which are experienced frequently over time, tend to become perceived as the norm and are not considered serious enough reasons to relocate (p. 5).

Instead of relocating, participants in the Bott and Braun (2019) study stated that they instead applied protection strategies such as the storage of belongings on shelves (55% of surveyed households); sleeping in raise beds (51% of surveyed households); covering floors with ceramic tiles (31%); increasing thresholds in front of their doors; afforestation of mangroves (13% of surveyed households); and building small drainage channels around their homes (5%), among other interventions. Due to the typically low magnitude albeit frequent flooding events, these interventions appear to be sufficient during most incidents (p. 5).

Linnekamp et al. (2011) also found that almost all surveyed households stayed home during a flood. In lower-income areas, about 10% of surveyed households moved in with family and friends. Other households moved their belongings, piled up their furniture, while others made small canals in their backyards so that the water could flow toward the streets. The authors noted that collective action occurs only during flood, but preventive action is usually done at the
individual level. 82% of surveyed households, (based primarily in lower-income areas), reported cleaning and repairing their belongings by themselves, with almost no household contacting government institutions during the flood.

Koerth et al. (2013) study results showed that respondents (regardless of their own personal experience) who were aware of the flood damages their homes had suffered in the past, took significantly more adaptive measures. This finding did not include those who were unaware of previous flooding experience of their homes). Peacock (2003) found that hurricane experience approached significance in determining coverage, while hurricane experience in the form of structural damage did not appear to play a role in determining coverage. Specifically, having a household member who has experienced a hurricane in the past, was positively correlated with envelope coverage only. However, there was no positive relationship when the household experienced hurricane damage, for envelope and shutter coverage. On the other hand, hazard knowledge and experience had positive effects on shutter and envelope coverage. Households who reported higher levels of knowledge regarding hurricane risk, expected damage extent, and how to prevent damage, were more likely to have significantly higher quality of shuttering and envelope coverage.

Wilson and Tiefenbacher (2012) found that study respondents who did not evacuate, despite their previous experiences, stated that they did not anticipate the strength or magnitude of Hurricane Ike due to their milder previous experiences. Majority of the 14 respondents had reported evacuating during Hurricane Rita, and yet underestimated the strength and magnitude of Hurricane Ike, interpreting relate warnings as “overblown” (p. 208). Because Hurricane Rita had veered off the expected path at the last minute, the respondents appeared to have believed that they were never in any real danger, and this indicated to them that the “the experts’ information
about Ike was probably wrong, not that hurricanes can be unpredictable” (p. 208). This erroneous interpretation of environmental cues from competing sources (nature and expert assessments) apparently created another barrier to the effective communication of risk to those most at-risk, and challenges local authorities’ promotion of preferred emergency communication modalities.

The Buchanan et al. (2019) study found that about 50% of surveyed households had not taken any previous actions to prepare for flooding. Another 9% had taken what the authors described as a “low-hanging fruit measure,” i.e., actions that do not require a lot of effort or costs compared to relocation or evacuation, such as stocking up on water, flashlights, batteries, and other emergency supplies, and seeking out hazard information. Other actions included lifestyle adjustments to reduce exposure, protective efforts such as waterproofing walls or securing sandbags, and accommodations such as investing in French drains and repaving gutters (p. 816). Koerth et al. (2013) and Harvatt et al. (2011) found similarly that protective measures that required low efforts and low costs appeared to be the most popular among respondents, across different hazards and emergency types. In a different study area however, Koerth et al. (2013) found that households tended to take a more structural approach to mitigation and focused more on those measures than on being informed of hazard risk information. The authors speculate that this difference could be because of the differences in risk management and flood risk communication or could be an indication of residents’ inclination of taking self-responsibility instead of relying on the state to protect or keep them informed.

Martins et al. (2018) found higher preparedness levels associated with acquiring preparedness supplies such as first-aid kits, non-perishable foods, and flashlights, as well as the use of communication resources, compared to evacuation capability. The authors substantiate findings by noting that these emergency preparedness supplies are typically everyday household
items that are most useful during an emergency (food, flashlights, emergency kits, first aid kits, etc.). The authors label this level of preparedness as “implicit preparedness,” described as activities that people engage in as part of their daily lives and work, which can prove potentially useful for disaster response (p. 11).

**Household factors**

Household composition (the presence of family or friends in a home) strongly predicated evacuation decisions in the Wilson and Tiefenbacher (2012) study. The authors found that ninety-nine (99) study respondents lived with their families, 19 lived with friends, and 17 lived by themselves at the time Hurricane Ike made landfall. 78 out of the 99 respondents who lived with their families reported having evacuated. Only 3 out of the 19 who lived with friends, reported evacuating. The household group who lived with friends were described by the authors as being rather disconnected, because only one of the 19 living with friends was proficient in English, and nine had no access to media like television and radio. Some of the respondents (all men) reported living with coworkers, and stated that their company had housed them, paid their rent, and transported them to and from work each day. They reported spending most of their day at work, and only had access to most information through their bosses. Compared to the household group who lived with family members, the previously described household group had to be self-reliant. Due to limited resources and a lack access to information via mass media, the friend/coworker household group reported having to evacuate themselves.

Brodar et al. (2020) found that having more children living at home, dog ownership, and job proximity were associated with a reduced likelihood of evacuation. Surprisingly, feelings related to stress and safety did not appear to have an impact on evacuation, although stress associated with storms was associated with evacuation at the bivariate level. Owning other pets
apart from dogs also did not significantly predict evacuation. For non-evacuees, the study found the following reasons why they chose to stay behind: 1. Keeping their families together; 2. being unsure about hurricane impact location; 3. worrying about how to protect their homes and belongings. Some of the notable factors that were reported as having great influences on mothers’ decisions to evacuate included having a safe place to go – 69.2% of non-evacuee respondents stated that not having a place to evacuate to, influenced their decision to not evacuate (p. 2261). Other factors included specific family factors, such as having a young child or family members with special needs (p. 2264).

Conversely, Lazo et al. (2015) also found that having more people in the household was associated with higher evacuation intention among surveyed residents. However, having children younger than 17 in the home was associated with lower evacuation intention, after controlling for household size. The authors’ findings correspond with findings in this section, that while having children can “help motivate evacuation, children can also make evacuation more challenging” (p. 1851). About two-thirds of survey respondents in the Brodar et al. (2020) study reported that having a young child at home influenced their decision to evacuate significantly, or “a whole lot.” (p. 2261). Nearly half of the surveyed mothers indicated that they would or probably evacuate if a hurricane was headed their way.

Wilson and Tiefenbacher (2012) found that households with preschool-aged children were more likely to evacuate. The study found that 79% of surveyed households with young children evacuated. The presence of young children appears to motivate protective actions beyond other risks that may present themselves. The authors noted that preschool-aged and school-aged children may serve as important emergency information conduits for their households, whether transmitted directly through the child, or through their school educators to
parents and guardians. Seventeen evacuee households reported receiving important hurricane information from their preschoolers’ schools, and 12 of those households had no English-speaking adults present in the home. 48 respondent households reported having up to four (4) children in their homes, and forty-four of those households evacuated, while only four did not.

Age of household members and related logistics surrounding care was found to have significant effects on both risk perception and evacuation action. For example, for older respondents with mobility issues or other impairments, having support of others (family members or friends) to help them during evacuation made them more likely to evacuate (Adjei et al., 2022). The Alam et al. (2023) study found that those aged 45 and older were more likely to evacuate during cyclones than the younger ones, many of whom stayed back to volunteer their efforts to protect their village from flooding. In contrast, regardless of age, in the Ahsan et al. (2016) study, the presence of a higher number of family members in a household made respondents more unlikely to evacuate before cyclone Aila.

Survey respondents in the Brody et al. (2017) study who had voluntarily purchased insurance were found to be significantly more likely to own more expensive homes, had lived at their current residences for longer periods of time, and be more educated than those who did not. Surprisingly, the perception of flood risk did not have a significant impact on the decision to purchase flood insurance (p. 768). The perceived cost of insurance, however, was found to be a major motivator of the decision to purchase insurance. For surveyed households who reported having insurance policies, the cost and associated expenses did not appear to be of concern (due to greater levels of affluence), compared to those without, and this correlated with the differences in the assessed home values of the two groups. Cannon et al., (2021) found that residents with longer tenures in their homes may be more likely to obtain insurance protection, possibly
because they may have “had more time to absorb information about flood risks form local officials, news media, and friends and peers, as well as the possibility that they have observed the impacts of hazards in nearby localities which have influenced their decision to purchase” (p.771).

The Basolo et al., (2017) study results suggest that homeowners compared to renters are more likely to perceive themselves as fully prepared for a hazard event and are thus not as likely to evacuate (p. 262). Those who lived in mobile or manufactured homes were also found to have heightened risk perceptions due to the high risk of wind damage to their homes, compared to those who lived in single family detached homes. The study found that 85% of households who stated that they had an elderly or young family member living in their household, lived in single-family homes, and believed that their family members needed to be protected from the impacts of an impending hurricane, particularly if they lived in evacuation zones or close to water bodies (Adjei et al., 2022, p.11).

Interestingly, Huang et al. (2017) did not find any significant correlation between homeownership and expected rapid onset and expected storm threat. They explain that the finding is theoretically relevant, as it appears to conflict with other study findings that show that homeowners are less likely to take hazard warnings and possible storm impacts seriously if they believe their homes can withstand the impact, and are less likely to evacuate (Basolo et al., 2017; Huang et al., 2016). Future studies need to investigate the exact factors that influence homeowners’ risk perceptions of their homes, for local authorities to develop targeted warnings that address any structural vulnerabilities that may exist.
**Demographic factors**

In addition to receiver characteristics influencing people’s adoption of protective actions during an emergency, the Buylova et al. (2020) study found that demographic variables and age and gender significantly impact behavioral intentions. For example, the study found that the female gender was associated with a higher likelihood of intention to both immediately evacuate and to engage in pre-milling evacuation behavior. This finding could indicate that females are more likely to be aware of emergency guidelines and recommendations associated with hazard risks, due to the responsibility they feel about the safety with their children and family members. The authors suggest that this sense of responsibility to loved ones may mobilize instincts of social attachment, which could lead to milling behaviors such as contacting loved ones and helping plan logistics for others’ evacuation (p. 10). In contrast, Casteñada et al. (2020) did not find statistically significant differences between men and women in their declared levels of preparedness at the household, community, and workplace levels. However, the study found that men who did not live in a partnered relationship declared the lowest levels of household preparedness.

The Cannon et al. (2021) study findings also corroborate the above finding, with findings suggesting that men perceived lower hazard risks than women. They discussed existing research and the theory that men have historically been centrally placed in patriarchal society with access to privileges and information based on their gender, whereas women, due to their long-standing struggle for equality, may have a greater perception of risk to hazards (p. 1172). As expected, Lazo et al. (2015) similarly found that males were less likely to evacuate, even though gender did not have a significant effect on evacuation intention among Texan respondents, while controlling for other variables. Meyer et al. (2018) also found gender and race to be the most significant and
consistent predictors of both evacuation intentions and behavior, in line with existing research. The findings suggest that those who may need more encouragement to evacuate may be white males, as they were found to be less likely to evacuate under mandatory evacuation orders, and regardless of expected storm strength.

Huang et al. (2017) found that although the female gender variable did not have a significant correlation with expected rapid hazard onset, it correlated with other risk perception variables such as expected wind impacts and expected evacuation impediments. Huang et al. (2012) found significant positive correlations with perceived storm characteristics, official warnings, social cues, expected personal impacts, and evacuation decision (p. 293). These results correspond with similar findings that found that women are generally more sensitive to environmental threats than men (Cannon et al., 2021; Buylova et al., 2020; DeYoung et al., 2016b; Lindell and Perry, 2012), although the more minute effects of other variables on evacuation decisions, as well as the patterns of correlation and regression coefficients need to be studied with regards to the female gender.

Lindell et al. (2015) investigated the relationship between demographic variables and risk perception and outcomes variables. The authors found that only household size, home ownership, and community tenure were significantly correlated with risk perception and outcome variables. For example, results showed that respondents from larger households tended to have lower expectations of the extent of damage and casualties associated with a tsunami event. Those with longer community tenure also tended to have lower expectations of casualties and damage and expected the tsunami to arrive later. Both groups reported being less likely to evacuate, and those who left, did so later. In contrast, homeowners found a tsunami to be more likely to occur, with greater chances of damage and casualties.
In the Cannon et al. (2021) study, the authors found that survey respondents who self-identified as being white had lower levels of flooding risk perception compared to those who identified in other racial and ethnic groups (p. 1173). Similarly, the Brody et al. (2017) found that respondents’ decision to purchase federal flood insurance were made based on financial ability. They posited that residents with the financial capacity to invest in more expensive homes are most likely to take actions that best protect their investment (p. 771). In similar circumstances, Huang et al. (2017) found that income and education had negative effects on expected evacuation impediments. This finding indicates that households with higher socioeconomic status are not as concerned about the inconveniences of evacuating, likely because they usually have the means of transportation needed to evacuate, can afford accommodation in a safer location, and can afford to purchase home insurance (p. 12).

DeYoung et al. (2016a) discussed significant predictors of evacuation for a mandatory order, as determined by study results. They found that age and race were significant predictors of evacuation based on a mandatory order. The effect of race was evident in the four statistical tests that were conducted. Although the proportion of nonwhite respondents was lower overall, they reported being more likely to evacuate for lower-level storms than white respondents. The authors discuss the contradiction of their study’s finding to other studies that shows that minority groups are less likely to evacuate due to being financially constrained and therefore less willing to mobilize due to fuel and other costs associated with evacuation (Meyer et al., 2018; Brodar et al., 2020; Czajkowski, 2011; Andrulis et al., 2011). The authors also state that in support of their findings, in cases where minority residents have been more inclined to evacuate, it may have been directly caused by a lack of trust in the efficiency of emergency services and support if the hazard threat becomes severe (DeYoung et al., 2016a, Nepal et al., 2012).
The Bollettino et al (2020) study found that the odds of a person engaging in training activities decreased with every additional year of age (p. 8). Lazo et al. (2015) found age to be a significant predictor in most of the regression model, finding that older respondents were more likely to have evacuation intentions in the Saw Forecast simulated model (i.e., after having seen the simulated weather forecast). However, further data analysis shows that in the Saw Forecast simulated model, there is a nonlinear relationship between age and evacuation intention, with evacuation intentions increasing until around age 60. This led the authors to suggest that age may interact with other factors to affect evacuation intentions depending on the context in which risk communication occurs (such as whether there is an evacuation order or not).

Relating to socio-economic characteristics and adaptation behavior, Koerth et al. (2013) found low significant correlations. For example, they found that males took more adaptive measures than females. They did not find significant correlation between adaptive behavior and age or having children in the home respectively. For housing variables, the authors also found low significant correlations as it related to adaptive behavior. Specifically, they found that urban residents took more adaptive measures than those in rural settings. The authors found that resident awareness of public protection made them more likely to self-protect – this finding excluded residents who were unaware if they were protected by public measures. The Koerth et al. (2013) study found low but significant correlation between length of residence in the area and distance to the coast and adaptive behavior, respectively. In contrast however, the study found that ownership, length of residence in the house, and the height of the house above sea-level did not have significant effects on adaptive behavior. Lazo et al. (2015) did not find education and income to be significant predictors of evacuation intention among surveyed residents.
Twerefou et al. (2019) found that higher income surveyed households were less likely to take steps to protect their homes. The authors suggest that the finding could be because of previous flood mitigation actions. Also, the authors note that the study area is an affluent industrial and harbor area, with well laid out drainage systems, which means that even though they experience recurrent flooding, floodwaters recede quickly. Therefore, the likelihood of residents resorting to private flood mitigation is quite low. Similarly, Linnekamp et al. (2011) found that lower-income households generally took more action (described in the study as resistance) to protect their homes from flooding, compared to households in higher-income areas in both study areas. The most common reported form of resistance was raising the level of yards, building barriers against the incoming floodwaters, and cleaning out surrounding drainage structures. The authors noted that residents did not wait for local government to do these things for them. In lower-income areas in Paramaribo (one of the study areas), respondents called local government as a preventive measure to clear the nearby canals. In Georgetown (the second study area), low-income households reported taking preventive measures by clearing furniture when faced with impending floods.

Similarly, Peacock (2023) found several socioeconomic and demographic measures that had significant effects on window shutter and envelope coverage. These measures were particularly relevant to social vulnerability. For example, the study found that years in residence had a significant and positive effect on both window shutter and envelope coverage (p. 155). This implies that the longer a household resides in a residence, the more likely they are to have higher quality window shutter and envelope coverage. Income also had a positive significant effect, unsurprisingly. This indicates that higher income households have better quality window shutter and envelope coverage compared to lower income households. While the study did not
find significant differences in the window shutter and envelope quality of elder and non-elder
groups, they found significant differences between black households and white households.
Findings showed that there was a significantly lower quality of shutter and envelope coverage in
black households, compared to white households (p. 156).

   Pan (2020) found that socioeconomic and demographic factors significantly impacted
evacuation decisions. Results indicate that family income, prior experience with a typhoon,
living with family members or alone, all had a positive effect on evacuation decisions.
Czajkowski (2011) found that financial constraints weighed on people’s decisions to evacuate
differently. For example, there were observed differences between surveyed households that had
salaried and hourly employees. Households with salaried employees were assumed to have greater
flexibility in missing days of work and not having their income affected, compared to hourly
workers. Using the dynamic model, the author noted that when costs of lost income are
eliminated from the evacuation decision, it made it easier to evacuate earlier (p. 11).

   Bollettino et al. (2020) found significant associations between general preparedness
levels and membership in an association. Survey respondents who reported an affiliation with a
social or professional association were far more likely to engage in preparedness measures – this
indicator was the single strongest predictor of engagement in general preparedness activities and
training (p. 12). Households with greater levels of wealth were found to be more likely to invest
in material forms of preparedness (p. 8). Twerefou et al. (2019) also found that socio-economic
factors had a positive, overall effect on protective behavior. Education, marriage, female
household leadership, homeownership status, indigene status, and age were also found to have
significant and positive effects on the likelihood of adopting a protective response against flood
damage. The authors also found that household heads with a college education were more likely
to adopt a protective response to flood damage. Similarly, the study found that heads of households who were born in the area appeared more likely to adopt a form of protective response compared to those who were not born in the area.

Harvatt et al. (2011) saw marked differences in the factors that affected people’s responses to the threat of sea-level rise and recurrent flooding. They found that for sea-level rise, people tended to doubt their ability to act as they believed that their actions would likely make no difference (p. 78). Socio-economic characteristics appeared to heavily influence respondents’ capacity to respond to these two hazards. Specifically, those who were more economically and politically empowered were often homeowners and therefore tended to have more knowledge of possible steps to take and had greater financial means to act. For those without residency tenure or who were low-income earners, they tended to express a lower tendency or more constrained ability to act. The survey data showed that active responses tended to correlate with homeownership (46% of homeowners compared to 27% of renters when it came to mitigative measures for sea-level rise. However, for recurrent flooding, there was not much of a difference in the findings between homeowners and renters. 66% of homeowners and 61% renters reported active responses – the authors speculate that this could be because both renters and homeowners have similar access to simple, nonstructural mitigations (p. 78).

**Exposure to hazard preparedness awareness activities**

Lindell et al. (2015) found that only a third of study respondents reported having exposure to elements of hazard awareness programs, and the results showed that those who participated in one program tended to participate in others. Respondents who were exposed to these awareness programs reported several benefits including having greater recognition that earthquakes can cause tsunami through the earth shaking, had greater expectations that a tsunami
could occur after the earthquake, and expected onset to be sooner. It was surprising however, that although participants had the abovementioned benefits because of training, their perception and outcome variables did not differ greatly from those of their non-participant counterparts.

Majority of the Bostrom et al. (2019) interview participants stated that preparedness awareness was crucial to mitigate the effects of a hurricane, with many sharing that much of the useful information they received about incoming hurricanes came from the Internet, television, TV segments, and pamphlets that were available at grocery stores. 48% of the Grothmann and Reusswig (2006) study participants reported to have informed themselves about options for self-protection from flood damage. 43% of respondents reported that they engaged in self-protective behavior like storing expensive belongings on higher levels of their homes to prevent water damage, while 38% of respondents reported purchasing flood protection devices. 31% of respondents reported taking protective measures (p. 110). The Ahsan et al (2016) study also found that evacuee households had received early warnings and understood those warnings, in addition to having participated in cyclone preparedness training before cyclone Aila. These respondents also reported having remained in contact with the Cyclone Preparedness Program (CPP) workers.

Bollettino et al (2020) found a positive association between education level and disaster training and planning activities. Specifically, they found that higher education levels were positively associated with decisions to participate in disaster training. However, the study was unable to show whether in the absence of previous hazard experiences, higher education levels still play a strong role in promoting preparedness actions, unlike other studies with similar research foci (Bagarinao, 2016; Hoffman and Muttarak, 2017, as cited in Bolettino et al., 2020). However, this study did not find any strong correlation between level of education and
“material” preparedness or adaptive behaviors such as securing their homes with sandbags, reinforcing structures, or relocating possessions to safer levels of the home. Lastly, the Bollettino et al. (2020) study found that being married was associated with lower levels of engagement in preparedness training (p. 12).

**Hazard risk messaging considerations**

For the few respondents in the Harvatt et al. (2011) who experienced a flood in the past, unofficial warnings played an important role in neighborhood and community awareness, suggesting that popular science and folk wisdom remain influential in encouraging behavioral responses (p. 75). The finding also indicates that social networks are powerful and influential modes of communication. Compared to the generic spatial nature of government flood warnings and the far-removed nature of the top-down approach to hazard risk communication and information dissemination, the unofficial warnings appeared to be more relatable to community residents.

Pham et al. (2019) found that official evacuation orders affected the timing of household evacuation across three states – Florida, Georgia, and South Carolina. Residents who evacuated during Hurricane Matthew reported not having prior hurricane evacuation experience and had sought for more information from their social networks after receiving an evacuation order. Not only does this finding substantiate findings of other studies that show that evacuation orders can inform the first steps in evacuation decision-making, but it also highlights the critical need for timely evacuation orders, to ensure that residents have enough time to receive the message, comprehend and believe it, before deciding to act. Wei et al. (2014) found contrastingly that the dramatic certain death warnings sent to respondents during Hurricanes Rita and Ike, did not appear to increase area residents’ expectations of surge damage and evacuation decisions.
Cuite et al. (2017) found that compared to the other location-based messages tested, enforcing evacuation for those in flood zones or flood-prone areas resulted in lower evacuation intentions among those who did not believe they live in flood zones, without reducing evacuation intentions among those who believed that they lived in flood zones. Similarly, compared to the other evacuation notice levels, voluntary evacuation messages reduced evacuation intentions among those who did not live in flood zones, while not reducing evacuation intentions for those that lived in a flood zone. Unfortunately, some messages that reduce shadow evacuation risk “leaving behind the small percentage of people who live in flood zones but do not know it” (p. 169). Cuite et al. (2017) also found that using municipality and street names in evacuation messaging returned higher evacuation intention rates than messaging that covered flood zones and flood-prone areas. Surprisingly however, using municipality names returned higher evacuation intentions than street names, when it was expected that the latter approach would bring a personal relevance to the warning message.

Social Influences

This theme focuses on the social aspect of coastal hazard decision-making, and expresses how social relationships with peers, family members, friends, religious affiliations, and information sources (social media, news outlets, etc.) can impact how households perceive and personalize risk, engage in information seeking behaviors, and ultimately make protective action decisions. I decided to leave it as a separate theme because of the rich meaning captured within the theme, and its multifaceted role as both a situational facilitator and a factor that has such a notable impact on households’ perceptive processes. Specifically, subthemes such as the sense of belonging/community, place attachment, community participation, and culture and worldviews discuss how these social factors impact and facilitate preparedness intentions, behaviors, and
outcomes. For example, in the DeYoung and Peters (2016) study, participants who reported feeling a sense of connectedness, belonging, and social responsibility in what they perceived as their community, showed higher levels of preparedness for future events.

Similarly, Martins et al. (2018) found that strong social bonds enabled preparedness in the study area before Superstorm Sandy. When households are well integrated into informal networks such as friends, neighbors, coworkers, and church members that they can rely on, they are more likely to engage in preparedness activities. The study results indicated a strong, positive association between evacuation capacity and network assistance. The authors suggest that the presence of informal networks seems to motivate households to plan for an evacuation since they have people they can rely on for support during or after a disaster has happened. Also, strong social ties provide access to resources such as a place to go during evacuation, or during an emergency. Additionally, the presence of informal networks brings exposure to hazard information and encourages disaster preparedness activities to keep communities prepared.

Alam et al. (2023) found that social connections—friends, relatives, and neighbors (61.9%) were the leading sources of receiving evacuation orders during cyclone Amphan (p. 521), followed by mosques (55.37%), social media (46.05%), and television (37.85%). Due to electricity outages and other disruptions, respondents reportedly resorted to relying on the abovementioned sources of information. Teo et al. (2019) found a high reliance of respondents on their social networks for the most up-to-date disaster information. Specifically, the study found that ethnic groups tended to depend on phone calls and texts to family and friends, mass media, and information from the Bureau of Meteorology (BOM). Out of the various media channels, television was reported as the most popular among the surveyed population.
The Context Aware framework was modified and thus expanded to show that social influences can greatly impact household decisions to self-protect, adapt, or cope when dealing with coastal hazards. For example, study findings indicate that having a sense of community was positively correlated with disaster preparedness. The literature showed that risk perceptions around sense of community and preparedness self-efficacy may be reliable predictors of preparedness (Gowhar et al., 2022; DeYoung and Peters, 2016b). Other study findings indicated that households were more likely to have adopted non-structural mitigation measures and have related discussions with others in their social networks who are well informed about hazard risks. It is likely that the more a person’s peers undertake specific preparedness and nonstructural mitigation actions, the more likely it is that the person will receive positive information about the hazard adjustment and possibly replicate it, if there are no other conflicting interests that are considered more important than the hazard. This finding suggests that informal and formal social influences can significantly improve hurricane mitigation using higher quality shutters and envelope protection.

**Sense of belonging, community and place attachment**

Bott and Braun (2019) elaborated on the significance of close ties and community belonging as “major reasons to stay for these hazard-prone populations – particularly 67% of survey respondents” (p. 5). The findings also highlight study respondents’ need for access to other safer localities outside the villages within the study area, which may improve people’s motivation to move to those areas when faced with imminent threats. Findings by the Gowhar et al. (2022) seem to corroborate Bott and Braun (2019) study findings. The Gowhar et al (2022) study in Srinagar City, India, found that place attachment was a major reason why people chose not to evacuate.
Many respondents in the Gowhar et al. (2022) study described their feelings associated with their homes as filled with loving memories of their childhood, life experiences of the unsung heroes before them, and a place where they could express themselves to the fullest through the socialization that occurred when one has a safe living environment (p. 9). Other respondents who lived near the river described their feelings of safety, nostalgia, and peace as they reside in their birthplace. They describe the benefits of living there as surpassing any other challenges that may exist, since “any place has its own set of issues.” (p. 10). Mishra et al. (2010) found that religious place attachment did not seem to affect respondents’ preparedness behavior. The authors speculate that reverence for nature, in addition to a belief in fate or destiny, spurred by religious, cultural, or social beliefs, may lead respondents to remain in place and to not actively prepare for floods.

Sense of community refers to the sense of connection, belonging, and cohesion that a person feels within the community, while sense of place is defined as a construct of emotional connectedness that a person develops with a physical or geographical location (DeYoung and Peters, 2016b). The authors found that sense of community was positively correlated with disaster preparedness. The literature showed that risk perceptions around sense of community and preparedness self-efficacy may be reliable predictors of preparedness (Gowhar et al., 2022; DeYoung and Peters, 2016b). However, a sense of community created a different cognitive mechanism from intention to action as it related to preparedness, compared with sense of place, as shown by the study’s bivariate and multivariate findings (DeYoung and Peters, 2016b, p. 272). The authors suggest that the findings point to the sense of responsibility that one has towards their neighbors and peers within the community, which can sometimes “spill over into preparedness activities such as alerting others, stocking supplies, and other related activities (p.
Specifically, participants who reported feeling a higher sense of connectedness with their community had higher preparedness levels for hazard events (p. 273). Also, the increased confidence in one’s ability to engage in preparedness behaviors appeared to be essential for influencing an increase in preparedness behaviors (p. 274).

Casteñada et al. (2020) concluded that residence in a city was a variable that had a small but significant influence on household, community, and workplace preparedness, in combination with other factors such as place attachment, social networks, and a person’s ongoing preparedness and assessment of local hazards (p. 1990). The authors explain that perhaps, the more time a resident spends in an area, so does their experience and ability to assess their own preparedness and prepare for impending hazards increase. As they experience more events and become exposed to more information on preparedness and mitigation programs, their capacity and ability to prepare improves (p. 1990). Furthermore, their sense of belonging and place attachment tends to increase with time and increasing exposure to hazard experiences. This observation is consistent with Mishra et al. (2010) study findings on sense of belonging and place attachment. The authors found that respondents’ attachment to their community affected their flood preparedness, especially since the economic, genealogical, and cultural components enhanced flood preparedness. Because of deep and enduring respect, strong familial and emotional bonds the local people shared with their ancestors, the authors believe that it causes a rootedness to the place. This rootedness is what likely makes them more alert to prepare for disasters that can cause destruction and damage to their ancestral homes and artifacts.

Martins et al. (2018) similarly found that households who hold strong feelings of attachment to their communities and neighborhoods, are more likely to engage in preparedness efforts like acquiring emergency supplies. It appears that households with strong bonds to their
communities seem to be prepared to act in defense of natural or man-made risks that threaten their communities. Similarly, Buchanan et al. (2019) found that renters who spent more time per week in community (civic meetings, athletic events, cultural and religious activities) were found to be more likely to purchase hazard insurance, suggesting that exposure to community members may increase the chance that renters learn more about personal/household responsibility for self-coverage as well how to navigate the bureaucracy.

Buchanan et al. (2019) found that adaptation by peers may help normalize adaptive behaviors of others and signals that flood risk is high. They found that the odds of homeowners elevating their homes was 80% greater if their peers did so, the odds were 92% greater that homeowners would relocate if their peers did so, and the odds were 57% of homeowners relocating if their peers elevated their homes and they were unable to. Consistent with existing literature, Lindell et al. (2005) found that respondents’ evacuation decisions were significantly correlated with observations of peer evacuations and businesses closing (although to a lesser extent) (p.). The data showed that peer evacuation observations were significantly correlated with local authorities issuing evacuation recommendations and observations of nearby businesses evacuating. Due to the apparent correlation between the observation of peer evacuations and evacuation decisions, the authors concluded that the former made an independent contribution to the latter.

Similarly, Lindell et al. (2015) found that peer warnings were an important warning source for respondents in the study area, particularly for respondents who live near the focal hazard source and will likely be impacted. Findings also indicate that news media (radio and TV) can reach a large percentage of at-risk populations because of the wide coverage of the broadcast, while peers similarly reach a large percentage of those at risk, because the information
diffusion process involves many people relaying information through their different social networks. Local authorities, limited by their inability to broadcast information with the same coverage as news media and staffing to effectively notify residents, were unable to reach residents who had limited access to new media and technology in general.

The effect of peer influence on emergency preparedness and nonstructural mitigation in the Grover et al. (2022) study appeared to be consistent with hazard preparedness literature (Buchanan et al., 2019). Specifically in the study, respondents were more likely to have adopted non-structural mitigation measures and have related discussions with others in their social networks. The authors suggested that the more a person’s peers undertake specific preparedness and nonstructural mitigation actions, the more likely it is that the person will receive positive information about the hazard adjustment and possibly replicate it, if there are no other conflicting interests that are considered more important than the hazard. Peacock (2003) found that households who lived in counties subscribed to the South Florida Building Code had significantly higher quality shutter and envelope coverage, compared with other counties. This was especially true in areas where surveyed households had most or all their neighbors with significantly higher quality shutters and envelope coverage. This finding suggests that informal and formal social influences can significantly improve hurricane mitigation using higher quality shutters and envelope protection.

The respondents in the Gowhar et al. (2022) study paint a very strong picture of cohesiveness and describe how their closeness as a community unit has allowed them to be united with a desire to grow and strengthen their beloved community. One respondent stated that “the benefit of living in a conscious community is that any people are encouraged to work for the welfare of community irrespective of gender on a voluntary basis” (p. 11). Through the shared
loss, response, and recovery from unusual circumstances such as floods, the community residents grow closer. Awareness programs are facilitated in collaboration with locally based social organizations and focus on increasing community engagement and volunteerism during crises and help to carry on such legacies to the younger generations (p. 11).

**Community participation**

Bott and Braun (2019) found that for the surveyed community, their ability to accommodate coastal hazards was strongly linked to their social capital which was enhanced by the community’s “high participatory capacity” (p. 5). The study found a dominant inward-oriented bonding social capital within surveyed communities, and a high level of trust between people. 95% of respondents believed that people are willing to help them if needed, and that it is based on reciprocity and mutual participation. The strength of the bond is therefore reflected in the ability of communities to jointly accommodate to hazards, such as through collective pooling of funds and resources and holding community meetings to address flooding and erosion beforehand and afterwards.

Renters who spent more time per week in community (civic meetings, athletic events, cultural and religious activities) were found to be more likely to purchase hazard insurance, suggesting that exposure to community members may increase the chance that renters learn more about personal/household responsibility for self-coverage as well how to navigate the bureaucracy (Buchanan et al., 2019).

Considering the risk of COVID-19 infection at overcrowded cyclone shelters, 26% of non-evacuees decided to stay home during cyclone Amphan (Alam et al., 2023). Some young community members also volunteered to reinforce embankments when the storm became stronger and the existing flood protection embankments became fragile, resulting in 5.5% of
non-evacuees who stayed back due to their voluntary involvement in embankment protection (p. 528). Lazo et al. (2015) found that in the three “Saw Forecast” models, respondents who agreed most with not wanting to “be stuck in the area after the storm” reported having higher storm intentions, when other variables were controlled. The findings suggest that people’s perception of post storm events significantly influence when they decide to evacuate, and it is based on their perception of forecasts they see. The finding is not generalizable however, as findings based on the abovementioned model in a different study area showed that people’s perception of storm events caused the opposite effect on their evacuation intentions.

The flooding adaptation practices described in the Gowhar et al. (2022) study denotes collective action. Respondents described the challenges faced in the September 2014 flood and their efforts at managing it. They described how they monitored the water levels of the surrounding waterbodies, looking for any possible riverbank breaches, and then passed on the information to immediate communities so that they could evacuate early. Other respondents described moving their valuables to higher levels of their homes, evacuating their families, and the young men returning to the area to safeguard vulnerable homes from robbery. Linnekamp et al. (2011) found collective action to be low in the study areas, but found that at the household level, households were proactive about the dangers of flooding. They appeared to work individually to clean and repair their homes, and generally did not report making any contact with local government during or after floods. Due to findings indicating low levels of cooperation between the local government and residents, it suggests that residents’ adaptive capacity may be restricted to the strategies they adopt and implement in their homes. There appears to be a need to improve the community’s adaptive capacity at the neighborhood and city level.
**Culture, religion, and worldviews**

Many participants in the Haynes et al. (2018) study described their sheltering culture as a tradition that has been passed down for generations. Sheltering in place appeared to be an established flood response and a social act that reflected and strengthened social relationships in the surveyed communities. A study participant stated that they had always stayed with the house and stayed with neighbors as a community. They finished by stating that “you don’t leave your neighbor alone if they don’t want to evacuate, and that this is probably the reason the bonds of the community are so strong” (p. 784). Some other respondents recalled how they were cared for by neighbors and friends during their time of sheltering in place (p. 785). Mishra et al. (2010) found that religious place attachment did not seem to affect respondents’ preparedness behavior. The authors speculate that reverence for nature, in addition to a belief in fate or destiny, spurred by religious, cultural, or social beliefs, may lead respondents to remain in place and to not actively prepare for floods.

Facebook was reported as a significant tool for socialization among those who sheltered in place and served as a way for families and friends to remain in contact and to gather locally relevant flood information. Respondents in the Nepal et al. (2012) also reported leaning on their friends when taking decisions and voiced that if those friends (who were more proficient in English) thought it important to take a certain action, then they would believe them and do it. Some respondents expressed that not having the counsel of their friends in such moments could be problematic.

Wilson and Tiefenbacher (2012) also found that churches and other groups seemed to influence both the dissemination of emergency information to undocumented immigrants as well as the communities’ receptivity to information. 58% of respondent households reported being
familiar with the relief work and evacuation assistance provided by churches and other local
groups, while majority of the group stated that they relied on those groups for information. A
study respondent in the Nepal et al. (2012) study also corroborated the above finding, with a
respondent stating that “most Vietnamese people, especially single mothers, do not have much
time to watch the news, listen to the radio, or call friends. We can only know the news when we
go to churches and see posters there. We have little time to get the news. Poor people who live
alone like me have few acquaintances” (p. 269).

Using both evacuation order and weather forecast modeling to predict evacuation intention,
Lazo et al. (2015) found that Florida respondents in the Evacuation Order model who were of
more individualistic worldviews, reported being less likely to evacuate. The authors stated that
the finding was consistent with expectations that people with individualistic worldviews were
more likely to react negatively to civil authorities and information that originates from them,
such as evacuation orders. For Florida respondents who adopted a more egalitarian worldview,
the study found them to be more likely to evacuate within both models, when other variables
were controlled. These findings suggest that worldviews can be useful in measuring the aspects
of culture that influence evacuation intentions.

**Perceptive Processes**

The theme *perceptive processes* was derived from the study descriptions of how people’s
risk and threat perceptions and protective action decisions were influenced by subthemes such
as: *prior hazard experience, psychological sense of safety (PSOS), proximity to hazard sources,*
and *warning messaging modalities.* Each of these subthemes (collectively and individually)
elaborate on the perceptive processes that encompass assessments of hazard risk, hazard threat,
and household vulnerability.
For example, direct or prior experience with a hazard was found to have a considerable influence on households’ perception of current or expected hazard risks (Lazo et al., 2015; Koerth et al., 2013). Study findings indicate that coastal households adapted if they perceived potential flood damages as severe, if they had previous flooding experience, and if they perceived themselves as being at risk of future flooding. Study findings also indicate that a household’s distance from the coastline may be the strongest predictor of increased flood risk perception (Combet-Friedman et al., 2012). As distance from the coastline increased, the authors noted that their participants’ risk perception of flooding events reduced as well.

Study findings also indicate that prior experience with a hazard may be influential in prompting households to have a family plan, even though there was no intention to evacuate (Bott and Braun 2019; Basolo et al., 2017). This finding may be related to the huge undertaking and inconvenience of evacuation. For mothers of young children and people with no direct experience, sheltering in place was noted to be a good option, as it prevented expensive evacuations and was not deemed necessary due to feelings of safety and security associated with sheltering in place (Brodar et al., 2020; Buchanan et al., 2019).

Lastly, study findings indicate the influence of peer and community-based warning messaging modalities on immigrant households. For example, Nepal et al. (2012) found word of mouth to be the preferred information source for linguistically isolated populations (LIPs). Study participants reported that when Hurricane Ike occurred, news and information gathering shifted towards three major information sources: word of mouth, television, and radio. Wilson and Tiefenbacher (2012) also found that churches and other groups seemed to influence both the dissemination of emergency information to undocumented immigrants as well as the communities’ receptivity to information. Similarly, Lindell et al. (2015) found that peer warnings
were an important warning source for respondents in the study area, particularly for respondents who live near the focal hazard source and will likely be impacted.

This theme relates back to the Preliminary Context Aware conceptual framework because it conveys those contexts (such as individual and household factors like age, gender, disability status of household members) that are critical to people’s perceptive processes or ways of mental processing. This theme extends knowledge and therefore expands the Context Aware conceptual framework through study findings because it encapsulates the impact of prior experience with coastal hazards, perceived hazard certainty, self-efficacy preparedness beliefs, psychological sense of safety, hazard proximity, and warning messaging modes, on the way coastal households receive communicated hazard risks, internalize risk, and personalize the degree of threat through varied threat assessment mechanisms (threat risk assessments, risk belief and personalization).

Furthermore, this theme consolidates pre-decisional processes into perceptive processes in the expanded model because study findings indicate that risk assessments, as well as risk belief and personalization (known as perceptive processes in the expanded model), make use of pre-decisional processes that can lead to behavioral responses such as seeking out hazard information and engaging in coping or adaptive strategies. These behavioral responses, when mediated by situational facilitators or impediments (trust and invisible needs respectively) in the expanded model, lead to preparedness outcomes such as protective actions, coping strategies, and adaptive strategies. This theme also highlights how the belief in one’s competency to safely protect themselves (self-efficacy) can lead to protective or adaptive behaviors, if households perceive that the cost of adaptation or self-protection is less than the cost of taking no action (Lazo et al., 2015; Koerth et al., 2013)
**Prior hazard experience**

Cannon et al. (2021) findings suggest that previous hazard experience has a significant effect on risk perceptions due to place and hazard proximity (p. 1173). This may be because for someone who experienced flooding at a previous residence, regardless of the source of flooding, there tends to be an elevated flood risk perceptions for future flood events. Huang et al. (2017) also had similar findings, with their regression analysis showing a positive relationship between previous hurricane experience and perceived storm characteristics. The authors suggest that experience might increase people’s risk awareness about the possibility of hurricane impacts intensifying and rapidly changing direction, and that these concerns may be exacerbated by the observation of social or environmental cues (p. 12).

Lazo et al. (2015) similarly found that respondents who lived in hurricane-prone areas longer were less likely to evacuate and found that income and education were not significant predictors of evacuation intention. The authors also found that those with prior evacuation intentions generally had higher evacuation intentions at the time of survey administration. The authors suggest that prior evacuation experience may cause a predisposition to evacuate during expected hurricane events and could also reinforce evacuation intentions to evacuate in the future by influencing efficacy.

Furthermore, Basolo et al. (2017) reported that prior experience with a hurricane was associated with lower likelihood of evacuation intentions, with the results of a logistic regression showing that prior experience with a major hurricane reduces the odds that a respondent will be likely to intend to evacuate, by 54% (p. 263). Interestingly, the authors found that prior experience with a hazard can be influential in prompting households to have a family plan, even though there was no intention to evacuate (Basolo et al., 2017). The authors figured that the
finding can be related to the huge undertaking and inconvenience of evacuation amidst the uncertainty of the proximity of hazard impact, stating that “it takes considerable effort and sometimes resources to pack up coveted belongings, sit in the equivalent of ‘rush hour’ traffic… However, for many living in hurricane territory, they have evacuated during previous hurricane threats only to have the hurricane turn and not strike their community at all. Prior hurricane experience, therefore, may lead households to stay in their home rather than evacuate” (p. 266).

39% of respondents from the Bott and Braun (2019) study state that migrating would be too expensive, and 49% of respondents maintained that the proximity of their current residences to job opportunities were factors for refusing to relocate. In contrast, flood insurance policy holders were on average, 18% more likely to have had previous experience with flood impacts (Brody et al., 2017).

Respondents in the Gowhar et al. (2022) study detailed how their prior experience with flooding gave them a strategic advantage in preparing for or responding to a flood-related incident, compared to those with limited or no prior experience. One respondent stated that many of the residents had purchased flood insurance and partially rebuilt or modified their homes, leading them to believe that their home would be able to withstand future similar flood incidences, with improved outcomes if the government assisted with the reinforcement of homes (p. 11). Other respondents who made their livelihood from the river, such as fishermen and sand excavators, had the advantage of owning boats and knowing how to swim. They were able to not only safeguard themselves and their families, but also help others during emergency evacuations and volunteer in other ways as needed. One respondent stated that due to prior experience, she knew what water levels to expect, who to contact for help, and where to relocate to. She stated
that “moreover, we have kept our sensitive documents in a flood-free location. We are aware that we are being exposed, but we are also capable of protecting our lives” (p. 11).

Elrick-Barr and Smith (2022) found that indirect hazard experience shaped respondents’ perceptions of vulnerability and views about their current response to sea-level rise impacts. One respondent for example, defending their decision to take limited action, stated that they did not think “it would be relevant for where we are located. The area has never been affected by those sorts of floods… it hasn’t stopped us from doing day-to-day things like getting kids to school.” (p. 6). It was interesting to note however, that experiential information was not considered an important source of information to guide future action.

Twerefou et al. (2019) similarly found that threat appraisal had a mixed effect on specific flood damage protection decisions by surveyed households. The authors suggested that like findings by Poussin et al. (2014), risk perceptions about expected flood damage does not always translate to flood preparedness. In fact, risk perception does not always cause fear or influence protective actions, but can lead to wishful thinking, a sense of hopelessness, and eventual non-protection.

Casteñada et al. (2020) discuss the impact of indirect and direct hazard experience on household preparedness. The study sampled households in two distinct cities with different levels of exposure to coastal and natural hazards. The surveyed respondents from the city with a lower exposure had noticeably higher preparedness levels due to the strong event that had impacted the neighboring city in question. This finding appears consistent with studies that suggest that vicarious experience (the learning and obtaining of information from other people’s actions and experiences) can result in a greater risk awareness of the likelihood of being affected by similar weather events (Wachinger et al., 2013; Becker et al., 2017, as cited in Casteñada et al., 2020, p. 1898).
Interestingly, Harvatt et al. (2011) study participants did not perceive themselves to be personally at risk from flooding. Responses from 70% of respondents in one of the study areas reported a low or very low hazard risk, while 60% from another study area reported being at moderate or high flood risk. The authors believe that for those with direct hazard experience, “memory must have faded, or the attention is short-lived” (p. 73). Twerefou et al. (2019) found, similarly and surprisingly, that households who had suffered flood related damage and losses in the past, reported doing nothing to protect their homes from future damage. The authors suggest that, in line with previous studies, that flood experience may wane over time, as well as a sense of hopelessness and significant costs that limit the implementation of protection against flood damage. Another reason for the low-risk perception levels was the existence of flood defense improvements. This seemed to signal to households that the flood risk had somehow been eliminated or at least minimized (Harvatt et al. 2011).

Grover et al. (2022) provide a possible explanation for the finding of low correlation of risk perception with hazard adjustment in their study. They explain that respondents may overestimate their ability to recover from a disaster impact as they may have underestimated how long the impact could last, the efficacy of disaster recovery actions, or the resources required to engage in disaster recovery (according to the PADM) (p. 10). The authors also opine that already-adopted mitigation measures could have reduced respondents’ risk perceptions at the time of the study. Because the study adopted a cross-sectional design, the data collection instrument could only measure the level of risk perception held at that time, and not the risk perception level that the respondent held at the time they adopted the specific hazard mitigation measures (p. 10).
DeYoung et al. (2016a) discussed significant predictors of evacuation for a mandatory order, as determined by study results. They found that previous ignoring of an evacuation order were significant predictors of evacuation based on a mandatory order. The authors found that respondents who had ignored orders in the past were more likely to state that they would only evacuate for higher category storms compared to those who had complied with evacuation orders in the past. This finding suggests that those who ignored previous orders may have gained more confidence due to their past decision to ignore an order.

Lazo et al. (2015) found that contrary to expectations, the severity of hurricane impacts from prior hurricane impacts were negatively related to evacuation intentions, as seen in the study’s “Evacuation Order” model in both study areas (Texas and Florida). The authors suggest that this is likely because while some respondents had experienced less than moderate storm impacts, others had experienced more serious hurricane impacts along with severe traffic gridlock. This may explain the reluctance some respondents may feel in evacuating for similar expected hurricane impacts in the future. Another likely explanation is that some Texas respondents may have what the authors call “false sense of invulnerability” due to the false experiences from weaker parts of storms making impact, or lucky near misses. These experiences have been shown to lead to reduced evacuation intentions, leading the authors to suggest the need to carefully examine and extract what specific aspects of people’s prior hurricane experience influences their behavioral intentions.

**Perceived hazard certainty**

The Adjei et al. (2022) study findings suggest that households with greater perceived certainty about the location of hurricane impact were more likely to have greater perceived certainty about evacuation logistics and as such, be more likely to make solid plans to evacuate.
Households who are relatively certain that their locations may be impacted by the impending hazard may opt to evacuate to safer destinations. They may also assess how much time they have left, what routes to take, and how long it will take to get to safety, which could make such households more certain about their evacuation logistics. In addition, households with greater certainty that their locations would be affected may begin to find out whether public transportation (especially for those who do not own personal vehicles) would be available for evacuation as well as the time that they would need to prepare for evacuation (e.g., withdraw money, fill up their gas, buy food supplies, etc.), which could make them more certain about evacuation logistics.

The Adjei et al. (2022) study found two variables to be statistically significant when it came to households’ perceived certainty about the location of the expected hurricane impact. Firstly, a greater understanding of hurricane related graphics about wind gusts and rainfall maps was positively associated with perceived certainty about impact location. This finding suggests that for an impending hurricane, “households who are able to understand wind gusts and rainfall maps to a greater extent are more likely to use this information in their assessments of whether the impacts of the hurricane (e.g., wind gusts and heavy rainfall) would affect their locations (or communities)” (p.13). This could make them more certain about the location of impact.

Huang et al. (2017) found that study respondents generally considered hurricane wind impacts as being more dangerous than the hydrological impacts such as storm surge and inland flooding, especially since they were reacting to reports of expected storm severity and impact proximity. This finding explains the high mortality rate encountered during Hurricane Ike, where inland flooding due to storm surges caused significant infrastructural damage and loss of lives (Morss and Hayden, 2010; Wei et al., 2014, as cited in Huang et al., 2017). The authors
suggested that this misconception may be due to fact that the Saffir-Simpson hurricane intensity scale measures the intensity of hurricanes only by wind impacts, leading people to erroneously expect weaker or non-existent hydrological impacts. Huang et al. (2012) also found that expected personal impacts were central to understanding evacuation decisions, more than perceived storm characteristics (p. 293). This is explained by the direct impact of official warnings, observations of social cues such as businesses closing and neighbors evacuating, on evacuation decisions, more than the observed cues of a storm approaching. The former offer greater certainty of the hazard’s impacts.

The effect of education on heightened risk perception was found to be non-significant, with findings suggesting that a household’s certainty about evacuation could be hinged on factors such as the availability of a safer destination to evacuate to, clear roadways, and functional vehicles (Adjei et al., 2022; Brodar et al., 2020). However, having at least a bachelor’s degree was found to be positively associated with the decision to evacuate, drawing a contrast with other studies that found that education was non-significant in determining household intention to take protective action (Baker, 1991; Huang et al. 2016, as cited in Adjei et al., 2022). This finding suggests that “those with higher education are more likely to better assess the risks associated with the hurricane, which could be useful for their decision making” (Adjei et al., 2022, p. 13). Additionally, it is possible that compared to their less educated counterparts, these educated households have increased social capital (e.g., friends from church, social groups, college) during evacuation, who could influence them (at-risk households) into taking the best protective action (i.e., evacuation).

The Bukvic et al. (2015) study respondents had major concerns for frequent flooding and recurrent hazards like nor’easters and hurricanes, which demonstrated their heightened risk
awareness and the recognition of related risks and the recurrent nature of such impacts.

Surprisingly, respondents’ uncertainty about the increase in areal crime, new FEMA advisory maps, city rebuilding requirements, and protective actions of peers had a lesser impact on respondents’ willingness to relocate (p. 219). Martins et al. (2018) found the relationship between preparedness and risk perception to be weak. However, they determined that when risks are tangible to individuals, they are more likely to have an evacuation plan and communication tools.

Findings from the Adjei et al. (2022) study suggest that in evacuation decision-making, some variables may influence risk perception and have no influence on the evacuation decision directly. For example, the study found that perceived certainty about evacuation logistics had more influence on a household’s decision to evacuate than the knowledge or perceived certainty of where the hurricane was supposed to impact. Also, study findings suggest that gender (being female) was positively associated with risk perception, but its effect on evacuation decision-making was non-significant. This finding appears congruent with the Huang et al. (2016) meta-analyses findings that out of 25 evacuation studies, 11 (44%) reported that the effect of gender (being female) on evacuation decisions was non-significant. However, the heightened risk perception is what likely prompts evacuation, as studies show that females may personalize evacuation warnings, leading to heightened risk perceptions (Lindell & Perry, 2012). The authors also conjectured that “females may have higher risk perceptions because they are generally more sensitive to environmental threats or hazards and interpret warning signs as valid (p. 10).

**Self-efficacy preparedness beliefs**

Koerth et al. (2013) found that actual adaptation behavior was correlated with perceived adaptation behavior. That means, people adapt mostly if they perceive themselves to be
competent to act (self-efficacy) or if they perceive that it would cost less to adapt than to take no action (described as response costs). Furthermore, the authors found that study respondents adapted if they perceived potential flood damages as severe, if they had previous flooding experience, and if they perceived themselves as being at risk of future flooding.

Findings indicate that that households were less likely to have immediate evacuation intentions if they had household members who were advanced in age, had mobility issues, and needed high levels of support (Buylova et al., 2020). Study findings indicate that age may positively associated with having mobility issues (walking difficulty) and negatively associated with self-efficacy and physical preparedness (p. 13).

Buylova et al. (2020) also found that self-efficacy appeared positively associated with pre-evacuation intentions. They explained this finding as “the increase in self-efficacy could create over-confidence” (p. 11). This overconfidence can stem from feeling sufficiently prepared and able to survive dangerous situations. Highly self-efficacious people may think that they can survive a tsunami even if they spend some time before evacuating, to help family and friends, contact loved ones to ensure their safety, and engage in information search about the hazard to better protect their families. Such beliefs are deemed dangerous by the emergency management personnel, as delayed evacuation can cause further traffic congestion and a reduction of time left for evacuation.

Study findings from DeYoung and Peters (2016) showed that social perceptions (i.e., the sense of community) and preparedness self-efficacy beliefs were reliable predictors of preparedness. However, the authors state that further investigation of the effect of new contexts and variables on social perceptions will be necessary to understand how sense of community affects preparedness directly within various contexts.
**Psychological sense of safety (PSOS)**

The Alam et al. (2023) study identified that the respondents with no prior storm surge experience were less likely to evacuate, and those who lived in structured or semi-structured homes in low-risk areas were more likely to stay home during cyclone Amphan. The study found that 68% of study respondents stayed home because they felt safe at home. The Meyers et al. (2019) study findings indicated a correlation between majority status and the perception that one’s home was safe to withstand flood hazards. Specifically, the study findings indicated that white respondents were more likely to feel that their homes were safe to shelter in, compared to minority respondents.

Bolettino et al. (2020) found a negative relationship between length of residence and disaster preparedness, with findings showing lower rates of participation in hazard preparedness and training activities significantly correlating with length of residence in a community. They theorized that “the longer people live in a community, the more confident or complacent they are that they can deal with hazards” (p. 12).

When asked about whether they would stay home during a future storm, some mothers explained that their perceived sense of safety and security was a reason for their choosing to shelter in place (Brodar et al., 2020). Specifically, they felt that their homes were secure and able to weather a future storm. They also reported feeling capable and prepared, with many stating that they felt safer at home than on the road. Others stated that they would shelter in place next time because things would probably not be as serious as the media outlets were reporting (Brodar et al., 2020, p. 2264). Similarly, in the Buchanan et al. (2019) study, several respondents in the in-person interviews stated that sea-level rise affects nuisance and not extreme flood events. This perception appeared to make them comfortable ‘taking their chances,” as they did not think that
an extreme flood event happening in their lifetime was possible, despite worsening climate change effects.

Lazo et al. (2015) similarly found greater evacuation intentions with those who agreed more strongly with wanting to keep their families safe as a motive for evacuation. The influence was noted to be particularly strong in the Evacuation Order model that the authors used. The finding suggests that an evacuation order may help to influence evacuation decisions by motivating people to protect themselves and their loved ones. Conversely, respondents living with a partner reported having a higher level of household, community, and workplace preparedness compared to single, separated, or widowed respondents, while respondents with children younger than age 18 also reported having higher preparedness levels than those without children (Castenada et al., 2020, p. 1893).

Peacock (2003) found that just over half of Florida’s single-family homeowners did not own window shutters because they felt that they did not need them. The authors found that respondents felt that they did not need shutters for some reasons, such as their homes being inland or far away from the coast. Other respondents stated that their homes faced north or were protected by trees. Many respondents also mentioned cost as a major restrictive factor in getting shutters. The authors deduced that the percentage of respondents who may have opted for not purchasing shutters, would be higher if more households began to feel the need for shutters, as weather conditions and coastal hazard events grow increasingly recurrent. Grover et al. (2022) found that home value correlates positively with the three investigated hazard adjustments (non-structural mitigations, structural mitigations, and emergency preparedness). This finding suggest that households with a greater asset value at risk have more incentives to invest in hazard
adjustments. However, the authors state, being willing to pay does not always denote being able to pay.

Haynes et al. (2018) found that at the beginning of the flooding event, most of the survey respondents (4.31/5 average score) were confident that their homes were structurally sound and able to withstand the impact. Some participants even described their homes as being “built for flood” (p. 784). However, a few respondents believed their properties to be high enough. 28% of respondents reported feeling scared and stressed due to power cuts and being unable to access flood information. Other respondents described their reluctance to leave their homes, pets, or businesses, and reflected an emotional connection to home and a desire to protect their belongings and livelihoods. The most frequently cited reason for sheltering in place was because respondents felt it was safe to do so, and because they did not think their homes or properties would flood during that flood event under review (p. 784). The study area in the Mishra et al. (2010) study depended on agriculture and allied activities such as paddy and wheat mills, along with other local small businesses. Due to the vulnerability of this economic and ecological niche, place attachment leads residents to be more prepared so they can avoid or reduce risk of major losses.

Buchanan et al. (2019) discuss the impact of single-action bias on surveyed renter households that were affected by Hurricane Sandy. The authors describe single-action bias as a psychological effect whereby taking a small action is considered enough to reduce anxiety potentially caused by an impending hazard (Weber, 2006, as described in Buchanan et al., 2019). Surveyed households living in apartment buildings stated that they felt physically removed from flooding risks to their belongings and were found to be less likely to purchase flood insurance due to wanting to avoid costly flooding-related costs, such as insurance premium payments or
additional payments to cover damages to their apartments. Secondly, surveyed renter households reported feeling a sense of safety, as they felt protected by their landlords’ insurance, and therefore assume themselves to be free from any flooding-related liability. On a related note, Landry et al. (2021) found that households who were optimistic about being eligible to receive post-disaster assistance to help cover property damage were significantly less likely to purchase a flood insurance policy. Linnekamp et al. (2011) found that almost all surveyed households stayed home during the floods due to fear of looting and their perception of their homes being the safest place to be during the flood. They had taken what they felt to be necessary steps to ensure the safety of their belongings by moving them to higher levels of their homes, while others piled up furniture and belongings.

In the Harries (2012) study, the belief that protective measures increase feelings of safety fell just short of statistical significance. The author noted that while residents may act because they believe and expect to feel a sense of safety afterwards, they may come to realize that the expectation was unrealistic, and therefore cease to hold the prior belief (p. 60). The author suggests that to be able to get a more valid test of the feeling of safety, there needs to be a more longitudinal approach to “allow participants to implement flood-protection measures and experience their emotional impacts (p. 660).

**Proximity to hazard source**

Combest-Friedman et al. (2012) found that a household’s distance from the coastline was the strongest predictor of increased flood risk perception. As distance from the coastline increased, the authors noted that their participants’ risk perception of flooding events reduced as well. Unlike other study findings, socioeconomic factors were not found to be significant factors in determining flood risk to household assets or livelihood but was most strongly determined by
proximity to the coastlines and perceived threat to coastal hazards such as flooding and erosion (p.145). Huang et al. (2012) found that respondents based their expected personal impacts on the information provided by the National Weather Service (NWS). Surprisingly, however, the data showed that not only did respondents lack the ability to interpret the flood hazard maps, but residents who lived further away from the coastline perceived more severe storm characteristics. The authors could not explain the reason for the correlation and suggest that further research be done to better understand the relationship.

Respondents in the Brody et al. (2017) study who had purchased federal flood insurance to protect their homes from flooding, lived significantly closer to the FEMA-defined 100-year floodplain boundary and paid home mortgages, although 42% of respondents reported not knowing whether they lived within or outside the floodplain boundary. Respondents living in a community with a higher Community Rating System (CRS) rating were found to be 2.3 times more likely to have an insurance policy.

The Buylova et al. (2020) study found that respondents who were more likely to have evacuation intentions are those who believed they lived in high-risk areas as well as those who already initiated preparedness actions. Such actions include the creation of a family emergency plan, emergency supply kits, and the identification of an emergency contact person (p. 10). Such people were also found to be less likely to engage in milling pre-evacuation behaviors. The authors suggested other factors at play such as greater financial stability, that could have led to those households being more prepared to evacuate immediately.

**Warning messaging modalities**

Huang et al. (2017) found that when storm information is communicated through multiple communication channels, it can affect people’s threat perceptions and evacuation
decisions. The authors also found a correlation among information sources, so this confirmed other study findings that people who tend to check one information source are likely to check other information sources as well (Basolo et al., 2009). The Huang et al. (2017) study finding extends current knowledge by showing that people’s tendency to confirm storm information via multiple channels increases hurricane threat perceptions and expected evacuation impediments (p. 11). Similarly, DeYoung et al. (2016b) reported that females, minority respondents, and younger individuals reported using more channels to seek out information, compared to their white, male, and older counterparts. It is possible that these groups have higher risk perceptions and are therefore more diligent about information gathering through various information sources. With younger adults being more likely to seek information through various channels, the authors postulate that this is due to their exposure to social media and other web-based information sources (p. 280-281).

Basolo et al. (2009) found that receiving multiple streams of information was associated with taking protective action in one study area (p. 358). Elrick-Barr and Smith (2022) investigated the impacts of various modes of information on respondents in two coastal cities in Australia and found that passive, interactive, and experiential information had different effects on household decision-making for coastal and natural hazards. They found that passive information (brochures and radio warnings), experiential information (direct hazard experience), and interactive information (interactions with others) shaped household response and risk perceptions differently (p. 5). For example, passive information was useful for households to help them decide when to implement coping strategies for incoming severe storms (such as securing loose items in their yards) or to prepare them for associated hazard impacts with tips on what to do.
Experiential knowledge, termed as *common sense* by some respondents, was found to be most valuable in helping a household decide whether to adopt coping or adaptation strategies, based on what they had experienced in that area (Elrick-Barr and Smith, 2022). The influence of interactive information or collective action (information or action characterized by peer or community-based social interactions) had a noticeably low influence on households’ response to hazards. Despite this finding, a respondent noted that interactive information was important for him since he had recently migrated to Australia. He stated that “Newcomers to Australia like me… I have never known weather like I have experienced in Australia… I relied on friends saying you must tie things down…So they were my source of information.” (Elrick-Barr and Smith, 2022, p. 7). Within all surveyed Chinese, Vietnamese, Hispanic, and Somali immigrant groups in the Nepal et al. (2012) study, friends were also reported to be a very important information source. For those who had newly migrated to the US or who were unable to follow the news of Hurricane Ike’s movements in real-time, they stayed current via phone calls and texts to family and friends, particularly those with greater English proficiency than them. Older respondents reported depending on their children and grandchildren who spoke better English than them.

Kammerbauer and Minnery (2019) noted that there were underlying social and cultural reasons for the noncompliance with the official warnings that were provided to study respondents and other residents. They found that the effectiveness of the warning messaging was hampered by the largely technical nature of the information and the way the messaging was interpreted (or failed to be understood) by residents. This in turn may have affected their perception of the urgency of the situation and their ability to decide how to respond.
In a different angle, Lindell et al. (2015) also found that environmental cues such as the shaking caused by an earthquake, combined with the knowledge of tsunamis sometimes being a by-product of earthquakes, was a major source of information about an incoming tsunami that motivated evacuation intentions for 66.1% of the sampled population. 17.2% of study respondents waited for further information, 13.4% continued regular activities, and one person (0.4%) went to watch the tsunami. The authors noted that the respondents’ perceptions of community risk were in part reinforced by evacuation advisories from respondents’ peers (for 36.3% of respondents), local authorities (for 31.6% of respondents), the news media and strangers (for 19.1% and 1.9% of the surveyed population respectively).

Wei et al. (2014) in their investigation of the impact of “certain death” evacuation warning messages, found that evacuation rates were no higher in vulnerable counties for Hurricane Ike (Category 2 at the time of landfall in Texas) than they were in Hurricane Rita (Category 3 at the time of landfall near Louisiana and Texas). The authors suggest that one reason for this is that the certain death message about surge hazard may have conflicted with respondents’ preexisting beliefs about hurricane risk threat, as the warnings did not appear to increase area residents’ expectations of surge damage and evacuation decisions.

**Preparedness Enablers and Inhibitors**

This theme considers the role of households’ unique situations (such as situational facilitators such as institutional/interpersonal trust and social influences) and situational impediments such as invisible needs and resource constraints, in influencing decisions to engage in self-protective, adaptive, or coping behaviors, to protect themselves and their households from current or expected hazards. Subthemes such as *trust in others’ protective ability and expertise* covered the linkages between households’ trust or distrust of their government’s expertise and
protective ability (via public mitigation structures), and their decision to take preventive, adaptive, or protective actions such as evacuation, elevation of frontages, relocation of belongings to higher levels, and the purchase of federal flooding insurance. For example, Cannon et al. (2021) study findings indicate a reduced likelihood of flood risk perception when there was an increased confidence in protective systems to protect residents’ homes from flooding.

Study findings suggest that evacuation intentions may be enabled and bolstered by households’ high perceived certainty about the location of hurricane impact were more likely to have greater perceived certainty about evacuation logistics and as such, be more likely to make solid plans to evacuate. For example, a household’s perceived certainty about a hazard can stem from knowledge of hazard features, public and private hazard risk education, and the knowledge and understanding of weather maps and forecasts. Similarly, the perceived certainty about a hazard can also affect how affected households plan or prepare for future hazards (Adjei et al., 2022; Lee et al., 2021; Huang et al., 2017; Huang et al., 2012).

*Impediments to evacuation* will be discussed as they highlight how resource constraints (financial and transportation) and household factors can impact households’ decision to evacuate. The study also found that having more children living at home, having family members with mobility issues, dog ownership, and job proximity were associated with a reduced likelihood of evacuation (Brodar et al., 2020; Lazo et al., 2015; Wilson and Tiefenbacher, 2012).

*Invisible needs* will also be discussed as it relates to the largely concealed needs of vulnerable subgroups such as undocumented immigrants or those who are considered *linguistically isolated populations (LIPs)*, that has huge implications on their ability to take protective, adaptive, or coping actions (DeYoung et al., 2020; Teo et al., 2019; Basolo et al., 2017; Wilson and Tiefenbacher 2012; Nepal et al., 2012). For example, Nepal et al. (2012)
found very low levels of LIP household preparedness and hazard awareness, with a notable lack of preparedness plans. Findings indicate that this is likely because LIPs were not aware of the basics of how to prepare for disasters at the household or individual level, especially with compounding factor such as restricted access to services, information, and limited finances.

Other subthemes such as *false alarms and erosion of trust* discuss how the timeliness and accuracy of hazard information can affect the trustworthiness of information sources and resulting decisions to follow mandated or recommended directives when faced with coastal hazards. For example, Huang et al. (2017) similarly found that unnecessary evacuation experience was positively related to perceived evacuation impediments. Findings suggest that memories of previous false alarms may *inhibit* people from evacuating. Their data found that apart from having strong effects on predicting expected evacuation impediments, unnecessary evacuation experience was also seen to have a significant negative effect on expected storm threat (p. 12).

This theme expands the preliminary Context Aware conceptual framework by elaborating on the subthemes of *trust* and *social influence* which are used as situational facilitators to help households manage the uncertainty around coastal hazards.

**Trust in others’ protective ability and expertise**

In the DeYoung and Peters (2016) study, confidence in government was significantly and positively associated with higher levels of reported preparedness. However, in the regression model, confidence in government did not significantly predict disaster preparedness (p. 271). This could signal that there are other factors that could interfere with preparedness levels, even when confidence in government is present, that should be further examined in other settings.
Respondents in the Nepal et al. (2012) study discussed the role of the government and individuals/households in ensuring household preparedness. For Chinese-speaking participants who came from a highly government-controlled environment, they held expectations that it was the responsibility of the government to inform them proactively of impending coastal threats and should be responsible for their safety and care.

Other variables were discussed in the Adjei et al. (2022) study that were found to be statistically significant at the p < 0.05 level. For example, households that had received an official and explicit evacuation notices were more likely to have higher risk perceptions due to the clear details surrounding hazard risk, trust in the information sources’ expertise, and a belief that the authorities have the responsibility to “notify them (households) of how deadly and risky the storm is, which may convince households of the dangerous nature of the storm, leading to greater risk perceptions” (p. 10).

Some interview participants from the Bostrom et al. (2019) study noted that while they trusted forecasters and other professionals for their knowledge and experience, they did not expect them to accurately track the path of a hurricane, given its often-dynamic movement. This means that people should preemptively take steps to protect themselves, to mitigate the sometimes-damaging impacts of an unexpected hurricane event (p. 16). Martins et al. (2018) also found that NYC households that trusted their local government were more likely to be proactively involved in preparedness planning and activities. Although previous research found that higher trust levels in government can cause low preparedness due to the transference of self-protective responsibility to government agencies, this study found that high levels of trust increased household preparedness.
On the other hand, the Martins et al. (2018) study also found that households with lower income and functional/access needs had low trust of government, which was found to negatively impact their preparedness levels. Findings from this study were congruent with findings from previous research that low levels of trust in government directly had a negative influence on preparedness behaviors of homes that were disproportionately affected by climate change effects. In both scenarios in the Martins et al. (2018) study, the authors suggest that the trust (or distrust) people have in their government, can affect their willingness to follow emergency preparedness recommendations and guidelines.

Though only a weak relationship was found, survey respondents in the Lazo et at. (2015) study reported that trust in hurricane forecasts and warnings was a motivator for their evacuation decisions. In the two study areas, respondents reported a greater use of the National Hurricane Center (NHC) and the National Weather Service (NWS) for hurricane information, followed by public officials, personal experience, and family and friends. While Florida respondents indicated a greater use of the Miami-based NHC, Texas respondents reported a greater use of religious leaders and clergy compared with Florida respondents. The authors concluded that even though trust in hurricane forecasts and warnings was positively related to evacuation intentions, it was significantly this way in the combined Evacuation order model for both study areas. The perceived accuracy and usefulness of forecast information showed different relationships in the Evacuation Order and Saw Forecast models. This indicates that respondents’ evacuation decisions are influenced in different ways by their perceptions of different warning information attributes.

Wilson and Tiefenbacher (2012) investigated the evacuation experiences of undocumented Hispanic immigrants in the Houston and Galveston areas of Texas. They found
that for older respondents, the issue was not their lack of familiarity with media representations of weather developments, but rather, their preconceptions of the irrelevance of the images portrayed by media such as television. The authors found that “comprehension and trust in the information were more important for promoting evacuation behavior, compared to receiving warning information in their native language” (p. 207).

**Impediments to evacuation**

According to Ahsan et al., (2016), some factors that precipitated non-evacuation included the unavailability of gender-segregated toilets and shelter spaces, inadequate or a lack of shelter space for their livestock, a poor understanding of warning messages and signals, and the cultural norms that adult females (who made up many of the sampled households) adhered to, which impeded evacuation (p. 35). Other reasons for non-evacuation, according to the Alam et al. (2023) study respondents included overcrowding in cyclone shelters—a high risk factor at the height of the COVID-19 pandemic, lack of transportation, as well as the inadequacy of shelter facilities and long distance to the nearest shelter. Poor and muddy road conditions from the accompanying rainfall were cited as another reason for non-evacuation, by 38% of study respondents. About 48% of all non-evacuees reportedly made that decision because they could not abandon their cattle, and in about 24.2% of the cases, respondents were unable to evacuate due to the difficulties of transporting mobility restricted family members to and from the cyclone shelters.

The Ahsan et al. (2016) study findings suggest that non-evacuee households did not evacuate due to the distance from their homes to the nearest cyclone shelter before the cyclone impacted the area (47% of respondents stated that this was their reason for not evacuating). 32% of respondents reported that they did not have enough room at the shelters closest to them. The
study also found that evacuee households had received early warnings and understood those warnings, in addition to having participated in cyclone preparedness training before cyclone Aila. These respondents also reported having remained in contact with the Cyclone Preparedness Program (CPP) workers. Parvin et al. (2019) found that although 84% of respondents evacuated, only about 10% took shelter in a cyclone shelter. Various reasons motivated the decision, such as the lack of a mandated evacuation order, delays in disseminating warning information, limited risk perceptions, and a lack of timely evacuation decision making and preparation. Other reasons included the far distance of cyclone shelters, inadequate accommodation, and facilities at cyclone shelters, as well as a lack of gender-specific location for women and children to shelter away from the general population.

Meyer et al. (2018) found that the most common reason reported by survey respondents for not evacuating was expected storm strength (reported by 15% of survey respondents). This was followed by other reasons such as: a low storm risk perception (8%), financial reasons (8%), perceived safety of their homes (7%), to protect/secure property (6%), lack of predicted flooding (5%), expected storm direction to go the opposite direction from their location (5%), lack of fear of the storm (5%), feelings around personal safety and able to remain safe at home (4%), feeling prepared to handle the situation (4%). Qualitative responses also helped substantiate study findings. For example, 161 respondents gave reasons for their non-evacuation even under mandatory evacuation order from a Category 3 or stronger storm. Reasons included work (12%), perception of their homes being safe or sturdy (11%), to protect property (8%), financial (6%).

Some respondents in the Haynes et al. (2018) study reported that evacuation was problematic for them. Some noted that after relocating their vehicles to higher ground earlier in the day as they anticipated the flood, they realized that the flood was going to be bigger than
expected. Loading up the car at that point would be dangerous and risking the gridlock and worsening weather conditions just did not seem practical. Other respondents cited disability, mobility issues, and mental and physical health challenges as their reasons for sheltering in place. Notably, some respondents perceived evacuation as something that would cause them to become displaced and empowered (p. 784).

Although there were many signals that warranted an urgent evacuation, people did not leave immediately. The Lindell et al. (2015) study also found that the reasons for the delay were as follows: attempts to obtain additional information from peers (24.0%), authorities (11.5%), and news media (15.6%). Evacuations also were delayed by people's attempts to locate family members (36.8%), pack an emergency kit (26.0%), warn others (19.8%), protect property (4.2%), or help others (2.3%) (p. 333). The study also reported that like other studies, evacuation was delayed in some households due to reasons such as “people failed to evacuate immediately after the shaking stopped, for the reasons discussed in those studies and elsewhere—gathering belongings, waiting for family members to return, or erroneous beliefs about the severity of the tsunami threat or the safety of the buildings they were in” (p.337).

Alam et al., (2023) found that although an evacuation order was issued ten hours before the landfall of Cyclone Amphan, most people only received them about three to six hours before the cyclone struck. Respondents who evacuated (46.06%), left home within two hour or less of the cyclone; with the average preparation time ranging between 108 minutes to 143 minutes for men and women respectively the study offered interesting insights for the reason behind the differing lengths of preparation time. Firstly, the study found that women required more evacuation preparation time, as they were responsible for the safety of dependent family members (children and the elderly), household chores, safeguarding household assets and
belongings, preparing food and supplies to be taken to the evacuation destination. 77.4% of evacuating respondents also reported that they brought COVID-19 safety kits (that included face masks, hand sanitizers, hand soap, and other protective gear), denoting their level of awareness of the co-occurring risk that COVID-19 brought.

Lazo et al. (2015) considered the potential barriers to evacuation and found that households with pets reported having greater difficulty in evacuating, resulting in lower evacuation intentions despite an evacuation order that was issued by the state. Brodar et al. (2020) found that having more children living at home, dog ownership, and job proximity were associated with a reduced likelihood of evacuation. Surprisingly, feelings related to stress and safety did not appear to have an impact on evacuation, although stress associated with storms was associated with evacuation at the bivariate level.

Those who lacked transportation also reported having lower evacuation intentions despite receiving a state-issued evacuation order. Surprisingly, respondents who reported lacking transportation but saw the weather forecast (which anticipated dangerous weather conditions), reported being more likely to evacuate, despite the challenges associated with lacking transportation. The authors conclude that after controlling for other factors, perceived evacuation difficulties relating to personal, or family disabilities did not significantly predict evacuation intentions.

**Invisible needs**

Various studies elaborate on the existence of unaddressed and oftentimes *invisible needs* of immigrants and other linguistically and socially isolated people that can impact their household preparedness levels (DeYoung et al., 2020; Teo et al., 2019; Basolo et al., 2017; Wilson and Tiefenbacher 2012; Nepal et al., 2012). The term *linguistically isolated people*
(LIPs) was developed by Siegel (1991) in advance of the 1990 census. This term was used to designate households where “all adults speak a language other than English, and none speaks English very well.” (US Census Bureau, 2001, p. 3).

Some LIP study participants in the Nepal et al. (2012) study who had no prior hazard experience, reported not knowing anything about preparing for Hurricane Ike in 2008 and the subsequent power outages. For others who had listened to advice on preparing by stocking up on emergency food supplies, reported that they did not have enough of non-perishable foods or reported that they had purchased food that required electricity to heat, thinking the storm would be over quickly. The authors noted that the information gap for preparedness and evacuation was widened by participants’ language barriers, limited access to services, and restricted financial capacities. Study respondents noted how language barriers were exacerbated by the hurricane, with many of the participants being unable to find help because they could not communicate with neighbors. One respondent stated: “I didn’t know the language; I needed someone to interpret for me. That itself was a hurdle. It took me an hour to get there [cooling station] because I didn’t have transportation. I was in line for over 12 hours” (p. 269).

Nepal et al. (2012) found the level of awareness of participants’ household preparedness to be very low, with a notable lack of preparedness plans. The authors state that this is likely because LIPs were not aware of the basics of how to prepare for disasters at the household or individual level, especially with compounding factor such as restricted access to services, information, and limited finances. For example, even though some newly emigrated respondents had been told to stock up on preparation for the impending Hurricane Ike, many reported not having enough of the right kinds of food and were not able to evacuate if the need arose. One respondent reported: “I didn’t prepare water or drinks. I thought that the storm would end
quickly, but it turned out that it lasted much longer” (p. 268). Another stated, “One of our friends told us to buy food but it went bad when there was no electricity (p. 269).

Respondents in the DeYoung et al. (2020) study indicate that language barriers can be a source of confusion when receiving weather warnings and other relevant hazard information, especially among older adults (p. 435). Teo et al. (2019) focused their study on ethnic groups and explored how people of different ethnic backgrounds and levels of English language proficiency responded to disaster situations (p. 8). The study found a significant relationship between an individual’s preparedness level and their ethnic background, suggesting that individuals’ different ethnic and historical backgrounds can affect their disaster preparedness and response. The study also found a significant relationship between English language proficiency and disaster preparedness.

On the other hand, respondents in the Nepal et al. (2012) study described their understanding of hurricane and disaster preparedness based on their lived experience of hurricanes while living in the US, or from their experience in their native countries. The study sampled Chinese, Somali, Hispanic, and Vietnamese immigrants who had lived in the US five years or less at the time of the study. A study respondent with no hurricane experience described his experience during Hurricane Ike, stating: “We were not experienced, so we bought a hand phone and a cordless phone that stopped working immediately after the electricity was cut” (p. 269). The authors note that the major reason for the lack of preparedness of the sampled population was the information gap that was caused by restricted access to information, services, and the financial capacity to adequately prepare.

Basolo et al., (2017) found that consistent with the research, immigrants, compared to native-born individuals, reported feeling that their household was less prepared for a hazard
event (p. 262). The authors opined that the respondents’ perception of under preparedness may be due to cultural differences and limited information sources that were available to them. The authors recommended that government agencies need to provide targeted information to these groups, to enhance hazard information dissemination throughout communities with larger populations.

Wilson and Tiefenbacher (2012) investigated the evacuation experiences of undocumented Hispanic immigrants in the Houston and Galveston areas of Texas. They found concerns about legal status influenced evacuation decisions. Specifically, respondents reported being worried about being deported during the evacuation process. 38 out of the 47 households who reported not evacuating, stated that it was due to concerns about their legal status. Many respondents reported being afraid of being prosecuted for their undocumented immigration status. Of the 47 non-evacuee respondents, 32 had deportation experience and were concerned about their immigration status. Others were afraid to seek out evacuation assistance because they worried that they would be asked to show identification before boarding the evacuation buses. Even though none of the non-evacuee respondents had experienced this, they stated that they had heard rumors of such requirements, thus indicating that rumors can influence risk perception in other ways besides hazard risk in the surveyed population.

Martins et al. (2018) found that social vulnerability was inextricably linked to invisible needs, shaping preparedness levels in some surveyed households. For example, for lower income households in NYC, there was a negative correlation between income and disaster preparedness, communicating before or during or before a disaster event, and evacuating when an emergency happens. The authors explain that the low preparedness levels may result from a low prioritization of disaster preparedness, with other issues of life taking higher precedence (means
of livelihood, bills, responsibilities, health, etc.). Furthermore, some lower income households may have limited access to technology and other tools that may improve preparedness capacity. The study however, found a positive correlation to preparedness supplies, suggesting that lower income households have a feeling of attachment to their communities and are motivated to purchase preparedness supplies as a result.

**False alarms and eroding trust**

Buylova et al. (2020) found that having experience with extreme events was associated with a lower likelihood of having immediate evacuation intentions. This finding is contrary to previous research findings on the influence of previous experiences with extreme events and the likelihood of taking immediate and planned evacuation plans (Charnkol and Tanaboriboon, 2006; Suppasri et al. (2013), as cited in Buylova et al., 2020). The authors suggest that it is possible that study respondents were reluctant to prepare to immediately evacuate because they had experienced a similar event in 2011. The study location (Seaside, Oregon) is in an area where local and even distant tsunamis are rare occurrences, and when the warning and mandatory evacuation order came, people immediately did so, however there was no tsunami or expected extensive damage. This “false alarm” could create a false sense of security and overconfidence in people, that they can handle future events. Another unfortunate consequence arising from this false alarm is a certain level of mistrust in official tsunami warnings (p. 11).

Previous failures of appropriate warning during a different cyclone was ranked as a major reason for distrust of evacuation warning sources, according to Alam et al. (2023). Specific failures were reportedly due to the inaccuracy of previous cyclone warnings; warnings that were exaggerated, ambiguous, and misleading (all contributing to the Crying Wolf phenomenon). Other sources of distrust included respondents’ perceived inefficiency of experts and authorities
(41.3% of respondents reported this as a source of their distrust), enormous corruption (39.4%), and unverified rumors distributed through social media channels (27.8%) (p. 521, 522). Basolo et al. (2017) found similarly that previous hazard experience made it more likely for households to shelter in place in the future instead of evacuating. This is partly due to high evacuation costs, high traffic volume, and overall logistical challenges, and largely due to the false alarms of previous hurricane events where evacuations had occurred, and the expected hurricane impact did not happen. because most had previously evacuated and ere expected impact did not happen.

Nepal et al. (2012) found word of mouth to be the preferred information source for linguistically isolated populations (LIPs). Study participants reported that when Hurricane Ike occurred, news and information gathering shifted towards three major information sources: word of mouth, television, and radio. Participants reported that they considered television news as a credible source that had the most up-to-date information. Interestingly, Spanish-speaking respondents stated that they did not trust the news delivered by the Spanish-speaking news stations due to their penchant for sensationalism and exaggeration of hazard risks.

Mixed opinions were recorded from participants in the Bostrom et al (2020) study, with some respondents reporting that they were tired of hearing the “wall-to-wall coverage” of the impending hurricane and preferred to look online for real-time updates, while others reported that they were grateful for the warnings, as they were “giving us the warning that we should have” (p. 17). Respondents from the Brodar et al (2020) study shared similar sentiments about their loss of trust in news outlets due to overexaggerated warnings, with some mothers stating that “the news hyped the hurricane too much...better off riding it about at home” (p. 2265).

Inconsistent, conflicting, and excessive messaging may also be affecting residents’ trust levels, according to Cannon et al. (2021). Study findings indicated that many surveyed
respondents did not trust authorities (i.e., the Army Corps of Engineers) and yet had low risk perceptions due to perhaps the mixed messaging they had gotten about other hazards that caused them to overprepare and expend more resources.

**Expanding the Preliminary Context Aware Conceptual Framework and Developing Research Propositions**

The Preliminary Conceptual Framework began with a discussion of contexts, comprising factors like environmental (having to do with environmental cues), social factors such as social cues, communication factors such as receiver characteristics, and largely individual factors such as age, race, and other demographic factors. It then moved into pre-decisional processes, which Lindell and Perry’s (2012) Modified PADM describe as the reception, attention, and comprehension of warnings, along with the interpretation of environmental and social cues that precede other forms of perception. Other forms of perception cover the certainty of expected personal impacts, prior hazard experience, and the influence of social and environmental cues, which then leads to associated risk assessments that evaluate the nature of the expected risk, and the search for potential solutions. When facilitated or assisted by factors such as trust in information sources, or impeded by resource constraints, it is likely that behavior responsees will be triggered, such as coping mechanisms, the search for relevant hazard information, and the decision to take a specific action.

In the expanded framework, I refer to **contexts** as settings in which factors (i.e. social, cultural, demographic, communication, household, etc.) impact (via single direction arrows) how coastal households experience their environments, interact with others, communicate and receive hazard risk communication, and how they process and personalize this information to make preparedness decisions (Brodar et al., 2020; Wachinger et al., 2013). These contexts consider
aspects of households such as how many members live in each household, age, income, education levels of household members, if children live in the home, and if the household lives in a rented or owned property. These contexts drive how people receive, conceptualize, personalize, and engage with hazard information to lead to various preparedness outcomes (the purchase of flood information, relocation/evacuation, structural adaptations/modifications, and hazard risk information-sharing among social networks).

While the Preliminary Context Aware Framework (Fig. 9a, p. 149) separated pre-decisional processes from perceptions, the Expanded Framework (Fig. 9b, p. 150) absorbed those processes into the perceptions box. This made sense to do because study findings showed that perceptive processes include the combination of pre-decisional processes such as exposure to hazard information, attention to cues, and comprehension of warning messages (Huang et al., 2017; Wilson and Tiefenbacher, 2012; Huang et al., 2012). In the expanded framework, household perceptive processes are directly kicked off by socio-environmental cues and socially transmitted warnings, among other influences like prior hazard experience (Alam et al., 2023; Brody et al., 2017). Next, they may move either directly into perceptive threat risk assessments and risk belief/personalization phases (via one-direction arrows), and when directly influenced by facilitating situational factors (i.e., institutional trust and social influences) or impeding factors (i.e., resource constraints, invisible needs), households may respond in ways that produce definitive protective actions such as evacuation, relocation, moving belongings to higher levels and securing items in their front yards. These households may also engage in responses that culminate in adaptive measures such as installing reinforced materials or elevating their homes; or coping measures like purchasing flood insurance and seeking hazard information from others (Koerth et al., 2013; Peacock, 2003).
While the Preliminary Framework delineated the behavioral response branch that consisted of information search, coping mechanisms, and protective responses, the Expanded Framework highlights how the behavioral response leads to more preparedness outcomes such as adaptive strategies, coping, and protective actions. The study findings indicate that these behavioral responses stem from the interactions between perceptive processes and situational facilitators or impediments, and the responses are what directly translate into preparedness outcomes, which consist of adaptive, protective, and coping behaviors and actions, not just protective ones. For example, searching for hazard information among peers, media outlets, and from experts, is a behavioral response that is a coping strategy, which impacts preparedness outcomes (Buchanan et al., 2019).

Securing loose items and relocating belongings to safer places are also protective actions that impact preparedness outcomes, while engaging in structural modifications to homes (elevating front yards and installing drainage systems can be seen as adaptive strategies (Koerth et al., 2013; Harvatt et al., 2011). This finding has important implications for emergency preparedness planning; understanding the various ways coastal households may respond to expected or current hazards can help preparedness experts and researchers to collaboratively design solutions that are tailor made and effectively address the nuanced challenges that exist in various coastal communities.

In the Expanded Framework, Social influences replace empowerment and community participation as a broader facilitator that consists of community participation, empowerment, culture and worldviews, and sense of belonging/place attachment which may make people more likely to band together, comply with advisory and mandatory warning messaging, or make individual preparedness decisions. This replacement occurred due to study findings placing
empowerment and community participation as critical aspects of socialization that can lead to increased risk perceptions, as well as connectedness, and cultures/worldviews, resulting in coping, adaptive, or protective actions (Gowhar et al., 2022; Elrick-Barr & Smith, 2022; Bollettino et al., 2020; Bott & Braun, 2019).

In the Expanded Framework, overreliance on social support systems was removed as a significant situational impediment. This removal was necessary due to insufficient evidence indicating that an overreliance on social support systems can cause significant preparedness impediments. Distrust/mistrust were placed in this category as an important factor however, because it highlights how a lack of trust in the government’s ability or willingness to help residents, especially those who are disproportionately at risk of hazard risks, may lead to residents engaging in sometimes unsafe coping strategies and community-based interventions to keep their properties safe during and after hazard events (Gowhar et al., 2022; Linnekamp et al., 2011). Invisible needs, such as information gaps due to language barriers and social isolation, are included in this category, as a critical impediment to overall preparedness, especially for households and community members that are disproportionately at risk before, during, and after hazard events. In the Expanded Framework, resource constraints remain as critical factors that can impede a household from successfully engaging in protective, adaptive, or coping actions. Resource constraints such as the high costs of evacuation and structural modifications, transportation challenges, and lack of accommodation during evacuation were found to impact preparedness outcomes significantly (Martins et al., 2018; Wilson and Tiefenbacher, 2012; Nepal et al., 2012).

Lastly, the Preliminary Framework touched on the role of situational facilitators and impediments in hindering or aiding protective actions. The Expanded Framework highlights and
expands the ways situational facilitators such as trust and social factors such as culture and worldviews, as well as the sense of connectedness/belonging can affect perceptive processes through perceptive factors like self-efficacy preparedness beliefs and perceived hazard certainty, ultimately impacting preparedness outcomes that include protective actions, adaptive strategies, and coping mechanisms (Adjei et al., 2022; Cannon et al., 2021; Buylova et al., 2020; Martins et al., 2018; DeYoung and Peters, 2016; Wilson and Tiefenbacher, 2012; Nepal et al., 2012). It also shows how situational impediments (such as invisible needs, distrust or mistrust, and resource constraints) can influence preparedness outcomes through perceptive processes. This can happen where there are reduced risk perceptions around known or expected hazard threats, causing coping or protective behavior such as the purchase of flood insurance, the decision to shelter-in-place; or heightened risk perceptions that lead to adaptive or protective actions such as evacuation and building reinforced flood barriers (Teo et al., 2019; Nepal et al., 2012).

In summary, both frameworks provide a level of understanding of how and why coastal households make certain decisions when faced with current or imminent coastal hazard risks. The expanded framework allows us to gain a deeper understanding of why certain coastal households make decisions the way they do, how those actions can impact overall household preparedness outcomes, and provides new ways for emergency managers and researchers to work with them to promote optimal preparedness actions and outcomes. Please see Fig 9a and 9b below for the preliminary and expanded Context Aware conceptual frameworks.
Figure 10a:

*Preliminary Context Aware Conceptual Framework*
Figure 10b:

Expanded Context Aware Conceptual Framework

Answering the Research Question

In response to the study’s research question: how do contexts and trust influence household preparedness for coastal hazards? this study found that contexts can influence the perceptive processes of households in various ways. For example, individual or household factors, prior hazard experience, and warning messaging modalities can affect how a household perceives
communicated risk (i.e., evacuation warning messages or neighborly advice to evacuate or engage in other preparedness actions). Perceptions include threat risk assessments, consisting of hazard impact proximity assessments, perceived certainty, belief or trust in messaging accuracy/applicability, and personalization of risk messaging. These perceptive processes often determine whether a household will shelter in place, evacuate, or engage in coping, adaptive, or collective strategies when dealing with the uncertainty of a coastal hazard.

Depending on if the decision-maker in the household has had direct experience with a specified hazard or indirect experience or has attained lengthy residency tenure at their current homes and a sense of belonging, they may perceive specific hazards a certain way (by being either risk averse or risk sensitive) (Cannon et al., 2021; Buylova et al., 2020; Martins et al., 2018; DeYoung et al., 2016b; Lindell and Perry, 2012). They may have a sense of being competent to act (described as self-efficacy), or have perceived certainty around the type and impact of hazards, as well as evacuation logistics, which could create over-confidence (Adjei et al., 2022; Buylova et al., 2020; DeYoung and Peters, 2016; Koerth et al., 2013). They may also have a perceived certainty about expected hazard impacts (wind speeds, hydrological impacts, etc) and proximity to hazard impact, due to having access to hazard information or knowledge of flood maps (Adjei et al., 2022; Lee et al., 2021). As a result of these experiences and household factors, households may have elevated or lower risk perceptions (described in the studies as psychological sense of safety or PSOS (Gowhar et al., 2022; Brodar et al., 2020; Bollettino et al., 2020).

This study found that trust can facilitate or impede preparedness actions. This is because households can decide whether to take steps to prepare or not, based on their trust levels in external sources – this was found to be a combination of institutional and interpersonal trust. If they believe
that the source of warning information is credible and trustworthy (local authorities, peers, and other social networks), they may be more likely to engage in desired preparedness actions. Study findings also indicate that households could engage in collective action such as collectively monitoring flood water levels, protecting neighborhoods, gathering and sharing flood information among themselves, and supporting one another during evacuations, if they do not trust that the government will support them to protect themselves (Gowhar et al., 2022; Wilson and Tiefenbacher, 2012; Linnekamp et al., 2011).

This study found that some households trusted and expected the government to protect their lives, livelihoods, and property from damage or loss by providing warnings and public protections (Twerefou et al., 2019). It also found that some study respondents took cues from their peers and social networks in deciding whether to evacuate or shelter in place (Kammerbauer and Minnery, 2019; Nepal et al., 2012; Huang et al., 2012). Study findings indicated that these expectations, in addition to prior hazard experience, could lead to inappropriate estimations of perceived household preparedness levels, risk perception levels, and self-efficacy (Adjei et al., 2022; Cannon et al., 2021; Twerefou et al., 2019; Huang et al., 2017).

This study found that when there is low institutional trust, particularly in communities that are disproportionately at risk of coastal hazards, compliance tends to be low, regardless of the presence of evacuation orders or warnings, or preparedness guidelines (Martins et al., 2018, Wilson and Tiefenbacher, 2012; Nepal et al., 2012). Furthermore, the dissemination of ambiguous warning messaging, false alarms, or failure to appropriately warn residents, and racial and socioeconomic disparities had led to distrust within some coastal communities, causing respondents to ignore evacuation warnings or follow emergency preparedness recommendations and guidelines (Alam et al., 2023; Brodar et al. 2020; Buylova et al., 2020; Kammerbauer and
Minnery, 2019; Martins et al., 2018; Huang et al., 2017; Wilson and Tiefenbacher 2012; Nepal et al., 2012). As a result, such communities may resort to less safe coping and adaptive strategies, other protective actions, and low-hanging fruit measures that do not require much effort such as securing loose items in yards, relocating belongings to higher levels in their homes, and purchasing emergency supplies (Gowhar et al., 2022; Elrick-Barr and Smith, 2022; Casteñada et al., 2020; Buchanan et al., 2019; DeYoung et al., 2016; Grothmann and Reusswig, 2006).

Study findings also indicate that for people that held more individualistic worldviews, evacuation was less likely, signaling the possibility of a lack of willingness to comply with officially mandated warnings (Lazo et al., 2015; Wei et al., 2014). Even when evacuation was a preferred protective action (to keep family members safe), such decisions were made independent of other community members outside the home. In contrast, among those with more egalitarian worldviews, evacuation was more likely (Lazo et al., 2015). In close-knit communities like in India, Guyana, and Suriname, collective preparedness actions involved joint relocations and evacuations, and the collective protection and safeguarding of neighbors’ belongings (Gowhar et al., 2022; Linnekamp et al., 2011).

The concept of information gaps is also highlighted in study findings as an invisible need that causes a critical impediment to coastal households, especially older, socially-isolated households, and households that are described in the literature as linguistically isolated populations (or LIPs) (Wilson and Tiefenbacher, 2012; Nepal et al., 2012; Siegel, 1991). These populations reported feeling isolated, and subsequently, underprepared for impending storms and hurricanes due to their low access to informational and other functional services, low English speaking and comprehension abilities, and low financial capacity (DeYoung et al., 2020; Teo et al., 2019; Basolo et al., 2017; Wilson and Tiefenbacher 2012; Nepal et al., 2012).
Based on the thematic findings and expanded conceptual framework, I developed seven (7) research propositions that can be tested in multi-hazard settings to understand the influences of coastal household decision-making processes when faced with uncertainty around a variety of coastal (and other) hazards.

**Research Proposition 1:** Prior hazard experience may facilitate coping strategies among at-risk coastal households.

**Research Proposition 2:** Place attachment may reduce evacuation intentions among residents with prior hazard experience.

**Research Proposition 3:** Prior experience with inaccurate warning messaging may reduce evacuation intentions among at-risk coastal households.

**Research Proposition 4:** Low institutional trust may lead to low compliance rates among at-risk coastal households.

**Research Proposition 5:** Preparedness behaviors may be facilitated by peer-based warning modalities.

**Research Proposition 6:** Nuances in regional flood cultures may affect households’ preparedness decisions.

**Research Proposition 7:** Invisible needs may impede evacuation in coastal households.

**Potential Applications of the Expanded Conceptual Framework**

In response to the pressing challenges posed by coastal hazards, particularly sea-level rise and coastal flooding, the potential applications of this expanded Context Aware conceptual framework can be successfully tailored to address the unique circumstances of the coastal Virginia/Hampton Roads area. Through this approach, it is expected that outcomes will include
the development of targeted strategies and solutions that effectively mitigate risks, enhance resilience, and foster sustainable development in the face of escalating coastal threats.

Yusuf et al. (2022) put forth a highly relevant tool to enhance coastal resilience and incorporate equity into coastal resilience planning and implementation, called the Resilience Adaptation Feasibility Tool (RAFT). This tool highlights the need for equitable practices that consider and account for the issues of social vulnerability that can restrict adaptive capacity, thereby hampering communities’ ability to recover from hazard and disaster events. This study explains that hazards can disproportionately impact those who are already socially vulnerable due to high unemployment rates, lower incomes, high poverty levels, medical fragility, and social isolation (Yusuf et al., 2022). This finding has significant implications for the overrepresentation of women, children, and those with disabilities, as it indicates that there are greater factors beyond demographic or household factors, that can impact social vulnerability.

This equity perspective in resilience planning considers procedural, distributive, and recognitional justice as central tenets that improve household and community adaptive capacity, enhance institutional trust, and mitigate preparedness impediments. Specifically, the procedural and distributive tenets promote community participation in decision-making processes and ensure the equitable distribution of goods and services within communities, especially for those who are most disadvantaged. Lastly, the recognitional tenet acknowledges the various ways people’s intersecting identities and associated social status can make them more vulnerable to hazard impacts. Put together, this equity perspective in coastal resilience planning can be useful in promoting more inclusive and collaborative approaches, enhancing adaptive capacity, enhancing institutional trust, and mitigating impediments to preparedness.
My conceptual framework and research propositions can extend existing work in the field, providing a valuable resource for researchers to engage communities and advise policymakers and industry stakeholders on two locally pertinent coastal hazard contexts: sea level rise and flooding. Specifically, my framework can improve data collection methods by employing techniques to identify invisible and unmet needs that may affect households' ability to relocate or recover, especially among immigrant and socially isolated populations. Research studies can also explore the propositions outlined in this study across various hazard contexts using an equity-focused lens. By applying principles of distributive, procedural, and recognitional justice, findings can inform the enhancement of preparedness planning strategies and the integration of equity into coastal resilience planning.

Furthermore, specific measures can be incorporated into social vulnerability assessments to analyze the impact of household characteristics, demographics, religious affiliations, and socioeconomic factors on attachment rationalities and risk perception levels within the region. Additionally, methodologies can be developed to gauge the influence of warning messaging on residents' decisions to undertake protective actions, implement adaptive measures, or adopt coping strategies. This collaborative approach allows researchers, policymakers, and local planning agencies to gain deeper insights into the nuanced factors influencing coastal household preparedness in this region. It also fosters collaborative engagement with communities to develop tailored interventions that address their community-specific concerns.
5. DISCUSSION OF FINDINGS AND CONCLUSION

This chapter provides a summary of findings, and discusses how the expanded conceptual framework and testable research propositions tie together to answer the study’s research question: *how do contexts and trust influence household preparedness for coastal hazards?*

This chapter describes the study’s contributions to practice and research and provides policy implications, study limitations, and opportunities for future research. This chapter also provides recommendations for emergency management planners, researchers, and community stakeholders to promote household preparedness by enhancing households’ adaptive capacity, mitigating evacuation impediments, expanding warning messaging modalities, and rebuilding institutional trust.

**Summary of Findings**

Together, the study’s thematic findings, expanded framework, and research propositions provide answers to the research question: *how do contexts and trust influence household preparedness for coastal hazards?* The systematic review identified several behaviors and activities related to hazard preparedness activities in the coastal zone. The systematic review also identified several factors related to context and trust that affect how coastal households engage in hazard preparedness activities. The thematic findings were developed from patterns in the data that addressed the many ways situational facilitators such as trust (institutional and interpersonal) and contextual factors such as demographic, household, communication, perceptive factors, interact to influence coastal decision-making, in response to the research question. These thematic findings expanded the preliminary Context Aware model by describing how decision-making stages in the underpinned PADM and Risk Communication models can be bypassed or consolidated when dealing with the uncertainty of coastal hazards.
The *adaptive capacity* theme encapsulated the context of household, socioeconomic, demographic, communication, cultural, and environmental factors that affect a household’s ability and intention to self-protect, adapt, or cope when dealing with coastal hazards (such as evacuation, having an emergency preparedness plan, purchasing federal flood insurance, shelter in place, relocating belongings to higher ground, etc.) when faced with coastal hazards. This theme plays a central role in helping us to understand how perceptive processes are influenced by contexts, which are then facilitated or impeded by specific enabling or inhibitive factors that lead to preparedness outcomes such as household-level evacuations, relocations, structural modifications, purchasing flood insurance, gathering hazard information, and relocating belongings to higher levels in houses.

The *social influence* theme focused on the social aspect of coastal hazard decision-making, and expressed how social relationships with peers, family members, friends, religious affiliations, and information sources (social media, news outlets, etc.) can impact how households perceive and personalize risk, engage in information seeking behaviors, take collective action, and ultimately make preparedness decisions (Grover et al., 2022; Buchanan et al., 2019). Two critical aspects of the social influences theme highlight 1). the significant influence of social relationships in motivating the adoption of desired preparedness behaviors. This was highlighted by study findings that peers who purchase higher quality window shutters in compliance with building codes, can often influence their neighbors to do the same, and 2). the impact of mandatory, advisory, and informal, peer-based warning messaging on household decisions to protect, accommodate, or retreat when facing fast-moving coastal hazards. This was highlighted by the findings that mandatory, fear-based messaging was not always effective if it was not targeted to receiver’s specific location or risk level. In contrast, peer-based advisory
warnings appeared to be very important predictors of hazard preparedness among minority
groups (Nepal et al., 2012; Wilson & Tiefenbacher, 2012).

The *perceptive process* theme described how people’s risk perceptions and preparedness
decisions were influenced by perception-related factors such as: *prior hazard experience,*
perceived hazard certainty, self-efficacy preparedness beliefs, psychological sense of safety
(*PSOS*), and information sources. (Adjei et al., 2022; Huang et al., 2017; Huang et al., 2012).
Perceived hazard certainty was highlighted as a factor of note that greatly impacted whether a
household felt confident enough, based on their access to up-to-date hazard information, hazard
risk awareness and education, and certainty of expected hazard impact, that they were able to
safely shelter in place.

The theme *preparedness enablers and inhibitors* covered aspects of trust such as
interpersonal and institutional trust and focused on the various ways trust and confidence in
government and information sources (peers, family, friends, media, experts, government
officials, etc.) can facilitate household decisions to take preventive, adaptive, and protective
measures in response to flooding, hurricanes, tsunamis, and other coastal hazards (Nepal et al.,
2012). For example, the belief that governments had the expertise and responsibility to keep
citizens safe, was found to influence higher risk perceptions in households who had received
official and explicit evacuation notices, leading to more desirable behaviors and preparedness
outcomes. Invisible needs (i.e. information gaps due to language barriers and social isolation)
and resource constraints, (such as high costs of evacuation and structural modifications,
transportation challenges, and lack of accommodation during evacuation) were highlighted as
major impediments to evacuation intentions and actions (Martins et al., 2018; Wilson and
Tiefenbacher, 2012; Nepal et al., 2012).
In response to the research question, my study found that contexts and situational facilitators like trust and social influences can influence household preparedness for coastal hazards positively, as evidenced by thematic findings of social networks, perceived hazard certainty, trust in information sources and civic authorities, and prior hazard experience impacting peoples’ decisions to evacuate and/or make structural modifications. My study also found that prior hazard experience, distrust in civil authorities, invisible needs, and inaccurate risk messaging (false alarms or ambiguous messaging) can influence hazard preparedness negatively, leading to warning fatigue, overestimations of self-efficacy, and decisions to shelter in place or perform coping strategies such as seeking out hazard information from others or purchasing federal flood insurance.

Conclusion

The purpose of this research was to provide a household-level understanding of the influence of trust and contexts on coastal household hazard preparedness. This was accomplished through a systematic review of 52 peer-reviewed, high-quality articles using rigorous search, screening, and selection processes that were guided by the PRISMA 2020 Protocol. The study produced a preliminary and expanded conceptual framework, seven (7) testable research propositions, and a comprehensive answer to the research question: How do contexts and trust influence household preparedness for coastal hazards?

This study is underpinned by Lindell and Perry’s (2012) Modified Protective Action Decision Model (PADM) and Paton’s (2007) Risk Communication Framework, and I utilized the hybrid review approach due to its flexibility and adaptability to a combination of review methods. This hybrid review combined the framework synthesis and the thematic analysis methods to develop
themes through a systematic coding process that eventually produced a testable and applicable conceptual model.

Furthermore, I applied a combination of latent and manifest coding during thematic analysis, to ensure that surface-level interpretations, as well as more in-depth, subjective interpretations of the data could be expressed and used to interpret various aspects of my research topic (Braun and Clarke, 2006). The analytical process allowed me to reflect on my assumptions, challenged my understanding of concepts and prior knowledge, and required a high level of openness, transparency about my research processes, decisions, and steps taken to ensure the trustworthiness of my research (Nowell et al., 2018).

**Study Contributions**

The findings from this study enhance our understanding of the influence of contexts and trust in coastal household decision-making. From a theoretical and methodological standpoint, this study extends the preliminary Context Aware conceptual framework, which is underpinned by the PADM and Risk Communication frameworks (Lindell and Perry, 2012; Paton, 2008). This study extends existing knowledge by specifying the various influences of coastal household decision-making.

Most of the coastal hazard research has focused on the physical features of coastal vulnerability, such as the determination and analysis of physical and structural characteristics, with little attention paid to the social features (Houston et al., 2019; Wachinger et al., 2013; Lindell and Perry, 2012; Paton, 2007). Also, risk communication of coastal and natural hazards has traditionally focused on getting information to residents of vulnerable communities (Houston et al., 2019; Paton, 2007). Newer studies are finding that understanding how people perceive risk could help improve risk communication, gauge people’s willingness to support government
policies and take protective action, enhance public knowledge about risk, encourage attitudinal changes, increase confidence in civic authorities, and support the development of effective mitigation and preparedness strategies (Houston et al., 2019; Wachinger et al., 2013; Kellens et al., 2013).

To bridge this research gap, this study methodologically explored the interaction and influence of household, communication, social, and miscellaneous factors on preparedness outcomes such as evacuation, relocation, purchase of flood insurance, and having a family preparedness plan. While this study cannot establish causality claims due to the methodology used and the mixed nature of study findings, it has provided an ordered and more relatable framework for emergency managers and researchers. Through the development of the preliminary and expanded conceptual frameworks and research propositions, stakeholders can better understand the nuances of household decision-making influences, to enable them make better informed decisions during preparedness planning, and be more collaborative and inclusive in developing household and community preparedness plans.

**Policy Implications**

The policy implications of this study revolve around enhancing coastal adaptation strategies, improving community resilience, and fostering collective action in the following ways:

- **Integration of the Context-Aware Framework**: Policymakers could consider integrating the Context Aware framework into existing coastal management and emergency response plans. This framework could provide a structured approach for understanding and addressing the contextual factors influencing household responses, facilitating more effective policy implementation.
- **Through promotion of collective action:** Policy measures can be developed to encourage and support collective action among coastal households. This may involve creating incentives for community-based initiatives, providing resources for collaborative preparedness efforts, and fostering a sense of shared responsibility for coastal resilience.

- **Tailored Approaches for Different Regions:** Recognizing the differences in individualistic tendencies between northern and southern U.S. states, policies could be tailored to address the unique needs and preferences of each region. This might involve region-specific communication strategies, targeted educational programs, and customized support mechanisms.

- **Institutional Trust Building:** Policies can focus on rebuilding and strengthening institutional trust, which is identified as crucial in the study. This could involve transparency in decision-making processes, effective communication from authorities, and initiatives to engage communities in the development of coastal adaptation plans.

- **Information Dissemination Strategies:** Given the emphasis on understanding how information modes shape household responses, policies may aim to improve the effectiveness of information dissemination. This could involve investing in advanced communication technologies, community outreach programs, and public awareness campaigns to enhance the understanding of coastal hazards and preparedness measures.

- **Equitable Adaptation Measures:** Policies should address the socio-economic disparities mentioned in the study, ensuring that adaptation measures are equitable and accessible to all members of the community. This may involve targeted financial assistance, support for vulnerable populations, and strategies to minimize the economic barriers to evacuation.
Policy and Research Recommendations

As the impacts of climate change and sea-level rise continue to threaten coastal communities, it is necessary to develop strategies to ensure the survival and well-being of those who are most at risk. There is a need for greater intentionality in flood evacuation planning to successfully address local flood cultures and the varied needs of residents more effectively (Alam et al., 2023; Adjei et al., 2022; Haynes et al., 2018). Moving away from the focus on improving evacuation rates to addressing the holistic practical and emotional reasons people shelter in place, may help to collaboratively address context-specific issues, and improve evacuation outcomes long-term (Gowhar et al., 2022; Haynes et al., 2018).

Study findings, along with the Context Aware Conceptual Framework, provide recommendations that can be applied by emergency management stakeholders in the Hampton Roads and other coastal areas, to enhance the adaptive capacities of coastal households and communities through various concerted strategies. This is especially relevant in communities that are disparately affected by the effects of coastal hazards. Recommendations consist of strategies to enhance coastal households’ adaptive capacity, mitigate impediments to evacuation, improve hazard risk messaging and information dissemination, and rebuild institutional trust.

Strategies to mitigate impediments to evacuation

Study findings highlight two common reasons for households’ lack of evacuation despite warnings. Traffic and fears over looting were cited as major concerns by respondents. Providing the right information via the right channels can decrease households’ tendencies to overestimate evacuation impediments such as traffic, unavailability of shelter options, overcrowding, misconceptions about the safety of the evacuation process, and looting (Brodar et al., 2020; Meyer et al., 2018; Huang et al., 2017; DeYoung et al. (2016a); Lazo et al., 2015; Linnekamp et
al., 2011; Huang et al., 2012). It is therefore necessary for emergency managers to carefully identify their target audiences so that the right information can be communicated via the appropriate channels. Providing maps of the last road in and last road out would be helpful for residents to be able to visually predict the state of the roads and assess whether to shelter in place or evacuate (Haynes et al., 2018).

In response to study findings on the huge information gap and restricted access to services experienced by linguistically isolated populations (LIPs), public health agencies need to place preparedness materials (in target languages) within reach of target groups via a natural community setting such as places of worship, community centers, or business areas. Furthermore, local area disaster preparedness agencies should make more concerted efforts to reach out, educate, and support LIPs in developing a household emergency preparedness plan (Nepal et al., 2012).

**Strategies to enhance households’ adaptive capacity**

Study findings indicate that homeowners are more likely to elevate their homes if their peers do it, are more likely to relocate if their peers relocate, and purchase higher quality shutters and envelope coverage if most of (or all) their neighbors had same. These findings can be relevant to public-private partnerships as they are encouraged to normalize adaptation by facilitating home elevation among residents by spreading awareness about what peers are doing, which may help incentivize others to do the same and perhaps create new social norms. Coupling new building codes with targeted public programs will be key to encouraging increased shutter usage through coastal counties that enforce building codes. Local authorities are also encouraged to take note of the strength of formal and informal social influences of hazard adjustments and
tap into informal community networks as that may be key to engaging different ethnic groups in disaster situations (Teo et al. 2019; Buchanan et al., 2019; Peacock (2003).

Study findings also indicate that households could be less likely to evacuate if they were potentially more certain that they would not be directly impacted. This finding highlights the need for Emergency Managers (EMs) to continue educating the public about the importance of having an evacuation plan and updating existing evacuation plans. Improving public awareness of impeding hazards can enhance a household’s ability to proactively plan evacuation logistics and therefore engage in better protective action decision making and evacuation planning. When planning for evacuations, EMs are advised to plan for worst case scenarios and provide such information in a timely, clear, and concise manner to residents, to avoid households misjudging the path of a hurricane, for example, and evacuating too late when they discover that they will be impacted after all (Adjei et al., 2022).

With study results indicating that prior experience with a hazard made people less likely to evacuate, it is necessary that EMs emphasize evacuation as the only sure way to avoid loss of life and essential property. EMs can also communicate and help implement a safety-first approach for community residents, by promoting more multi-stakeholder interventions. These interventions can range from structural mitigation measures such as placement of reinforced materials at the time of construction and building homes on stilts, hybrid solutions (grey and green infrastructure), the implementation of early warning systems, risk-informed land-use planning, and risk financing schemes to household-level adaptations like owning emergency supplies, purchase of flood-proof furniture, community empowerment, and information-sharing (Gowhar et al., 2022; Bott and Braun, 2019; Bostrom et al., 2019; Basolo et al., 2017; Koerth et al., 2013; Linnekamp et al., 2011). These interventions are critical to saving lives, especially of
those residents who may erroneously believe that they are capable of surviving flood events because they have successfully adapted to prior flooding. These interventions are also useful for the strengthening of solidarity and participation among citizens, reducing hazard impacts, enhancing knowledge on current and future hazard impacts, and the development of shared responsibility and adaptive capacity.

**Strategies to improve hazard information dissemination**

In examining the effects of risk messaging on evacuation intentions, study findings indicate that regardless of respondent characteristics, mandatory evacuation messages resulted in higher evacuation intentions, when compared to different warning messages (Buylova et al., 2020; Brodar et al., 2020; Cuite et al., 2017). Advisory messaging had the second highest evacuation intention than voluntary evacuation messaging. While the findings appear like a definitive way to manage evacuation intentions and eventual actions, local authorities are cautioned against using the mandatory evacuation messaging tactic or overhyping predictions too often or too far in advance, as that could result in the “crying wolf” phenomenon and potentially cause burnout or warning fatigue, drastically reducing evacuation rates and endangering residents’ lives and property (Buylova et al., 2020; Brodar et al., 2020; Bostrom et al., 2019; Haynes et al., 2018; Cuite et al., 2017).

Study findings indicate that minority residents are at risk of receiving late hazard warnings and experience increased vulnerability in hazard situations, due to invisible needs such as language barriers and delayed or lack of access to information (Teo et al., 2019; DeYoung et al., 2016b; Nepal et al., 2012). Gathering data on the risk warning modality preferences of residents, especially those who are disproportionately affected by hazard impacts, can help stakeholders understand how each information source can affect information processing, decision-making,
and a person’s engagement in protective action. This understanding will help to break down response time based on how long it can take for a person to access hazard information from one information source (radio, television, social media) or via multiple sources.

Study findings also indicate that some minority residents prefer to access hazard information via word of mouth, necessitating a broader communication approach that is community-based, peer-led, and participatory in nature (Teo et al., 2019; Nepal et al., 2012). Using language-specific preparedness activities may be helpful to expose invisible needs, and ensure appropriate levels of dissemination, comprehension, and application of preparedness information.

Greater recognition of the delays inherent in public risk communication should be emphasized and communicated to residents often (Parvin et al., 2019; Haynes et al., 2018). Doing so may help residents become more aware of their personal responsibility in observing environmental cues and taking the necessary steps to ensure the safety of their households (even if that includes sheltering). Community members and emergency managers may also work collaboratively to develop education materials that draw on the experiences of those who successfully sheltered. This will be helpful for them to gather and share information about the challenges those residents experienced, to improve the preparedness levels of those who may still decide to shelter in the future.

Despite sheltering, many residents reported entering the floodwaters to secure their belongings or to help their neighbors (Haynes et al., 2018). This reflects the danger in sheltering, and emergency managers are encouraged to improve timely warnings while providing information about safe places for people to move their cars to, provide active assistance in transporting people back to their homes before hazard impact. Doing this may collaboratively
reduce flood risks and may help emergency managers to understand the local sheltering cultures and the practical, social, and emotional needs of residents who choose to shelter.

**Strategies to (re)build institutional trust**

Study findings indicate that passive information (brochures and radio warnings) is rarely factored into household hazard adaptation decision-making (Elrick-Barr and Smith, 2022). This may be because passive information reaches a wide range of audiences and rarely contains targeted information that captures the interest of all households. Emergency management agencies and stakeholders are encouraged to create opportunities for interactive, collaborative, and two-way communication with residents so that there can be collective discussion to share experiences, beliefs, and values, which can help build trust and collaboration.

Study findings indicate that distrust of local government negatively affected disaster preparedness among households that are disproportionately by risk (Cannon et al., 2021; Martins et al., 2018). It is therefore necessary for local authorities to establish relationships with households that are disproportionately affected by flooding and coastal hazards through participatory engagement and improved risk communication, to build trust and increase their adaptive capacity and preparedness levels.

Recognizing when and where sheltering is the preferred option for residents and approaching that as the basis for engagement and discussion of flood risks, is an important aspect of preparedness (Brodar et al., 2020; Haynes et al., 2018; Mishra et al., 2010). This approach could enhance trust in government by collaboratively addressing the practical concerns that reduce motivation to evacuate, provide information that enables residents to be aware of potential structural issues in their homes, and offer resources to help them make changes to make their homes safer in future floods.
Opportunities for Future Research

Opportunities for future research provide avenues to operationalize the research propositions provided in this study and apply the Context Aware framework in various hazard and community-based settings.

Study findings indicated that unofficial warnings played a crucial role in community and neighborhood awareness of flood hazards, underscoring the importance of social networks as modes of warning communication, especially when dealing with the uncertainty of fast-onset hazard events (Teo et al., 2019; Wei et al., 2014; Wilson and Tiefenbacher, 2012; Nepal et al., 2012; Nagarajan et al., 2012; Harvatt et al., 2011). Future research can leverage the Context Aware framework to examine the effects of top-down mandatory and advisory, as well as peer-based warning messaging on community members with invisible needs, especially among socially isolated populations lacking robust social networks and limited access to hazard information. The Context Aware framework offers a valuable tool for making systematic comparisons across multiple storms, contributing to a more comprehensive scientific understanding of warning message effects on these specific population groups.

Study findings indicate that risk perceptions related to the psychological sense of safety (PSOS), prior hazard experience, and preparedness self-efficacy are reliable predictors of preparedness (Gowhar et al., 2022; DeYoung and Peters, 2016). For households that feel safe in their homes due to structural modifications and prior hazard experience, they may feel equipped to survive significant hazard events (Peacock, 2003). However, socioeconomically disadvantaged households may not feel safe sheltering in place and may face challenges in making evacuation decisions due to high associated costs and other invisible needs (Twerefou et al., 2019; Meyer et al., 2018). The Context Aware framework can be utilized to investigate the
rationalities used by people in making preparedness decisions, including attachment rationalities, which encompass religious, socioeconomic, and cultural aspects.

Studies show that coastal adaptation efforts mostly focus on individual responses to coastal hazards, with little research addressing the impact of collective action by coastal households (Gowhar et al., 2022; Elrick-Barr and Smith, 2022). The Context Aware framework, coupled with study recommendations aimed at enhancing household adaptive capacity and mitigating evacuation impediments, offers a valuable approach to investigate the influence of collective action on household preparedness outcomes. This is particularly relevant in northern U.S. states, known for their more individualistic tendencies compared to southern states (Khalil et al., 2019, as cited by Elrick-Barr and Smith, 2022, p.8). Examining the data through this lens will provide a comprehensive perspective on how different worldviews and information modes shape various categories of household responses, including coping, adaptation, and collective action.

**Study Limitations**

I used a combination of Web of Science, ScienceDirect, ODU Monarch OneSearch, and Google Scholar as my primary databases. I also used backwards/forward citation tracing techniques and the literature mapping tool *Connected Papers* to identify peer-reviewed works for my systematic review. Despite this rigorous search process, I may have omitted studies that were not included in those databases. To maintain the integrity of the research process and ensure overall consistency, I documented my search, screening, and selection processes while simultaneously using the PRISMA 2020 and selection criteria as a guide.

Secondly, due to resource constraints, my pre-defined selection criteria excluded a broad variety of literature such as grey literature. My selection criteria restricted eligible literature to
peer-reviewed works published within a certain time frame, focused on a specific population, set within specific geographical settings, and containing key words. To mitigate this limitation and maintain the consistency and integrity of the research process, I documented study exclusions and provided justifications for study exclusions in Chapter 4, guided by the PRISMA 2020 Protocol and my selection criteria.

Lastly, due to the use of secondary data in this study, there is a possibility that validity and reliability issues may be transferred. To mitigate this issue, I conducted a risk of bias assessment on each study, and categorized them as low, medium, or high, based on findings such as the authors’ transparency during the data collection and analysis processes, study validity and reliability, as well as the discussion of the study’s explicit and implicit biases and limitations. Results from this risk of bias assessment can be found on page 220, in the Appendices section.

To ensure adherence with guidelines as outlined by the PRISMA protocol, I also used the associated PRISMA 2020 Checklist and explained any protocol deviations in the “Search, Screening, and Selection” section of the Results chapter (Chapter 4) (Drucker et al., 2016).
REFERENCES


Dingerson, L., & C. Hershner. (2005). Predicting future shoreline condition based on land use change and increased risk associated with climate change. NOAA Coastal Services Center Geotools Conference, Charleston, SC.


McComas, K. (2004). When even the ‘best-laid’ plans go wrong: Strategic risk communication for new and emerging risks. *EMBO reports.* 5(S1), S61-S65. https://doi.org/10.1038/sj.embor.7400257


https://doi.org/10.1016/j.pdisas.2019.100032


https://doi.org/10.1108/EUM0000000005930


Sasaki, Y., Aida, J., Tsuji, T. et al. (2019). Pre-disaster social support is protective for onset of post-disaster depression: Prospective study from the great East Japan earthquake & tsunami. *Scientific Reports*, 9, 19427. https://doi.org/10.1038/s41598-019-55953-7


http://pewresearch.org/assets/social/pdf/SocialTrust.pdf


APPENDICES

APPENDIX A

PERMISSIONS AND AUTHORIZATIONS TO REPLICATE FIGURES (PATON, 2007; LINDELL & PERRY, 2012)

EMERALD PUBLISHING LIMITED ORDER DETAILS

Feb 02, 2023

Order Number 501790741
Order date Feb 02, 2023
Licensed Content Publisher Emerald Publishing Limited
Licensed Content Publication Disaster Prevention and Management
Licensed Content Title Preparing for natural hazards: the role of community trust
Licensed Content Author Douglas Paton
Licensed Content Date Jun 26, 2007
Licensed Content Volume 16
Licensed Content Issue 3
Type of Use Dissertation/Thesis
Requestor type Academic
Portion Figures/table/illustration
Are you the author of the requested content? No
Format Electronic
Geographic Rights World rights

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Number of figures/tables 1

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Number of copies

Title Trust and Contexts: A Conceptual Framework for Understanding Coastal Hazard Household Preparedness Influences

Institution name Old Dominion University

Expected presentation date Dec 2023

Portions Figure 1. Summary of predictors of intention to adopt natural hazard preparedness measures

Mrs. Ogechukwu Marlyn Nwandum-Vincent

Requestor Location ACWORTH, GA 30101
United States
Attn: Oge Agim Nwandum-Vincent

Publisher Tax ID GB 665359306

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<td>The Protective Action Decision Model: Theoretical Modifications and Additional Evidence</td>
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Requestor type: University/Academic

Format: Electronic

Portion: Figure/table

Number of figures/tables: 1

Will you be translating?: No

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Institution name: Old Dominion University

Expected presentation date: Dec 2023

Portions: Fig. 1

Mrs. Ogechukwu Marlyn Nwandu-Vincent

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APPENDIX B

PRISMA 2020 PROTOCOL: PERMISSIONS AND AUTHORIZATIONS TO REPLICATE FIGURES AND TABLES FROM THE PRISMA 2020 PROTOCOL

PRISMA Statement

The PRISMA 2020 Statement was published in 2021. It consists of a checklist and a flow diagram and is intended to be accompanied by the PRISMA 2020 Explanation and Elaboration document.

Usage of the PRISMA Statement and Explanation and Elaboration Document

It is strongly recommended that the PRISMA 2020 Statement be used in conjunction with the PRISMA 2020 Explanation and Elaboration Document. This document is intended to enhance the use, understanding and dissemination of the PRISMA 2020 Statement. Through examples and explanations, the meaning and rationale for each checklist item are presented.

The PRISMA Statement and the PRISMA Explanation and Elaboration document are distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Figure 11

PRISMA 2020 Flowchart: Literature Search and Screening Processes

Identification of studies via databases

Studies identified from:
- Databases (n = 1045)
  - selected from Web of Science (WOS), ScienceDirect, Google Scholar and backward/forward citation tracing*

Studies removed before screening:
- Duplicate records removed (n = 36)
- Records marked as ineligible by automation tools (n = 59)
- Records removed for other reasons (n = 15).

Studies screened at the Abstract (ABS) Level.
(n = 214)

Studies excluded**
(n = 95)
- ** excluded due to duplication (2), lack of relevance to the participant focus (28), reported outcomes (39), and phenomena of interest (32).

Studies sought for retrieval.
(n = 119)

Studies not retrieved.
(Stored for future analysis)
(n = 3)
- ** One study added to FT review (n=1)

Studies assessed for eligibility at the Full-Text (FT) Level
(n = 116)

Studies excluded: (n = 64)
**Reason:** Lack of study focus; irrelevant phenomena of interest, study outcomes, and participant focus; redundancy, duplication error, and ineligible publication types.

Studies included in review
(n = 52)

### Table 3

**PRISMA 2020 Checklist:**
**Quantitative Study Research Design**

<table>
<thead>
<tr>
<th>Study design</th>
<th>Authors</th>
<th>Study focus</th>
<th>Hazard type/year</th>
<th>Study setting</th>
<th>Techniques</th>
<th>Selected population and sample size</th>
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</thead>
<tbody>
<tr>
<td>Quantitative</td>
<td>Adjei et al. (2022)</td>
<td>Investigates the factors that predict household hurricane risk perception.</td>
<td>Hurricane Matthew (2016).</td>
<td>Jacksonville, Florida.</td>
<td>Mailed surveys; disproportionate stratified sampling; structural equation modeling (SEM).</td>
<td>5000 households that were affected by high wind, coastal surge, and intensive flooding.</td>
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<tr>
<td></td>
<td>Basolo et al. (2009)</td>
<td>The study examines the influence of people's confidence in local government on actual and perceived household preparedness levels.</td>
<td>Earthquakes and hurricanes.</td>
<td>New Orleans, western Los Angeles (LA) County.</td>
<td>Phone survey; random sampling; multivariate analysis.</td>
<td>182 in the LA study area; 222 in the New Orleans area.</td>
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<tr>
<td></td>
<td>Basolo et al. (2017)</td>
<td>Investigates the factors that influence household perceived preparedness.</td>
<td>Hurricanes</td>
<td>Miami-Dade county, Florida.</td>
<td>Phone survey; random sampling, multivariate</td>
<td>507 households in the study area that are susceptible to</td>
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<tr>
<td>Study</td>
<td>Focus</td>
<td>Data Collection and Analysis</td>
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<tr>
<td>Bollettino et al. (2020)</td>
<td>This study explores the knowledge and perception of Filipino households and the associated effects on their household preparedness for rapid onset coastal hazards like typhoons.</td>
<td>Cross-sectional households-based survey; random sampling. 5,184 adult household members. Response rate was 42.5%.</td>
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<td>Brodar et al. (2020)</td>
<td>The paper examined the sociodemographic, hurricane-related, family, and psychological factors associated with mothers' evacuations decisions following Hurricane Irma.</td>
<td>Online surveys; purposive sampling; predictive modeling and multivariate analyses. 536 mothers of children below 18.</td>
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<td>Brody et al. (2017)</td>
<td>This study analyzes household-level data to identify the major factors influencing coastal residents to voluntarily purchase federally subsidized flood insurance for homes located outside of the 100-year floodplain.</td>
<td>Three-wave mailed surveys; random stratified sampling; bivariate analysis. The overall sample consisted of 351 households. The authors selected 99 who lived outside the 100-year floodplain; Survey response averaged around 18% for the four surveyed counties.</td>
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<tr>
<td>Authors</td>
<td>Study Title</td>
<td>Data Collection Details</td>
<td>Sample Size</td>
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<td>Buchanan et al. (2019)</td>
<td>This study adds to our understanding of how people may respond to various adaptation options and policies, using a household survey in New York City, New York, neighborhoods affected by Hurricane Sandy.</td>
<td>Hurricane Sandy (2013) The Bay region, New York City. Semi-structured in-person, online and mailed-in surveys; clustered and stratified random sampling; bivariate analysis.</td>
<td>41 completed in-person surveys, 28 completed mailed surveys, and 172 online survey respondents.</td>
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<td>Bukvic et al. (2015)</td>
<td>This study takes an interdisciplinary approach to examine the effects of pre-disaster socio-economic household characteristics, level of preparedness, disaster exposure, experience with recovery, community embeddedness, and resource loss on relocation decision-making.</td>
<td>Hurricane Sandy (2013) Impacted areas in New York and New Jersey: Ventnor City, Longport, Margate City, Lavallette, Pine Beach, Manasquan, Belmar, and Long Beach. In-person, door-to-door surveys; random sampling; bivariate analysis.</td>
<td>118 responses (125 collected, with 7 rejected for ineligibility reasons).</td>
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<td>Buylova et al. (2020)</td>
<td>This study analyzes how situational variables of hazard proximity, past experience, preparedness, perception of location relative to a tsunami inundation zone, knowledge of tsunamis, and demographic variables, along with psychological constructs of risk perceptions</td>
<td>9.0 scale Cascadia Subduction Zone (CSZ) earthquake and resulting tsunami Seaside, Oregon Structured, self-administered, anonymous online and mailed household surveys; systematic sampling.</td>
<td>211 completed surveys (22% response rate)</td>
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</table>
and self-efficacy, influence intended evacuation behaviors. The study leans on the PADM framework to investigate the main predictors of evacuation related behaviors.

<table>
<thead>
<tr>
<th><strong>Cannon et al. (2021)</strong></th>
<th>This study focuses on several predictors of flood risk perception including specific trust measures of local, state, and federal authorities, sociodemographic characteristics, and experience with flood damage.</th>
<th>Flooding</th>
<th>New Orleans, Louisiana</th>
<th>Structured in-person, door-to-door surveys; random sampling; ordinal regression analysis, ordinary least squares regression.</th>
<th>403 completed surveys (response rate of 20.73%).</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Casteñada et al. (2020)</strong></td>
<td>The study explores the influence of experience and sociodemographic variables in different levels of natural disaster preparedness among inhabitants of the Chilean coast. Three domains of preparedness were studied: household, community, and work.</td>
<td>Earthquakes, tsunamis</td>
<td>Iquique and Concepción, Chile</td>
<td>Face-to-face survey; 3-stage random stratified sampling; multivariate analysis.</td>
<td>701 total completed surveys in Iquique, 803 in Concepción.</td>
</tr>
<tr>
<td>Study Reference</td>
<td>Study Description</td>
<td>Key Keywords</td>
<td>Location</td>
<td>Methodology</td>
<td>Sample Size</td>
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<td>Combest-Friedman et al. (2012)</td>
<td>This study examines local meteorological information and explores household perceptions of climate change and coastal hazard risk.</td>
<td>Coastal erosion; sea-level rise (SLR)</td>
<td>Santander, Philippines.</td>
<td>Secondary data; structured interviews; stratified random sampling; bivariate analysis.</td>
<td>N= 87 completed surveys</td>
</tr>
<tr>
<td>Cope et al. (2017)</td>
<td>This study examines the effects of geographically differentiated social network support resources on perceived household preparedness and resource adequacy for coping with environmental hazards.</td>
<td>Hurricanes (Rita and Katrina (2005), Gustav (2008), Isaac (2012)); environmental threats; marine oil spills; sea-level rise (SLR); coastal erosion; saltwater intrusion; fisheries depletion; environmental pollution.</td>
<td>Plaquemines and Lafourche, Louisiana.</td>
<td>Mailed and online surveys; random sampling; bivariate analysis.</td>
<td>928 completed surveys (9.5% response rate)</td>
</tr>
<tr>
<td>Cuite et al. (2017)</td>
<td>This paper examines both main effects of message variables and interaction effects as it relates to evacuation behavior. This study randomly assigned respondents to message conditions in each of two hypothetical storm scenarios and developed insights about Coastal storm</td>
<td>Connecticut, New York, New Jersey</td>
<td>Online surveys; random sampling; ANOVA.</td>
<td>451 (27%) survey participants in Connecticut; 698 (41%) in New York; 567 (33%) survey participants in NJ</td>
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</tbody>
</table>
To better understand household hurricane evacuation, the purpose of this paper is to develop a dynamic model of hurricane evacuation behavior that models evacuation behavioral response to hurricane forecasts in a way that captures the intertemporal aspects of the evacuation decision process.

Tropical storms; tropical depressions; hurricanes
Gulf of Mexico region (simulated)
Weather forecast data (secondary); regional household data
Landfall data was collected from 19 storms affecting 15 coastal areas along the Gulf of Mexico from 1992-2005.

To better understand the lack of preparedness in disaster and major hazard events, the study investigates how sense of community, sense of place, confidence in government, preparedness self-efficacy, and risk perception relate to household disaster preparedness.

Hurricanes; tornados; severe thunderstorms; and ice storms
Central area of North Carolina
Online and face-to-face surveys; purposive sampling; bivariate analysis
344 completed surveys (14% response rate)

Using two main research questions, the purpose of this paper is to examine well-being and preparedness Coastal and environmental hazards (Hurricane Katrina (2005); the Mobile County, Alabama; Florida, and Louisiana.
In-person surveys; purposive sampling;
among Cambodian and Laotian immigrants living near the Gulf Coast of the USA, and the ways in which indicators such as sense of community and risk perception are related to these constructs.

**Grothmann and Reusswig (2006)**
This study develops a socio-psychological model based on the Protection Motivation Theory (PMT). This study explains how private precautionary damage prevention is influenced by residents’ perceptions of previous flood experience, risk of future floods, reliability of public flood protection, the efficacy and costs of self-protective behavior. It also examines residents’ perceived ability to perform these actions, and non-protective responses like wishful thinking.

Deepwater Horizon oil spill (2010).

**Grover et al. (2022)**
This study examines the prediction of three types of household flood hazard adjustment (emergency

Deepwater Horizon oil spill (2010).

**Multivariate analysis.**

**Telephone survey; random sampling; regression analyses.**

157 heads of households completed surveys.
preparedness, structural mitigation, and nonstructural mitigation) by a comprehensive set of risk perception variables (expected personal consequences, affective response, hazard intrusive thoughts, and hazard intrusive discussions).

<table>
<thead>
<tr>
<th>Authors</th>
<th>Methodology</th>
<th>Study Area</th>
<th>Results</th>
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</thead>
<tbody>
<tr>
<td>Harries, T. (2012)</td>
<td>Using secondary analysis of survey data from UK households who had experienced flooding or who were at risk of flooding, this paper presents evidence to suggest that protective behavior may be influenced less by material and financial considerations than by concerns about feelings of anxiety and insecurity.</td>
<td>Flooding Across the UK</td>
<td>Secondary data analysis; telephone surveys; multivariate logistic regression. 555 completed surveys (28% response rate).</td>
</tr>
<tr>
<td>Huang et al. (2017)</td>
<td>This study extends previous research by testing the protective action decision model (PADM) on hurricane evacuation decisions during Hurricanes Katrina and Rita.</td>
<td>Hurricanes Katrina (2005) and Rita (2005)</td>
<td>Mailed surveys; disproportionate stratified sampling method; regression and correlation analyses. 270 completed surveys (total response rate of 39.9%) in Jefferson (37%) and St. Charles (43%). 1007 completed surveys.</td>
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<tr>
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<td>Event</td>
<td>Study Area</td>
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<tr>
<td>Huang et al. (2012)</td>
<td>The study extends hurricane evacuation studies in general and the PADM, by</td>
<td>Hurricane Ike</td>
<td>Houston-Galveston Study Area (GSA); Lake Sabine</td>
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<td>beginning to document the mechanisms through which official warnings, hazard</td>
<td>(2008)</td>
<td>Study Area (SSA).</td>
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<td>experience, coastal location, and social cues affect evacuation behavior.</td>
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<td>Koerth et al. (2013)</td>
<td>This study examines the anticipatory adaptation to coastal flooding at</td>
<td>Flooding</td>
<td>Axios-Loudias-Aliakmonas National Park.</td>
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<td>household-level in the Axios-Loudias-Aliakmonas National Park, located at the</td>
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<td>Theraic Gulf in Greece.</td>
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<td>Landry et al. (2021)</td>
<td>This study examines flood insurance uptake using household level survey</td>
<td>Flooding</td>
<td>Florida; Texas; Louisiana; Alabama; Mississippi</td>
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<td>data and employs instrumental variables (related to local history of aid</td>
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<td>distribution and political economy) to address endogeneity of individual</td>
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<td>expectations of</td>
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eligibility for disaster assistance.

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<th>Areas/Study Area</th>
<th>Methodology</th>
<th>Sample Size/Response Rate</th>
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<td>Lazo et al. (2015)</td>
<td>Hurricanes</td>
<td>Broward, Miami-Dade, and Palm Beach counties, Florida; Brazoria, Galveston, Harris, and Matagorda, Houston-Galveston Study Area (GSA)</td>
<td>Online survey; purposive sampling; Principal Component Analysis (PCA); regression analysis.</td>
<td>808 completed surveys (61.6%).</td>
</tr>
<tr>
<td>Lindell et al. (2005)</td>
<td>Hurricane Lili</td>
<td>Vermillion and Cameron parishes (Louisiana); Orange, Jefferson, and Chambers counties (Texas).</td>
<td>Mailed surveys; random sampling; correlation analysis.</td>
<td>507 completed surveys were returned, with a response rate of 50.7%.</td>
</tr>
<tr>
<td>Lindell et al. (2015)</td>
<td>Earthquake; tsunami</td>
<td>Tutuila-Leone, Malaeloa/Aitulagi, Malaeloa/Ituau, Taputimu, and In-person interviews; systematic</td>
<td>262 completed interviews (78% response rate)</td>
<td></td>
</tr>
<tr>
<td>Study</td>
<td>Description</td>
<td>Environment</td>
<td>Methodology</td>
<td>Results</td>
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<tr>
<td>Martins et al. (2018)</td>
<td>This study examines the levels and patterns of household preparedness in New York City (NYC) before Superstorm Sandy. The study predicts the influence of social and socio-psychological factors – such as vulnerability, social capital, and risk perception – on effective disaster preparedness behavior in NYC before the storm hit.</td>
<td>Hurricane Sandy (2012)</td>
<td>Telephone interviews; random sampling; factor analysis.</td>
<td>2001 completed interviews (22.05% combined response rate of landline and cellphone interviews).</td>
</tr>
<tr>
<td>Mishra et al. (2010)</td>
<td>The study investigated three kinds of place attachment - economic, genealogical, and religious place attachment using data collected from 300 residents in flood prone areas of Orissa, India.</td>
<td>Flooding Orissa, India</td>
<td>Delivery of paper-based surveys; purposive sampling; factor analyses (CFA and EFA); correlation analyses.</td>
<td>300 completed surveys were returned, resulting in a 50% response rate.</td>
</tr>
<tr>
<td>Nagarajan et al. (2012)</td>
<td>This paper develops an Agent-Based Simulation (ABS) model of multiple agents (evacuee households) in a hypothetical community to investigate the impact of behavior as an unofficial</td>
<td>Major disaster; coastal hazards that require evacuation.</td>
<td>Simulated environment</td>
<td>1000 simulated households were examined to identify how neighbors’ hazard awareness behaviors serves</td>
</tr>
</tbody>
</table>
channel on the overall warning dissemination. Parameters studied include the percentage of people who warn their neighbors, the efficiency of different official warning channels, and delay time to warn neighbors.

<p>| Pan, A (2020) | This study examined coastal residents under typhoon storm surge disaster zone and analyzed their risk perception under typhoon storm surge disaster environment. A binary logistic regression analysis was performed, which resulted in an effective empirical model for evacuation behavior of coastal residents. | Typhoon storm surge | Longwan, China | In-person interviews; random stratified sampling; multivariate analysis | 300 completed surveys, with an overall response of nearly 97%. |
| Peacock, W. (2003). | This paper presents statewide estimates of shutter usage and envelope coverage for owner-occupied single-family detached housing in Florida. | Hurricanes | Florida | Telephone survey; equal probability random digit dialing sampling; multivariate analyses. | 1533 completed surveys, with a 59% statewide response rate, and a 63% response rate in Miami-Dade County. |</p>
<table>
<thead>
<tr>
<th>Authors</th>
<th>Study Title</th>
<th>Study Region</th>
<th>Methodology</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pham et al. (2019)</td>
<td>This study investigates evacuation behaviors associated with Hurricane Matthew in October of 2016. It assesses factors influencing evacuation decisions and evacuation departure times for Florida, Georgia, and South Carolina from an online survey of respondents.</td>
<td>Hurricane Matthew (2016) Atlantic coast of Florida, Georgia, South Carolina.</td>
<td>Mailed and online surveys; random sampling; logistic regression analysis.</td>
<td>94.8% cooperation rate was recorded (697 total: 225 from Florida, 159 from Georgia, and 313 from South Carolina).</td>
</tr>
<tr>
<td>Teo et al. (2019)</td>
<td>This study focused on ‘ethnicity’ and ‘English language skill’ and explored how people with different ethnic backgrounds and levels of English language proficiency responded to a disaster situation.</td>
<td>Coastal hazards; natural disasters Logan, Southeast Queensland, Australia.</td>
<td>In-person survey; purposive sampling; chi-square test, hierarchical regression analysis.</td>
<td>180 completed surveys, with a response rate of about 45%.</td>
</tr>
<tr>
<td>Twerefou et al. (2019)</td>
<td>This paper discusses the psychological and socio-economic factors as well as the constraints that inhibit private precautionary flood-risk mitigation measures among urban households in the Greater Accra Metropolitan Area of Ghana.</td>
<td>Flooding Greater Accra Metropolitan Area, Ghana.</td>
<td>Online surveys; purposive sampling; multivariate analyses.</td>
<td>1204 completed surveys, with a 93.3% response rate.</td>
</tr>
</tbody>
</table>
Wei et al. (2014) This study examines the effect of an unusual ‘‘certain death’’ warning message on Galveston, Harris, and Jefferson County, Texas, residents’ expectations of storm surge damage and evacuation decisions during Hurricane Ike. Hurricane Rita (2005); Hurricane Ike (2008). Galveston, Harris, and Jefferson counties, Texas Mailed surveys; purposive sampling; correlation analyses. 39.4% response rates for Hurricane Ike; 35.6% response rate for Hurricane Rita.

**Total** 36

*Source: Author-developed, based on the systematic review data*
Table 4

<table>
<thead>
<tr>
<th>Study design</th>
<th>Authors</th>
<th>Study focus</th>
<th>Hazard type/year</th>
<th>Study setting</th>
<th>Techniques</th>
<th>Selected population and sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative</td>
<td>Bostrom et al. (2018)</td>
<td>This paper examines the societal dimensions of warning decisions during extreme weather events in one of the most hurricane-prone areas in the U.S., Miami-Dade County, Florida.</td>
<td>Hurricanes</td>
<td>Miami-Dade county, Florida</td>
<td>Online surveys; follow-up, in-person interviews; random sampling; thematic analysis.</td>
<td>28 interviewees; 460 survey respondents.</td>
</tr>
<tr>
<td></td>
<td>Bott and Braun (2019)</td>
<td>This paper contributes new understanding by presenting the results of original, mixed-methods research (a household survey and focus group discussions) that documents the accommodating strategies of communities and households in the Semarang Bay on northern Java in Indonesia.</td>
<td>Coastal hazards</td>
<td>Semarang Bay, Indonesia</td>
<td>Focus group discussions; follow-up standardized household survey; thematic analysis.</td>
<td>650 surveyed households in 18 study areas.</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Description</td>
<td>Event</td>
<td>Location</td>
<td>Methodology</td>
<td>Sample Size</td>
<td>Notes</td>
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<tr>
<td>DeYoung et al. (2016b)</td>
<td>This paper examines the information-seeking behaviors of people facing hurricanes. The study focuses on information channel type and disasters and presents results on hurricane evacuation information gathering.</td>
<td>Hurricanes</td>
<td>Wilmington, Raleigh, Outer Banks, Jacksonville, and North Carolina.</td>
<td>Telephone surveys; stratified random sampling; thematic analysis; content analysis.</td>
<td>424 completed interviews (10% combined response rate for landline and cellphone; 15.4% combined cooperation rate for landline and cellphone).</td>
<td></td>
</tr>
<tr>
<td>Gowhar et al. (2022).</td>
<td>This article analyses the dominant social factors that motivates people to occupy flood-prone areas, from the perspective of residents across the social spectrum in the largest Himalayan urban center, Srinagar City.</td>
<td>Kashmir Flood (2014)</td>
<td>Srinagar City, India</td>
<td>In-person, semi-structured interviews; random stratified sampling; thematic analysis.</td>
<td>400 households were recruited using the stratification method to ensure sample representativeness.</td>
<td></td>
</tr>
<tr>
<td>Haynes et al. (2018)</td>
<td>Focusing on the experiences of residents and business owners who sheltered during a major flood event, this study explores the motivations for staying during floods, residents’ practices while sheltering, and the attendant challenges and impacts.</td>
<td>Flooding event Richmond, Brunswick, and Tweed, New South Wales, Australia.</td>
<td>In-depth in-person semi-structured interviews; follow-up phone, online, and in-person surveys; purposive sampling; exploratory case study.</td>
<td>Semi-structured interviews ((n = 83)); Survey responses ((n = 330)).</td>
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<tr>
<td>Harvatt et al. (2011)</td>
<td>This paper reports a novel study to understand the relationship between householder experience, understanding and response to two natural hazards – flooding and sea-level rise – in three contrasting high-risk areas of England Flooding; sea-level rise (SLR) Suffolk, North Devon, Cornwall (England).</td>
<td>Mailed structured surveys; in-depth, face-to-face interviews; purposive sampling; conceptual framework development; thematic analysis.</td>
<td>35 in-person interviews were conducted, with responses analyzed and used to develop the structured survey. 77 survey responses were recorded, with a 43% response rate.</td>
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<tr>
<td>Study</td>
<td>Methodology</td>
<td>Location</td>
<td>Sample Size</td>
<td>Response Rate</td>
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<tr>
<td>Kammerbauer and Minnery (2019)</td>
<td>Mailed surveys; Semi-structured follow-up telephone interviews; case study; thematic analysis</td>
<td>Brisbane, Australia</td>
<td>16</td>
<td>4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nepal et al. (2012)</td>
<td>Focus group discussions; convenience sampling; thematic analysis using the grounded theory approach</td>
<td>Houston, Texas</td>
<td>139</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Wilson and Tiefenbacher (2012)</td>
<td>Face-to-face interviews; snowball sampling; thematic analysis</td>
<td>Houston-Galveston area, Texas</td>
<td>135</td>
<td>63%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: Author-produced, based on the systematic review data*
<table>
<thead>
<tr>
<th>Study design</th>
<th>Authors</th>
<th>Study focus</th>
<th>Hazard type/year</th>
<th>Study setting</th>
<th>Techniques</th>
<th>Selected population and sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed methods</td>
<td>Ahsan et al. (2016)</td>
<td>This study investigated the responses of the people affected by cyclone Aila to cyclone warnings and associated evacuation orders, and unveiled behavioral aspects that explain why they did or did not comply with the evacuation orders.</td>
<td>Cyclone Aila (2009)</td>
<td>Koyra, Bangladesh</td>
<td>Case study; focus group discussions; face-to-face surveys; random sampling; Principal Component Analysis (PCA); parametric and non-parametric tests.</td>
<td>420 households were selected for the study’s sample size.</td>
</tr>
<tr>
<td></td>
<td>Alam et al. (2023)</td>
<td>This article explored household evacuation decisions in response to cyclone Amphan and considering the risks of the COVID-19 pandemic. Consequently, this study investigated evacuation behaviors among the households and explored the impacts of COVID-19</td>
<td>Cyclone Amphan (2020)</td>
<td>Satkhira, Bangladesh</td>
<td>Literature review; structured interview survey to residents; geospatial analysis; systematic sampling; chi-square test.</td>
<td>Interview sample size consisted of ( n = 378 ) from fourteen villages in the study area.</td>
</tr>
</tbody>
</table>
during the evacuation procedures.

<table>
<thead>
<tr>
<th>DeYoung et al. (2016a)</th>
<th>The paper examines the role of several demographic indicators on stated hurricane evacuation thresholds, or the lowest category storm for which participants indicated they would evacuate, for mandatory and voluntary orders.</th>
<th>Hurricanes; storms.</th>
<th>Wilmington, Raleigh, Outer Banks, Jacksonville, and North Carolina.</th>
<th>Telephone survey: stratified random sampling; multivariate analysis; thematic analysis.</th>
<th>284 completed interviews (10.45% response rate, 16.67% cooperation rate)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elrick-Barr and Smith (2022)</td>
<td>Drawing on case study research in two Australian coastal communities, this study explores the types of information shaping household responses to three hazard scenarios: a heatwave, a severe storm, and sea-level rise.</td>
<td>Heatwave; severe storm; sea-level rise (SLR).</td>
<td>Mandurah and Moreton Bay Coastal Region, Australia.</td>
<td>Pre-qualifying surveys; structured phone interviews; random sampling; purposive sampling; chi-squared nonparametric tests; binomial logistic regression analysis; deductive analysis.</td>
<td>Survey sample size (n = 400); semi-structured interviews (n = 17).</td>
</tr>
<tr>
<td>Linnekamp et al. (2011)</td>
<td>The article examines household perceptions of flooding as part of climate change in two low elevation coastal zone cities in the Caribbean. The research examines differences in vulnerability</td>
<td>Flooding; extreme rainfall.</td>
<td>Paramaribo, Suriname; Georgetown, Guyana.</td>
<td>Field surveys; in-person interviews; case study; systematic sampling; bivariate analysis.</td>
<td>Georgetown sample size (n = 108); Paramaribo sample size (n = 80).</td>
</tr>
</tbody>
</table>
of households as the combined results of socio-economic inequalities in entitlements and exposure to natural hazards such as flooding and extreme rainfall.

<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Sample Size</th>
<th>Results and Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meyer et al. (2018)</td>
<td>This study examines Louisiana residents’ hurricane evacuation intentions and previous evacuation decisions during Hurricanes Katrina, Gustav, and Isaac to understand the effects of demographic factors, risk perception, and previous experience.</td>
<td>Sample size ($n = 2635$) consisted of both landline ($n = 909$) and cell phone ($n = 1647$) respondents and 79 additional completed surveys from the St. Bernard parish list; total cooperation rate was 91%.</td>
<td></td>
</tr>
<tr>
<td>Parvin et al. (2019)</td>
<td>This research analyzes how different groups of people are influenced by different factors and take evacuation decision and finally choose their evacuation destination.</td>
<td>Sample size ($n = 200$) consisted of mostly heads of households.</td>
<td></td>
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</tbody>
</table>

Source: Author-produced, based on the systematic review data
**Table 6**

**PRISMA 2020 Checklist: Study Validity and Bias Risk Assessment Results**

<table>
<thead>
<tr>
<th>Study Title</th>
<th>Outcome</th>
<th>Risk of bias assessment</th>
<th>Validity of study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjei et al. Adjei, E., Benedict, B. C., Murray-Tuite, P., Lee, S., Ukkusuri, S., &amp; Ge, Y. “Gurt”. (2022). Effects of risk perception and perceived certainty on evacuate/stay decisions. <em>International Journal of Disaster Risk Reduction, 80</em>, 103247. <a href="https://doi.org/10.1016/j.ijdrr.2022.103247">https://doi.org/10.1016/j.ijdrr.2022.103247</a></td>
<td>The study's latent variable (Risk Perception/RP associated with evacuation logistics) was found to have impacted household evac decisions more than the measured variable (RP related to the location of hurricane impact). In other words, RP related to evac logistics vs. RP related to location of impact had a greater impact on households’ decisions to evacuate.</td>
<td>Authors discussed that oversampling of some populations (married couples, households with higher incomes, females, etc.) led to a sampling bias that can be mitigated by intentionally seeking out survey data from more diverse populations, in a way that accurately depicts the characteristics of the population that is being surveyed.</td>
<td>High</td>
</tr>
<tr>
<td>Ahsan, M. N., Takeuchi, K., Vink, K., &amp; Warner, J. (2016). Factors affecting the evacuation decisions of coastal households during Cyclone Aila in Bangladesh. <em>ENVIRONMENTAL HAZARDS-HUMAN and POLICY DIMENSIONS, 15</em>, 1. <a href="https://doi.org/10.1080/17477891.2015.1114912">https://doi.org/10.1080/17477891.2015.1114912</a></td>
<td>Evacuation rates were notably low, despite agencies' efforts to disseminate relevant information to all residents. The study found that the potential safety of household members and livestock (major source of income), and adequate sheltering facilities had significant impacts on decisions to evacuate. Furthermore, distance from respondents’ homes to the nearest cyclone shelters and</td>
<td>No variables in the dataset used in this study addressed the nexus between the structure of society and the evacuation response, which can be considered as a limitation of this study</td>
<td>High</td>
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</table>
cultural/religious worldviews had notable influences on households' decisions to evacuate or shelter in place.

https://doi.org/10.1007/s11069-022-05564-9

COVID-19 was found to have impacted households' decisions to evacuate ahead of cyclone Amphan, with larger numbers choosing to stay home to avoid infection. Almost all respondents however, stated that they received evacuation notices. The study found gender, household responsibilities, and the trustworthiness of evacuation information source to be statistically significant as they studied households' evacuation decision motivations.

Although not explicitly, the authors discuss the sampling bias that occurred which make the study findings non-generalizable to other areas, especially under differing socio-economic conditions or diverse geographical settings.

Findings suggest that individuals associate their perceived household preparedness with their assessment of local authorities' competency in managing disaster effects. Findings differed across the two study areas however, with a major distinction between the two areas suggesting that in the New Orleans study area, higher levels of confidence in local government was only associated with having a family plan. This contrasts noticeably with other studies that found that higher levels of confidence usually caused households to wait on local government to protect them from disaster effects (insert relevant studies). Comparatively, in the LA County study area, exposure to more preparedness information sources was positively associated with having a family plan and knowing how to turn off utilities.


Study findings showed that risk perception was positively associated with perceived preparedness, intent to evacuate, and one of the actual preparedness measures. Perceived local government readiness was also positively related to perceived preparedness and an actual preparedness measure. Results for factors such as socio-demographics varied by dependent variable.

The authors stated that the study considered only the exposure to preparedness information and found that receiving multiple streams of information was associated with taking protective actions in one study area.

A sampling bias was preemptively identified and elaborated upon by the authors, as they stated that the response rate was likely to be low using their sampling method, and that Hispanic households would likely be underrepresented.

- The study found an overall low public awareness among Filipinos about climate change and noted regional variations. Additionally, previous experience with disasters, education level, and health status were all important associations that increased the odds of participation in disaster preparedness activities. Membership in a community organization was also a highly correlated factor with actions to prepare for disasters.

- There were no reported biases or limitation in this study. However, the authors elaborated on all research processes and explained the way sample representativeness was achieved.


- Results from in-depth mental models interviews with members of the public (N=28) and survey data from three counties in Florida (N=460) show that a large majority of respondents have some hurricane experience, which influences their thinking about storm impacts, individual actions to mitigate the hazard, and vulnerability to the hazard.

- To mitigate against sampling biases, the study authors utilized a third-party recruitment methodology that is designed to be representative of the United States (the GfK Knowledge Panel).
| Bott, L., & Braun, B. (2019). How do households respond to coastal hazards? A framework for accommodating strategies using the example of Semarang Bay, Indonesia. *International Journal of Disaster Risk Reduction, 37*, 101177. [https://doi.org/10.1016/j.ijdrr.2019.101177](https://doi.org/10.1016/j.ijdrr.2019.101177) | The study found that participatory capacity and self-organization were key factors in enabling communities to live in unstable environments. Because coastal hazards have become a normal element of life, people have found ways to accommodate to and hence live with floods, rather than retreating or gaining permanent protection. | There were no reported biases or limitations in this study. However, the authors discussed their data collection and analysis methods that consisted of data triangulation using quantitative survey data obtained from a third-party database, to substantiate findings from the focus group data. |
| Brodar, K. E., La Greca, A. M., Tarlow, N., & Comer, J. S. (2020). “My Kids Are My Priority”: Mothers’ Decisions to Evacuate for Hurricane Irma and Evacuation Intentions for Future Hurricanes. *Journal of Family Issues, 41* (12), 2251–2274. [https://doi.org/10.1177/0192513x20933931](https://doi.org/10.1177/0192513x20933931) | Mothers’ reported reasons for evacuating highlighted family and psychological factors as most critical in decision-making. Mothers who evacuated for Irma or experienced more Irma-related loss/disruption reported significantly greater intention to evacuate for future hurricanes than mothers who did not. Mothers prioritize the safety and comfort of their children and keeping their family together when deciding whether to evacuate. | A self-reporting bias was reported by the authors, as the stated that their study data came from retrospective reports that were collected three months after Hurricane Irma. Secondly, a selection bias was reported, with the authors stating that their recruitment method using Facebook may not represent mothers who do not use social media. |
| Brody, S. D., Highfield, W. E., Wilson, M., Lindell, M. K., & Blessing, R. (2017). Understanding the motivations of coastal residents to voluntarily purchase federal flood insurance. *JOURNAL of RISK RESEARCH, 20*, 6. [https://doi.org/10.1080/13669877.2015.1119179](https://doi.org/10.1080/13669877.2015.1119179) | Study findings indicated that a resident located outside the 100-year floodplain who had voluntarily purchased federal flood insurance could be characterized, on average, as more educated, living in relatively expensive homes, and a long-time resident who thinks about flood hazard relatively infrequently, but nonetheless, considers flood insurance to be relatively affordable. Unexpectedly, the physical proximity of a respondent to flood | The authors reported that the use of surveys could lead to limitations related to response rate, response biases, question framing, which could affect data reliability. The study survey response rate was 18% overall across the four sampled counties. |
hazard areas makes little or no discernible difference in the decision to obtain flood insurance.

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<tr>
<td>The study findings suggest that single-action bias plays a substantial role in intended coastal adaptation, whereby the odds of homeowners who have already implemented a modest-cost measure to insure and relocate in the future are 66% and 80% lower, respectively. The study also found that renters’ motivation to relocate is largely driven more by external issues such as crime, gentrification, and economic security than by flood hazard.</td>
</tr>
<tr>
<td>The authors stated that study findings were more biased towards upper middle-income homeowners and therefore there needed to be more research carried out that captured a more diverse, representative population to help generalize findings in the area.</td>
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</table>

The findings hereby reveal that the willingness to consider relocation is primarily influenced by the age of respondents, disaster exposure, level of experienced stress related to recovery, personal financial recovery concerns, future cost of living in high-risk area, concerns with increase in crime and future flooding, and disaster induced resource loss.

The author identified that the purely quantitative approach of the study lacked the ability to elucidate the bottom-up concerns raised by respondents, potentially limiting the input of the surveyed group who were considering relocation. Such findings could be relevant for the development of flexible relocation programs to accommodate identified needs. Secondly, the study was reported to have non-representative samples that prevalently represented oceanfront property owners to the negligence of other vulnerable coastal populations.


Study findings suggest that risk perception and self-efficacy have a positive significant influence on the intended behaviors of immediate evacuation. In addition, physical preparedness, tsunami-relevant knowledge and location perception serve as significant predictors of immediate evacuation intentions. Being female is positively associated with pre-evacuation behavioral intentions, encompassing checking

The authors reported having major study limitations such as low survey response rate (22.2%) which potentially affect the study's generalizability, along with survey nonresponse errors and measurement errors.
<table>
<thead>
<tr>
<th>Source</th>
<th>Summary</th>
<th>Limitations</th>
<th>Importance</th>
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</thead>
<tbody>
<tr>
<td>Cannon, C., Gotham, K. F., Lauve-Moon, K., &amp; Powers, B. (2021). From the general to the specific: the influence of confidence and trust on flood risk perception. JOURNAL of RISK RESEARCH, 24, 9. <a href="https://doi.org/10.1080/13669877.2020.1806909">https://doi.org/10.1080/13669877.2020.1806909</a></td>
<td>Using ordinal logistic regression, we find that residents who perceive the levee system as unlikely to protect their homes and the city are significantly more likely to perceive an increased risk of flooding. Previous flood experience, age, female gender, and race were also significant predictors of flood risk perception.</td>
<td>The authors reported significant study limitations related to the study of the multivariate variable of risk that considers behavioral and cognitive factors. They also reported that sampling bias was possible, because the study sample was only gotten from seven New Orleans neighborhoods and was therefore not generalizable to other new Orleans neighborhoods or to other regions.</td>
<td>High</td>
</tr>
<tr>
<td>Castaneda, V. J., Bronfman, N. C., Cisternas, P. C., &amp; Repettoz, P. B. (2020). Understanding the culture of natural disaster preparedness: exploring the effect of experience and sociodemographic predictors. NATURAL HAZARDS, 103, 2. <a href="https://doi.org/10.1007/s11069-020-04060-2">https://doi.org/10.1007/s11069-020-04060-2</a></td>
<td>The study's main results suggest that direct prior experience and higher frequency of exposure to earthquakes and tsunamis generate the highest level of preparedness. Furthermore, study results demonstrate the importance of studying and implementing preparedness activities in other contexts such as community and work.</td>
<td>The study authors admitted to the possibility of a self-reporting bias arising, due to the nature of the self-reported surveys. They also noted that the survey responses came from a single family members' experience and did not consider the lived experiences who may reside in their home, as well as any other related aspects of the hazard experience, such as physical and social implications of the hazard experience.</td>
<td>High</td>
</tr>
<tr>
<td>Reference</td>
<td>Summary</td>
<td>Importance</td>
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<td>-----------</td>
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<tr>
<td>Combest-Friedman, C., Christie, P., &amp; Miles, E. (2012). Household perceptions of coastal hazards and climate change in the Central Philippines. <em>Journal of Environmental Management, 112</em>, 137–148. <a href="https://doi.org/10.1016/j.jenvman.2012.06.018">https://doi.org/10.1016/j.jenvman.2012.06.018</a></td>
<td>Results indicate that perceived risk to coastal hazards is most affected by households’ spatial location and resource dependency, rather than socio-economic conditions. However, important differences exist based on the type of hazard and nature of risk being measured. Resource dependency variables are more significant in determining perceived risk from coastal erosion and sea level rise than flood events. Spatial location is most significant in determining households’ perceived risk to their household assets, but not perceived risk to their livelihood. The authors did not report any study limitations, but my assessment is that there is a possibility of overrepresentation of males primarily coastal fishermen in the sample, potentially affecting the study's generalizability.</td>
<td>Medium</td>
<td></td>
</tr>
<tr>
<td>Cope, M. R., Lee, M. R., Slack, T., Blanchard, T. C., Carney, J., Lipschitz, F., &amp; Gikas, L. (2017). Geographically distant social networks elevate perceived preparedness for coastal environmental threats. <em>Population and Environment, 39</em> (3), 277–296. <a href="https://doi.org/10.1007/s11111-017-0292-0">https://doi.org/10.1007/s11111-017-0292-0</a></td>
<td>Results from a random sample household survey of 928 coastal Louisiana residents confirm that perceived preparedness and resource adequacy for coping with environmental hazards is higher among those with strong support resources that are more than 2 h away from where they live, whereas access to support from local neighbors plays a lesser role. The authors reported a self-reporting bias that is possible due to the self-reporting of participants on their perceived preparedness levels. They also discuss the threat of bias that may occur due to their survey's low response rate of 9.5%. They however stated that the low response rate was at par with response rates of other larger survey research organizations (p. 291).</td>
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<td>Cuite, C. L., Shwom, R. L., Hallman, W. K., Morss, R. E., &amp; Demuth, J. L. (2017). Improving Coastal Storm Evacuation Messages. Weather, Climate, and Society, 9(2), 155–170. <a href="https://doi.org/10.1175/wcas-d-16-0076.1">https://doi.org/10.1175/wcas-d-16-0076.1</a></td>
<td>The results of this study highlight that evacuation messaging is a complicated issue, and the types of messages that work best depend on the goals of the communicator and the characteristics and perceptions of the message receiver. The study found that message wording had small but significant effects on evacuation intentions, which is consistent with previous research (Dow and Cutter 2002; Stein et al. 2010).</td>
<td>High</td>
<td>This study has several limitations. It was conducted online, using a hypothetical scenario, which lowers the ecological validity of the study. The authors also reported concerns of external validity due to their samples being from a limited geographical area.</td>
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<td>Czajkowski, Jeffrey. (2011). Is It Time to Go Yet? Understanding Household Hurricane Evacuation Decisions from a Dynamic Perspective. Natural Hazards Review. 12. 10.1061/(ASCE)NH.1527-6996.0000037.</td>
<td>Consequently, and most significantly, the dynamic framework is used to explore several relevant policy questions that plausibly affect the timing of household evacuations, sometimes providing the rationalization for seemingly counterintuitive post storm assessment evacuation results. For example, would building more and better shelters induce earlier evacuation? Or why does implementing contraflow cause some households to be less likely to evacuate? Thus, this analysis has begun to address the need for modeling hurricane evacuation behavioral responses in more precise and comprehensive ways, laying a foundation for continued development in this regard.</td>
<td>High</td>
<td>The author discusses the limitation that stems from the type of data captured from the dynamic model. The author states that the model only provides wherein the probability of injury based on the storm category is assumed to be the same across all injuries.</td>
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<td>DeYoung, S. E., &amp; Peters, M. (2016). My Community, My Preparedness: The Role of Sense of Place, Community, and Confidence in Government in Disaster Readiness. <em>International Journal of Mass Emergencies &amp; Disasters, 34</em> (2), 250–282. <a href="https://doi.org/10.1177/028072701603400204">https://doi.org/10.1177/028072701603400204</a></td>
<td>Preparedness self-efficacy and sense of community were found to be positive and significant predictors of preparedness. Risk perception was also found to be a partial mediator on preparedness self-efficacy with preparedness as the outcome variable. The authors reported the possibility of bias due to limitations related to measurement issues (scale development and reliability) and external validity (lack of generalizability to a diverse population). For example, the sample size was not representative, it consisted of predominantly white, and middle to high income participants.</td>
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<td>DeYoung, S. E., Wachtendorf, T., Davidson, R. A., Xu, K., Nozick, L., Farmer, A. K., &amp; Zelewicz, L. (2016). A mixed method study of hurricane evacuation: demographic predictors for stated compliance to voluntary and mandatory orders. <em>Environmental Hazards, 15</em> (2), 95–112. <a href="https://doi.org/10.1080/17477891.2016.1140630">https://doi.org/10.1080/17477891.2016.1140630</a></td>
<td>Quantitative analyses reveal that race was significantly associated with a lower stated evacuation threshold in both the bivariate and multivariate models and that previous refusal to comply with evacuation orders was associated with higher stated evacuation thresholds. Qualitative analyses reveal two key findings: (1) wind is perceived as more dangerous than water (rain and storm surge) associated with hurricanes; (2) traffic concerns were the most frequently cited reason listed for possible refusal to comply with evacuation orders. The authors report a generalizability bias that occurred due to the sample population being older, less racially diverse, and wealthier than the general population of North Carolina.</td>
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<td>Authors</td>
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<td>DeYoung, S. E., Wachtendorf, T., Farmer, A. K., &amp; Penta, S. C. (2016).</td>
<td>NOAA Radios and Neighborhood Networks: Demographic Factors for Channel Preference for Hurricane Evacuation Information. <em>Journal of Contingencies and Crisis Management</em>, 24 (4), 275–285. <a href="https://doi.org/10.1111/1468-5973.12123">https://doi.org/10.1111/1468-5973.12123</a></td>
<td>Results show that respondents reported they would use television and radio most frequently for gathering information about hurricane evacuation. Minority respondents reported more preference of the use of community or local government as information sources than white respondents, females gathered information from multiple channels more than males, and younger residents gathered information from multiple channels more than older respondents.</td>
<td>The authors discuss various limitations associated with the study that constrain the generalizability of the findings; firstly, that the study sample was older and mostly white.</td>
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<tr>
<td>DeYoung, S., Lewis, D., Seponski, D., Augustine, D., &amp; Phal, M. (2020).</td>
<td>Disaster preparedness and wellbeing among Cambodian and Laotian Americans. <em>Disaster Prevention and Management</em>, 29 (4), 425–443. <a href="https://doi.org/10.1108/DPM0120190034">https://doi.org/10.1108/DPM0120190034</a></td>
<td>Results from two multiple regressions revealed that sense of community and age contributed to well-being and were significant in the model, but with a negative relationship between age and well-being. Risk perception, confidence in government, confidence in engaging household preparedness and ability to cope with a financial crisis were significant predictors and positively related to disaster preparedness.</td>
<td>The authors report the possibility of a selective bias that could have occurred during the selection of research participants. The results only represent the indicators from people who heard about the research project or who are within the social networks of the community partners.</td>
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<td>Author(s)</td>
<td>Title</td>
<td>Abstract/Summary</td>
<td>Limitations/Study Limitations</td>
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<td>Elrick-Barr, C. E., &amp; Smith, T. F. (2022)</td>
<td>Current information provision rarely helps coastal households adapt to climate change. <em>SUSTAINABILITY, 14, 5.</em> <a href="https://doi.org/10.3390/su14052904">https://doi.org/10.3390/su14052904</a></td>
<td>Study findings show that passive information informs action in fewer than half of all households. Furthermore, even current attempts at more action-oriented information only informs coping strategies.</td>
<td>While the authors did not explicitly discuss any biases or limitations, they stated that the study was conducted in peri-urban coastal settings prior to the global pandemic and future research should extend to other coastal contexts (rural and city areas).</td>
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<td>Gowhar Farooq Wani, Ahmed, R., Syed Towseef Ahmad, Singh, A., Walia, A., Ahmed, P., Ashfaq Ahmad Shah, &amp; Riyaz Ahmad Mir. (2022)</td>
<td>Local perspectives and motivations of people living in flood-prone areas of Srinagar city, India. <em>International Journal of Disaster Risk Reduction, 82,</em> 103354. <a href="https://doi.org/10.1016/j.ijdrr.2022.103354">https://doi.org/10.1016/j.ijdrr.2022.103354</a></td>
<td>The qualitative data from personal interviews, conducted with the residents having previous flood experience was analyzed by using data-driven thematic approach – an iterative and reflective process – to develop five “key” themes reflecting lived experience. The themes include: (1) place attachment, (2) good living conditions, (3) adaptation to flooding, (4) sense of community, and (5) social harmony.</td>
<td>The authors discussed a study limitation that was due to an unprecedented circumstance - the Covid-19 pandemic. They explained that the pandemic affected sampling procedures and as a result, some residents who may have been better informed about flood threats but who were incapacitated by the virus or taking precautions, were unable to participate in the study, limiting the sample size.</td>
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| Results of the study show the explanatory power of the socio-psychological model, with important implications for public risk communication efforts. To motivate residents in flood-prone areas to take their share in damage prevention, it is essential to communicate not only the risk of flooding and its potential consequences, but also the possibility, effectiveness and cost of private precautionary measures. | The authors pointed out some limitations of the study. Notable among them were that although the study aimed at testing a causal model of flood damage prevention, the non-experimental and cross-sectional nature of the research design makes it inappropriate to infer causality. Secondly, because actual behavior was measured by self-reports of behavior, the authors opine that there is a possibility of self-reporting bias occurring. Lastly, a representation bias may have occurred due to the relatively small and locally restricted sample size, affecting generalizability. | High |

The data reveal that the risk perception scales measure psychometrically distinct constructs that are only significantly correlated with nonstructural mitigation. Moreover, contextual factors such as hazard information, hazard experience, hazard proximity, age, and home value have significant, but differing effects on the adoption of the three types of hazard adjustments.

The authors report that despite the study’s limitations using a cross-sectional survey design, study results highlight the lack of a single model to predict the adoption of several flood hazard adjustments. These results suggest that tailored outreach and information is needed to motivate the adoption of different types of flood hazard adjustments. This is especially important because increasing changes in the global climatic system are expected to produce flood threats of greater frequency and intensity.

High


This study drew two main conclusions from its exploration of the relationship between protective behavior, experience of flooding, and a range of beliefs about floods and flood protection. Firstly, whilst confirming the importance of risk perception for protective behavior, the analysis challenges the preeminence often accorded it in the literature, indicating that beliefs about the impact of protection measures on anxiety and feelings deserve more attention than they have previously received. Secondly, it suggests that the impact of experience might be understood

The authors discuss the representation bias that may have occurred due to the overrepresentation of retired and self-employed people and the underrepresentation of families with older children.

High
better by looking at the mediating role played by beliefs.

It has confirmed that even in high-risk areas, a lack of direct personal experience of flood events serves to attenuate understanding and to constrain motivation to take personal action. For sea-level rise, perceived responsibility to act is firmly transferred to others. In relation to both hazards there is strong confirmation of the impact of the processes by which people and groups learn, acquire and create interpretations of risk. Social networks provide important local sources of information often more important than official sources.


The authors note that given there are limitations of the Social Amplification of Risk Framework (SARF) that is used in the study. The authors note that "one problem with SARF has always been around its central metaphor of amplification and the sender message-receiver model of communication on which it rests which can appear to downplay the social construction of risk." However, the authors note that the framework is still able to offer at least a basic explanatory metaphor to gather evidence about people's experience.
understanding, and response to flooding and sea-level rise (p. 67).
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<th>Reference</th>
<th>Summary</th>
<th>Limitations</th>
<th>Methodological Issues</th>
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<tr>
<td>Haynes, K., Matalena Tofa, Avci, A., Jonathan van Leeuwen, &amp; Coates, L. 2018. Motivations and experiences of sheltering in place during floods: Implications for policy and practice. <em>International Journal of Disaster Risk Reduction</em>, 31, 781–788. <a href="https://doi.org/10.1016/j.ijdrr.2018.07.011">https://doi.org/10.1016/j.ijdrr.2018.07.011</a></td>
<td>The research identified a culture of sheltering during floods in these communities that is passed down through families and communities. Nuanced personal and locally specific factors influenced decisions to shelter, and official warnings and evacuation orders were often considered inaccurate or too late or disregarded due to ‘warning fatigue’. Findings also reveal that sheltering can be physically and psychologically challenging, and often involves actively defending people, property, and possessions from floodwaters.</td>
<td>The authors did not report any study limitations. They maintained transparency on their sampling processes, and it appears that the sample was representative of the areas they were collected from.</td>
<td>High</td>
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<td>Huang, S.-K., Lindell, M. K., &amp; Prater, C. S. (2017). Multistage Model of Hurricane Evacuation Decision: Empirical Study of Hurricanes Katrina and Rita. <em>Natural Hazards Review</em>, 18 (3), 05016008. <a href="https://doi.org/10.1061/(asce)nh.1527-6996.0000237">https://doi.org/10.1061/(asce)nh.1527-6996.0000237</a></td>
<td>An examination of this mediation model shows that a household's evacuation decision, as predicted, is determined most directly by expected wind impacts and expected evacuation impediments. In turn, expected wind impacts and expected hydrological impacts are primarily determined by expected storm threat and expected rapid onset. Finally, expected storm threat, expected rapid onset, and expected evacuation impediments are determined by households’ personal characteristics, their reception of hurricane information, and their observations of social and environmental cues.</td>
<td>The authors reported a response rate that was lower than 50% - 41.4%, which was within the range of other HRRC mail surveys. Because of this, they anticipated a representation bias, as the sample may have failed to represent some specific demographic categories. However, they triangulated their demographic data with the 2000 and 2010 census data and found them to be generally consistent with the average values. The authors also discussed the possibility of a self-reporting bias, with survey data collected months after evacuation had taken place.</td>
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The study found fewer significant predictors of perceived storm characteristics and more significant predictors of expected personal impacts and evacuation decisions than hypothesized. Also contrary to hypothesis, female gender, perceived storm characteristics, official warnings, and hurricane experience predicted departure times. However, as expected, evacuation rates declined with distance from the coast; unlike Hurricane Rita 3 years earlier, there was a very low level of shadow evacuation in inland Harris County. Finally, most households evacuated 2 days before landfall, between the time of the National Hurricane Center hurricane watch and warning, and evacuated overwhelmingly during the daytime hours.

The authors discussed the low response rate (40%) and the subsequent lack of a representative sample. However, upon triangulation of the demographic data, the authors only found an overrepresentation of homeowners.

The data show that cultural and social circumstances influenced the way in which residents perceived flood risk. The effectiveness of the communication was compromised by a disconnection between the largely specialized and technical nature of the information given and how residents interpreted it—or failed to understand it—when making their decisions on how to respond. This led to unintended and problematic consequences, especially regarding the urgency of individual decision-making in relation to the degree of risk, which often was underestimated.


While the authors did not note any validity concerns or study limitations, they reflected on their use of the scenario method which appeared to be the first of its kind in Greece to address household adaptation to coastal flooding.
<table>
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<th>Authors</th>
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<th>Summary</th>
<th>Study Quality</th>
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<tr>
<td>Landry, C., Turner, D., &amp; Petrolia, D. (2021)</td>
<td>Flood Insurance Market Penetration and Expectations of Disaster Assistance.ENVIRONMENTAL &amp; RESOURCE ECONOMICS, 79(2), 357–386.<a href="https://doi.org/10.1007/s10640-021-00565-x">https://doi.org/10.1007/s10640-021-00565-x</a></td>
<td>The study found that coastal households that exhibit positive expectations of disaster aid eligibility are 25 to 42 percent less likely to hold flood insurance. We estimate that charity hazard could be responsible for 817,000 uninsured homes in the United States corresponding to a loss of $526 million in forgone annual revenue for the National Flood Insurance Program.</td>
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<td>Lazo, J. K., Bostrom, A., Morss, R. E., Demuth, J. L., &amp; Lazrus, H. (2015).</td>
<td>Factors Affecting Hurricane Evacuation Intentions. Risk Analysis, 35 (10), 1837–1857.<a href="https://doi.org/10.1111/risa.12407">https://doi.org/10.1111/risa.12407</a></td>
<td>The study found that in both information conditions having an evacuation plan, wanting to keep one’s family safe and viewing one’s home as vulnerable to wind damage predict increased evacuation intentions. Results reinforce the value of focusing hurricane information efforts on evacuation plans and residential vulnerability and suggest avenues for future research on how hurricane contexts shape decision making.</td>
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<td>The authors raised a potential issue of sample representativeness and explained how they took steps to mitigate the risk, by testing for differences in means between subsampled data and the full data set, and then testing the equality of proportions through a combination of the two-proportions z-test and t-tests.</td>
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<td>While the authors did not explicitly state study limitations, they explained that due to differences in the geography of surveyed respondents in the tow study areas (majority of surveyed residents lived in evacuation zones Texas compared to Florida), sample representativeness may have been impacted. However, they explained that the differences in study findings warranted further research into the reasons for varying motivations for evacuation intentions, by location and motivation type.</td>
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<td>Lindell, M. K., Lu, J.-C., &amp; Prater, C. S. (2005). Household Decision Making and Evacuation in Response to Hurricane Lili. <em>Natural Hazards Review, 6</em> (4), 171–179. <a href="https://doi.org/10.1061/(asce)1527-6988(2005)">https://doi.org/10.1061/(asce)1527-6988(2005)</a> 6:4(171)</td>
<td>The results replicated previous findings on the sources of hazard information, evacuation concerns, and the timing of evacuation decisions. In addition, they provide new information about evacuation preparation times and the finding that household characteristics are uncorrelated with evacuation decision times or evacuation preparation times.</td>
<td>The authors raised the issues of a 50% response rate that was on par with other mail-in surveys with similar characteristics. However, they noted that the overrepresentation of some demographic variables could produce bias in other variables.</td>
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<td>Lindell, M. K., Prater, C. S., Gregg, C. E., Emma, Huang, S.-K., &amp; Wu, H. C. (2015). Households’ immediate responses to the 2009 American Samoa earthquake and tsunami. <em>INTERNATIONAL JOURNAL of DISASTER RISK REDUCTION, 12</em>, 328–340. <a href="https://doi.org/10.1016/j.ijdrr.2015.03.003">https://doi.org/10.1016/j.ijdrr.2015.03.003</a></td>
<td>The results show that earthquake shaking, combined with knowledge that this can cause a tsunami, was the most common source of first awareness about a possible tsunami and that broadcast media were the most common first social sources of warnings. Radio was an important source of additional information, as were face-to-face contacts and phone calls.</td>
<td>The authors mentioned the possibility of an overrepresentation of some demographic categories, as well as risk of bias inherent in respondents' self-reports of their actions ten months after hazard impact.</td>
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<td>Linnekamp, F., Koedam, A., &amp; Baud, I. (2011). Household vulnerability to climate change: Examining perceptions of households of flood risks in Georgetown and Paramaribo. <em>HABITAT INTERNATIONAL, 35</em> (3), 447–456. <a href="https://doi.org/10.1016/j.habitatint.2010.12.003">https://doi.org/10.1016/j.habitatint.2010.12.003</a></td>
<td>Results show a lack of city-wide organization and participative measures for the households concerned, with possible detrimental effects on lower-income households.</td>
<td>The authors elaborate a bit on their sampling process, and the steps they took to ensure that their samples were representative of the population. However, I feel that they did not elaborate or clarify their interview process enough, and did not address the possibility of self-reporting biases that could arise from respondent responses to interview questions, as well as the</td>
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The study found that (a) understanding of disaster and preparedness is contextual, (b) awareness of preparedness needs and actual plans among LIPs is inadequate, and (c) word of mouth is the preferred information source for linguistically isolated groups.

The authors discuss their sampling methods, and explain how they were able to capture a representative sample. They also reported satisfaction in the way their methods provided sufficient detail on important concepts that were related to the preparedness of LIPs.

Findings indicate that household disaster preparedness levels in NYC are high, especially regarding the acquisition of emergency supplies and communication resources. A trust in local government and assistance from one’s social network are the strongest predictors of general household preparedness.

The authors discuss the main study limitation, which is related to its modest predictive ability via the four-path model analysis. They go on to explain that the low predictive ability of the models is a design flaw - the applied questionnaire was not designed to predict disaster preparedness.
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<td>Meyer, M.A., Mitchell, B, Purdum, C.J., Breen, K, &amp; Iles, R. (2018). Previous hurricane evacuation decisions and future evacuation intentions among residents of southeast Louisiana. <em>International Journal of Disaster Risk Reduction, 31,</em> 1231–1244. <a href="https://doi.org/10.1016/j.ijdrr.2018.01.003">https://doi.org/10.1016/j.ijdrr.2018.01.003</a></td>
<td>Overall, the results indicate that most people will evacuate from strong storms, especially when ordered to do so. Future evacuation intentions correlated with previous evacuation decisions and corresponded to storm strength and official evacuation orders.</td>
<td>The authors describe the time order issue for the study of independent variables such as risk perception and previous experience as a study limitation. They also discuss the possibility of bias entering participant responses as the questionnaire had questions about the weaker storm, and asked respondents to indicate the likelihood of evacuating for the stronger storm.</td>
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| Mishra, S., Mazumdar, S., & Damodar Suar. (2010). Place attachment and flood preparedness. *Journal of Environmental Psychology, 30,* 2. https://doi.org/10.1016/j.jenvp.2009.11.005 | Overall, place attachment was found to significantly influence flood preparedness. Hierarchical regression analysis was performed to determine whether the three factors of place attachment influence flood preparedness. Controlling for confounding effects of age and family type, regression analysis revealed that people having genealogical and economic place attachment prepared for floods, but those with religious place attachment did not prepare for floods. | The authors stated that an overrepresentation of male respondents, reliance on literate household members, and not as many questions on religious place attachment may have introduced significant bias into the study, with implications for generalizability and validity. However, they state that these gaps provide an opportunity for future research. | High |

Parameters studied include the percentage of people who warn their neighbors, the efficiency of different official warning channels, and delay time to warn neighbors. Even with a low proportion of people willing to warn their neighbor, the results showed considerable impact on the overall warning dissemination.

The authors discuss the disadvantages of their software, which include its limited flexibility in generating output graphs by the user. The authors provided a solution to the issue by creating standard output reports to mitigate the issue. They also describe their process of limiting biases through the replication process using 10 cases.

This paper identified several independent variables whose effects on evacuation might interact with the effect of coastal residents. This result not only offers a strategy for improving disaster prevention, but also provides policymakers with some insights to intensify and improve emergency plan of preventing typhoon storm surge.

The authors noted that their study sample was not representative due to their sample being small (about 1% of the total population) and made up of majorly fishermen and seafood farmer groups.


In addition to the examination of evacuation influencing factors, this research attempted to categorize people into different groups based on their risk perception attitude and actions during evacuation. It noticed four types of people termed as serious, reluctant, undecided, and non-evacuee. Evacuation behavior or actions, factors leading to evacuation destination and final evacuation destination of all these four groups were identified.

The study found that content of

The authors noted that the sample population may not be representative, due to the higher number of male respondents than female ones. They also noted that evacuation orders were typically announced in mosques, when men frequent more often than women. This also skews survey responses about receiving evacuation orders, because men were more likely to receive the warning information than women in the study area. The authors also noted that a long time had passed between when Cyclone Aila happened, and when the

| Pan, A. (2020) | High |
cyclone warnings and evacuation orders, timing of evacuation orders, evacuation preparation time, people's risk perception, weather conditions, condition of roads and cyclone shelters, and finally the distance of cyclone shelters are important factors to influence people's evacuation decision and selecting evacuation destination.

 surveys were administered. While they were concerned about the possibility of self-reporting bias, they observed that respondents remembered events very well, and the onset matched the remarkable evacuation outcomes that were publicized before the study field research started.

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<td>The findings suggest that perceptions of hurricane risk and knowledge, past hurricane experience, proportion of neighbors with shutters, residing in coastal counties and counties subscribing to the South Florida Building Code, household income, and race/ethnicity are all significant determinants of shutter usage and envelope coverage.</td>
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<td>The authors state that the data is representative of households that reside in owner-occupied single family detached homes in Florida. This distinction is critical, as it facilitates the generalization of findings to a subset of the general population.</td>
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<td>Descriptive results show that many variables are considered in the decision to evacuate, but results from subsequent analyses, and respondents’ comments about their experiences, highlight that evacuation orders are the primary triggering variable for when residents left. The authors note that while the sample was not as representative of the general population as they would have liked, the sample still provides a useful case study of hurricane evacuees. They also noted that other limitations came up in the study because of decreasing survey rates over time, missing responses, and the overall monetary and time constraints of conducting survey research. They emphasized that these limitations could present opportunities for future research and more advanced methodological improvements to adequately investigate hurricane evacuation research.</td>
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<td>The findings suggest that policy makers need to give due consideration to how different ethnic groups understand and prepare for disasters, and to design disaster management and communication plans that cater for different language ability. The authors outline their efforts to obtain a representative and non-duplicative sample, including using staggered meeting times at different times of the day and inviting individuals from eligible households.</td>
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The results show that threat appraisal has mixed effects on the decisions by households to adopt a damage protection measure against flooding. With regards to coping appraisal, the study found that households who do not feel helpless about flooding in the neighborhood resort to some structural measures such as reinforcing their house against flood damage. The study also finds that socio-economic factors have an overall positive effect on protective behavior. Additionally, structural measures taken by the public sector to provide protection against damage from a flood are shown to complement the adoption of some specific private protective measures such as clearing drains and sandbagging by households.

Although the authors did not discuss any study limitations, they detailed the self-reporting that was done by survey respondents. There is typically a tendency for self-reporting bias to be introduced into the process, as well as social desirability biases that could make respondents answer questions in ways they deem to be socially acceptable.

In summary, these data fail to show evidence that the dramatic certain death warning increased expectations of surge threat and evacuation decisions. These findings underscore the need for those disseminating weather warnings to better understand how hurricane warnings flow from an initial source through intermediate links to the ultimate receivers as well as how these ultimate receivers receive, heed, interpret, and decide how to act upon those warnings.

The authors stated that one limitation of this study is that these data cannot definitively identify the specific cause of the disconnect between the certain death warning message and risk area. They speculated that the disconnect may have happened during the warning messaging processing stage, specifically in a possible conflict between the warning message and the receiver’s preexisting beliefs about hurricane wind threats. Another potential source of bias may come from the length of time between hurricane impact and data collection (between 6 to 9 years difference) and people’s fading memories of events, as well as the possibility of self-reporting biases.

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<th>Source: Author-developed, based on the systematic review data</th>
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The results suggest that emergency management plans ought to promote the dispelling of rumors that weaken the effect of emergency communication, promote non-emergency outreach to peripheral populations through community groups, and promote better, basic, non-technical, Spanish-language media through mainstream conduits (i.e., the most watched non-Spanish television channels) that do not require high-tech devices or advanced understanding of visual media tools. The authors elaborated on the challenges the study faced due to the transient nature of the survey respondents, making it hard to get a reliable representation of the undocumented population represented by the study's sample. Also, the authors noted that the face-to-face nature of the interview may have made it harder for some respondents to be candid due to the fear of local authorities or deportation.
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SELECTED PUBLICATIONS
