DETERMINANTS OF INTENTION TO ENGAGE IN FLOOD MITIGATION BEHAVIORS: AN ANALYSIS OF STUDENT RESPONSE AT TEXAS STATE UNIVERSITY

by

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I. INTRODUCTION

The purpose of this study was to investigate the influence of threat perception, coping appraisal, hazard knowledge, and previous flood experience on intention to engage in flood mitigation among university students living in high-risk flood areas. The independent variables for this study were used to create an expanded theoretical framework derived from the Protection Motivation Theory (PMT; Rogers & Prentice-Dunn, 1997). The use of PMT facilitated research to identify how risk reduction behavioral action and efficacy beliefs may inform risk management (Tanner & Árvai, 2018).

Significance of the Problem

Research disseminated from global organizations such as The United Nations Office for Disaster Reduction, Global Disaster and Alert Coordination System, Relief International and the World Health Organization all report increased activity of natural disasters that put the global population at risk (Black, 2017; Tanner & Árvai, 2018; United Nations, 2019). Thus, the need to understand how individuals perceive their own personal threat and are aware of the consequences of living in high-risk flood areas is vital for increasing resiliency and the likelihood of mitigation behaviors among college students.

This study focuses on students who attend and live on the campus of Texas State University and the surrounding city of San Marcos, Texas. The university has a large enrollment of over 38,000 students and is situated in an area of south-central Texas commonly referred to as “Flash Flood Alley.” (LCRA, 2020). Therefore, it is imperative to understand how students perceive their own personal risk and how they act to

minimize risk during major flood occurrences, as many of the locations in and around the campus are designated as high risk flood areas. High risk flood areas, also known as Special Flood Hazard Area(s) (SFHA), are defined by FEMA (2018, pp. 2) as, "the area that will be inundated by the flood event having a 1 percent chance of being equaled or exceeded in any given year. The 1 percent annual chance flood is also referred to as the base flood or 100-year flood". FEMA also uses alphabetical characters to identify the level of risk in each flood zone. A-zones are known to be highly hazardous, which includes houses that are characterized by being near bodies of water that are subject to rising waters (Hays County, 2019). Due to the nature of these flooding hazards, all homes in A-zones are required to have homeowner flood insurance (Hays County, 2019). FEMA has identified other flood zones such as X, which have minimal risk and does not require homes to have flood insurance, and D, which are areas that do not have any current studies on risk, but have the potential to flood (Hays County, 2019).

FEMA has recently redrawn and released updated floodplain maps for Hays County, which indicate majority of San Marcos, especially around the Blanco River and Spring Lake, are highly hazardous and in the 1 pecent annual flood chance (FEMA, 2019). The redrawn maps could play a part in helping identify areas that would be the most hazardous and would need the most attention due to the hazardous nature of some locations in high-risk flood plains. Locating students that are considered to be at-risk helps with the understanding of how they perceive their risk from potential flood occurrences and how much information and knowledge needs to be disseminated to increase their level of threat perception and intention to engage in mitigation behaviors.

Risk perception is associated with vulnerability and evacuation behaviors and can

most often be influenced by perceived risk and prior experience with disasters (Tanner & Árvai, 2018). Recent studies have examined how risk perception of natural disasters will affect a populations' decisions to evacuate or institute mitigation behaviors based on how highly they perceive the risk of living in that area (Fatti & Patel, 2013; Tanner & Árvai, 2018). Slovic and colleagues suggested there is a relationship between emotional experience, threat perception, and mitigation behaviors (Siegrist & Gutscher, 2008, pg. 772, as cited in Finucane et al., 2000; Slovic et al., 2002, 2004). Certain groups of people may portray higher risk perception because they are more vulnerable, which could be seen among individuals who live within high risk flood plains or in areas that are at higher risk every year to experience natural disasters. However, the latter could be true, which could show that individuals who are more vulnerable may not present higher risk perception. Emotional experience can influence threat perception, and ultimately mitigation behaviors, by connecting emotional experiences with possibly traumatic ones that can be experienced during a flooding incident. The same results can be seen as stated above, that individuals who experience flood incidences may present higher threat perception and engage in mitigation behaviors. However, individuals who have multiple emotional experiences due to flooding may be more likely to be seen with higher threat perception but are less likely to engage in mitigation behaviors. An example of this might be seen in individuals who have emotional experiences with the mitigation behaviors themselves, and the emotional experienced tied to them may not benefit them.

Engaging in mitigation behaviors and perceiving flood risk can be associated with the presence of increased risk-taking behaviors among college students. Students, now free of parental supervision and faced with new moral obligations, can be seen to engage

more often in risky behaviors (Schneider & Morris, 1991). Students may present a lowered threat perception if they are likely to engage in risky behavior, because of the lack of concern with consequences due to flooding, and the presence of risky behaviors.

Theoretical Approach

This study was guided by the Protection Motivation Theory (PMT) (Rogers & Prentice-Dunn, 1979). The use of the PMT framework (Figure 1) guided research to identify how risk reduction behavioral action and efficacy beliefs will influence behavioral intention among college students residing in high risk flood areas. Coping appraisal includes variables such as self-efficacy and response efficacy to determine the effectiveness and capabilities among at-risk individuals to engage in mitigation behaviors. Tanner and Árvai (2018) additionally hypothesized that "coping appraisal will result in lower levels of [threat] perception". Lower levels of threat perception can be seen due to the individuals experiencing a higher sense of efficacy in terms of personal mitigation and preparedness behaviors.

All constructs within PMT were utilized and examined during this study. Perceived threat and severity and vulnerability create perceived threat, which consists of the threat that an individual perceived during a certain event. Self-efficacy, which is the individual's belief in their ability to successfully complete mitigation behaviors, and response efficacy, which encompasses the individual's belief that the mitigation behavior will be effective, creates coping appraisal (Westcott et al., 2017). The model used for this study expands upon PMT to include previous flood experience and hazard knowledge. The introduction of these two constructs encompasses previous literature that describes links between experience and knowledge to influence behavioral intention. Previous

flood experience is the experience of any flooding events students have faced. Hazard knowledge is the knowledge students have on the consequences of flooding and about specific response strategies for themselves and from the university.

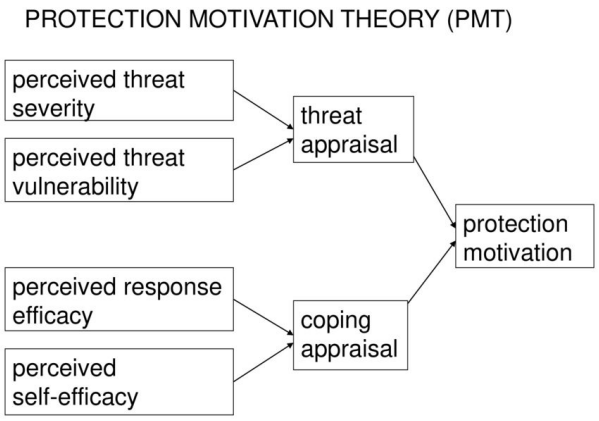

Figure 1: Protection Motivation Theory (PMT; Rogers & Prentice-Dunn, 1997).

Research Questions

The following research questions were used to understanding factors associated with intention to engagement in flood mitigation behaviors among college students who live in a high-risk flood area, the following research questions will be analyzed:

- To what extent does previous flood experience influence the knowledge of hazards in university students?
- To what extent does previous flood experience influence coping appraisal in university students?
- To what extent does previous flood experience influence perceived threat of flooding in university students?

- To what extent does hazard knowledge influence coping appraisal in university students?
- To what extent does hazard knowledge influence perceived threat of flooding in university students?
- To what extent does previous flood experience influence the intention to engage in flood mitigation behaviors for university students?
- To what extent does coping appraisal influence the intention to engage in flood mitigation behaviors for university students?
- To what extent does perceived threat influence the intention to engage in flood mitigation behaviors for university students?

Assumptions

For this study, it was assumed that all participants in the final sample were university students. Additionally, it was assumed that all individuals involved understood the risks and were able to answer the survey honestly based on their perception and experiences. It was assumed that students answered items within the survey honestly. It was assumed that all survey items were written as to be understood and could easily be interpreted by the respondents. It was also assumed that students would be able to answer questions based on accurate recollection of previous flooding experiences.

II: LITERATURE REVIEW

Introduction

Individuals and communities worldwide are often faced with natural disasters and hazards that affect and interrupt their everyday normalcy. Understanding how individuals perceive the risk of experiencing a natural disaster and analyzing how perception is influenced by factors such as experience, knowledge, and efficacy can lead to better mitigation efforts and to understanding gaps in knowledge and perception. Attempting to influence behavior change among students is crucial to understanding threat perception among students and encourage mitigation behaviors. This study sought to understand the level of influence certain constructs of PMT and behavioral factors have on students' ability and intention to engage in mitigation behaviors due to the nature of flooding in San Marcos, TX.

History of Natural Disasters

Natural disasters and natural hazards can be dated back to ancient times, when civilizations were overwhelmed with earthquakes, floods, and plagues that had the ability to wipe out significant number of people in these civilizations (Barclay, 2010; Coulston & Deeny, 2010; Pappas, 2018). The most notable disasters and hazards in our history take place when such mitigation and preparedness measures were not thought of in terms of safety for their people. The eruption of Mt. Vesuvius in Italy in 79 CE, which remains an active volcano in today's age, is an example of civilizations being notified about the impending disaster and not taking any subsequent action (Barclay, 2010; Pappas, 2018). One of the first floods recorded happened when the Yangtze River in China crested and peaked in 1931 (History, 2009a). The Yangtze River flood was captured and recorded for

specificity about the characteristics of the flood and the effect on the community. The areas south of China where the Yangtze River runs was overwhelmed by a densely saturated river basin area, from previous downpours, that set the stage for a major flood when the rains hit again in July 1931 (History, 2009b). The rains in July flooded over 500-square miles, ruining rice fields and other resources dependent upon by major cities surrounding the area. The first domestic flood recorded in the United States was in Johnstown, New England in 1889 (History, 2009a). The dam built upriver from Johnstown was overwhelmed by excess rainwater, and one of the spillways of the dam had become clogged, which resulted in the dam collapsing (History, 2009a).

Characteristics of Flooding

Flooding is when floodplains have "prolonged rainfall over several days, intense rainfall over a short period of time, or a debris jam causes a river or stream to overflow and flood the surrounding area" (NOAA, 2019; USGS, 2018). The increase in urbanization in some areas can contribute to the increased flooding due to the decreasing ability to absorb rainfall and increasing the amount of runoff that will flood low-lying areas (Douglas et al., 2008; Du et al., 2019; Fatti & Patel, 2013; USGS, 2018). Any area of land, whether it has become urbanized or not, that border a body of water is considered a floodplain (USGS, 2013). If an area in these floodplains begin to urbanize and buildings are built within the plain, the flood hazard increased due to the restriction of flood water run-off and the increased likelihood that run off will flood and cause damage to any adjacent property in that same area (USGS, 2013).

Additionally, flooding in areas such as coastal regions are due to tropical storms, hurricanes, or storm surges caused by these systems. A tropical cyclone is "a rotating

low-pressure system [with] organized thunderstorms but no fronts" (NOAA, 2018). A hurricane is formed when a tropical cyclones maximum sustained winds have increased and exceeded 74 mph (NOAA, 2018). Storm surge is increased water levels and tides above the predicted levels due to the direct or indirect presence of a storm (NOAA, 2019). Though flooding from hurricanes and storm surge are of most threat to vulnerable areas in coastal region, subsequent flooding can occur in nearby residential and urbanized areas if the storm were to move and stay stationary over land (Shao, Gardezi & Xian, 2018). This was seen as a result of Hurricane Harvey in 2017, when the hurricane moved onto land and the rotating low-pressure storm remained stationary over Houston, TX causing devastating amounts of rain that resulted in tremendous flooding (National Weather Service, 2019).

Background on San Marcos, TX Flooding

The most notable flooding in San Marcos, TX happened in October 1998. The flooding occurrences during this month spread from Central to South Central Texas, with many major towns and cities seeing the effects of 2 hurricanes in the Gulf. The hurricanes brought 30 inches of rain to areas from Austin to south of San Antonio, with a majority of areas seeing at least 15 inches within 36 hours (NOAA, 1998). A mix of both a low-pressure system near Austin with the forming and outer bands of Hurricane Madeleine, the Guadalupe River peaked at over 477,000 cubic feet of water (NOAA, 1998).

Recent flooding events that show the increased likelihood of flooding in San Marcos happened in what is dubbed the "Memorial Day Flood" in 2015. The Memorial Day Flood was followed by the "All Saints Day Flood", on October 30th, 2015. The Memorial Day Flood was preceded by one of the wettest months recorded, which was

followed by 6-10 inches of rain spread across the Central Texas Region on May 23rd (NOAA, 2015a). NOAA (2015a) stated that "The [Blanco] river rose 5 feet every 15 minutes" and had crested at 41 feet by 1 am. On October 30th, San Marcos and surrounding areas were still continuing to recover from the Memorial Day flood when a severe warm front dropped an excess of 15 inches, in some areas. The result flooded an already saturated area in San Marcos with more rainfall and excessive velocity, resulting in flooding over October 30th and 31st (NOAA, 2015b).

Impact on Human Behaviors

Previous flood experience can play a critical role in perceiving actual risk (Shao, Gardezi, & Xian, 2018; Gotham et al., 2018; Siegrist & Gutscher, 2006), resiliency (Cutter, Ash, & Emrich, 2014; Fatti & Patel, 2013), adopting mitigation behaviors (Whitmarsh, 2008; Thistlethwaite et al., 2018; Siegrist & Gutscher, 2008), increasing knowledge about hazards (Ghanbarpour, Saravi, & Salimi, 2014), understanding vulnerability (Tanner & Árvai, 2018) and household adjustments (Brody, Lee, & Highfield, 2017). Populations with past hazard experience may understand and acknowledge the risks that flooding, whether it be coastal or flash flooding, and will be more likely to adopt mitigation strategies. Additionally, this population will be more likely to adhere to preparedness messages and act in response to it (Whitmarsh, 2008; Bodoque et al., 2019). Previous flood experience can also be attributed to an individuals' perceived vulnerability, or the actual vulnerability of a population (Greene, Paranjothy, & Palmer, 2015).

The differences between perceived and actual risk can determine whether individuals will adopt mitigation and preparedness efforts to ensure their safety. If

individuals perceive risk, the likelihood that they will adopt these efforts is decreased because they do not understand that risk to be plausible (Horney et al., 2010; Shao et al., 2017). Individuals living in high-risk floodplains may not have high perceived risk due to the misunderstanding or lack of knowledge of the location of the floodplain and the risk that is associated with it (Ghanbarpour, Saravi, & Salimi, 2014; Horney et al., 2010). However, other studies have shown that individuals who live in high-risk flood areas are able to understand and make mitigation efforts because they have increased knowledge about their risk and evacuation plans because of the high-risk (Siegrist & Gutscher, 2006). Individuals who have been exposed to natural disasters in the past with little to no damage or effect will likely have less perceived risk, which results in reduced likelihood of adopting mitigation and preparedness efforts (Shao et al., 2017).

Increasing knowledge about hazards can be attributed to the seeking of risk management information by vulnerable and at-risk populations. Griffin, Dunwoody, & Neuwirth (1999) explained risk information seeking behaviors to be those of individuals who are attempting to fill their own perceived or actual gaps in their knowledge of risk. Increasing knowledge about overall hazards can also include increasing knowledge about floodplains, especially high-risk flood plains, flood evacuation designations, and mitigation behaviors (Horney et al., 2010; Kellens, Zaalberg, & De Maeyer, 2012). An additional factor in risk information seeking behaviors is ensuring that individuals know where and how to access this information. Individuals that have flood risk should know where to gather information before, during, and after the disaster, to increase the level of resiliency (Coulston & Deeny, 2010). Understanding and utilizing the knowledge from the population living in these areas can also positively influence the types of information

disseminated and the best methods of disseminating information to these communities (Coulston & Deeny, 2010).

Theoretical Framework

Protection Motivation Theory (PMT) has frequently been used in previous literature, most often seen regarding fears and attitudes of the population being studied. PMT is most often used to determine the motivation within individuals to protect themselves based on the constructs within PMT; perceived threat and coping appraisal (Plotnikoff & Trinh, 2010). PMT can also be seen in studies looking at cancer prevention (Courneya & Hellsten, 2010), rehabilitation adherence and physical activity (Brewer et al., 2003; Plotnikoff et al., 2009), and even studies about technology and security (Chenoweth, Minch, & Gattiker, 2009; Crossler, 2010; Crossler & Bélanger, 2014; Meso, Ding, & Xu, 2014; Vance, Siponen, & Pahnila, 2012). Westcott et al., (2017) used PMT to evaluate the effect of protection across various groups of people in regard to bushfires. Bubek et al., (2017) additionally used PMT to study flood preparedness decisions based on social vulnerability in Germany and France. Additionally, Westcott (2018) analyzed how to use PMT to normalize preparedness within the public health sector. Based on previous studies that have used PMT, as well as specific studies that focus on mitigation behaviors and flooding, indicate that PMT is the best theoretical framework to be used for this study.

Contributions to the Literature

The most pressing deficiency the hazards research literature, in terms of this study, is the paucity of research that addresses risk perception, level of knowledge, and behavior response among college students, specifically. The literature does focus on how

using risk perception can increase the likelihood of engaging in mitigation behaviors; however, this study aims to identify and explain how increasing threat perception, hazard knowledge, and coping appraisal might lead to further behavior change in all aspects of protective action (mitigation, preparedness, response and recovery)in high-risk flood areas. This research contributes to the hazards literature in a deeper understanding of the concept of behavioral intention and threat perception that has diverse meanings and applications in multiple settings. In this study, threat perception, hazard knowledge, previous flood experience, and coping appraisal were used to gain insight on how students attending a university might engage in mitigative action during a major flood event.

III: METHODOLOGY

Introduction

This section serves to outline and discuss the methodological approach for this project. The processes required for subject selection, pilot testing procedures, and statistical analyses are detailed below to provide insight to the specifics of this project. The methodology outlined will seek to answer the research questions, including:

- To what extent does previous flood experience influence the knowledge of hazards in university students?
- To what extent does previous flood experience influence self-efficacy in university students?
- To what extent does previous flood experience influence perceived threat of flooding in university students?
- To what extent does hazard knowledge influence self-efficacy in university students?
- To what extent does hazard knowledge influence perceived threat of flooding in university students?
- To what extent does previous flood experience influence the intention to engage in flood mitigation behaviors for university students?
- To what extent does self-efficacy influence the intention to engage in flood mitigation behaviors for university students?
- To what extent does perceived threat influence the intention to engage in flood mitigation behaviors for university students?

IRB Approval

This project was approved by the Texas State University IRB on December 4, 2019.

Participants

Participants were enrolled as a student at Texas State University during the Spring 2020 semester and maintained enrollment throughout the course of the study. All places of residence, including on and off campus housing, were included. All classifications were eligible to participate, including undergraduate, graduate, and doctoral students. Students currently enrolled at Texas State University were utilized in the initial sampling frame before a randomized sampling distribution was used to identify possible participants.

Survey Development

A 51-item electronic survey to measure demographic variables, perceived threat, coping appraisal, hazard knowledge, and previous flooding experience was administered in February 2020. Items for the survey were adapted from previous surveyed items, including directed research from previous Texas State University students, and published literature (Boysen, 2011).

During the pilot phase of this project, participants were recruited by their enrollment in several Public Health, Exercise and Sports Science, and Geography courses. The goal was to pilot in approved courses to obtain feedback on the items and variability in the respondents for readability of the items. Instructors for the courses were contacted directly in order to obtain approval to administer the pilot survey during their class time. If the instructor agreed to grant time allotted to administer the pilot survey, the

student researcher explained the purpose of the study, as well as provided instructions on how to access the electronic survey. The electronic survey included the informed consent form which allowed students to proceed with participation. Students had the option for voluntary participation and were not penalized for deciding to not participate. The instructors did not participate in the pilot study.

Pilot surveys were administered between December 2019 and January 2020 to test reliability and validity of survey questions to evaluate the effectiveness of the survey. The pilot survey was also used to test readability of the survey questions in order to determine whether the correct language and terminology was used in order for the question to be comprehended. After approval was gained from classes used for the pilot, the researcher attended one public health course to administer the pilot study. A total of 44 students participated in the pilot test, which included both undergraduate and graduate students. Due to unforeseen circumstances, the pilot study had to be administered to the graduate Geography course via email, without meeting in person. Since the pilot study was administered at the end of the Fall semester, the pilot was unable to be administered in additional Public Health or Exercise and Sports Science courses.

Focus groups were initially going to be used to discuss the items and the experience of the survey. Due to time constraints due to finals and the end of the Fall semester, one focus group was held in the Public Health course that was attended by the researcher. The email sent to participants also outlined the confidentiality and anonymity of their answers within the survey items. Following the survey completion, focus group questions were asked about the overall survey and specific questions about the items and their readability. All notes from the focus group were taken and used to revise the survey

items.

The pilot survey was sent to Qualtrics to test the readability in an electronic format. The first page of the survey online included instructions on how to answer the items in the survey. The guidelines for confidentiality to keep respondents identify and information confidential was outlined verbally before the survey began. For the final project, an email that was sent to potential participants that briefly outlined the instructions for the survey and confidentiality of the answers given by participants. The email contained a link for participants to click on that redirected them to complete the survey. The email sent to prospective participants included a link that would imply consent if participants clicked to start the survey.

Reliability analyses were conducted for items and constructs included in the pilot survey. Table 1 details the Cronbach Alpha scores for each construct. Each of the constructs demonstrated a strong reliability score, which indicated that the instrument was strong overall. Cronbach reliability analyses indicate acceptable alpha values for most constructs, except for behavioral intention (a=.657), self-efficacy (a=.558), response efficacy (.532). Despite these constructs having lower Cronbach scores, they were kept as items in the survey in order to appropriately assess students based on the theoretical framework. Some items from the initial survey (54 items) were deleted, reworded, or moved within the survey, resulting in a total of 51 items for the final survey. Items that were able to be misconstrued or did not make sense to the focus group participants were either reworded or removed from the final survey. Other items were moved within the scales based on the readability and the context of the preceding questions being asked. Reliability analyses were used to determine the reliability and validity of the items before

completing the final survey.

Table 1: Reliability Analyses for Pilot Survey

Variable	Cronbach Alpha
Perceived threat	.867
Flood Experience	.751
Behavioral Intention	.657
Hazard Knowledge	.813
Self-efficacy	.558
Response efficacy	.532

Following the pilot study, several items were edited or deleted due to participant confusion or reiteration of items that could be answered by other items. Cronbach alpha statistics and factor analysis were used to assess the reliability and validity of survey scales. Following the pilot test, based on feedback from student focus groups and reliability and validity estimates, a total of 3 items were removed to create the final survey. A scale for coping appraisal was used in the pilot survey but was deleted because the information and data for coping appraisal was accurately captured from self-efficacy and response efficacy. Items in the behavioral intention, self-efficacy, and response efficacy scales were reworded to more accurately convey what was attempting to be captured from student responses. Each item was used as an individual question, which was an edit from the pilot study that listed one overarching question, with mitigation behaviors listed individually to be answered.

Actual risk was determined through an overlay of FEMA's floodplain map of San Marcos, TX, on top of the basic map of the same area. Individuals living within the 100-year floodplain was at "high-risk", with other classifications of risk dependent upon their location to hazardous floodplains. Actual risk was used to determine the risk of students living within San Marcos city limits due to restrictions of floodplain maps and access to

GIS mapping. Within the survey that was administered, participants were asked to indicate their place of residence that is considered to be their hometown, as well as their current place of residence. The responses were taken and displayed visually on a map that will dictate actual risk.

Several ordinal, 5-point Likert-type scales were used in this study to measure perceived flood risk, hazard knowledge, and coping appraisal. A nominal scale was used to determine whether the respondent had experienced different circumstances in their lifetime. Demographic questions utilized nominal, ordinal, and interval based on the type of question being asked. Sex, rental status of home, location of rental, and type of rental used a nominal scale, whereas academic class status, and race/ethnicity were ordinal. Age and the locations of city/town were interval/ratio.

Variables

The variables included in this study were hazard knowledge, previous flood experience, coping appraisal (self-efficacy and response efficacy), perceived threat, and behavioral intention. These variables were viewed as being independent, mitigating, or dependent, depending on the theorized relationship between the variables identified in the theoretical framework.

Measures

Self-efficacy

For this study, self-efficacy refers to the students' belief that they can engage in mitigation behaviors and be successful. The self-efficacy scale was measured using an ordinal 5-point Likert scale with 1 indicating not very able and 5 indicating extremely able. The scale includes 4 items, including questions determining the extent that

respondents feel they are able to successfully perform specific mitigation behaviors (lifting furniture, making a preparedness kit, etc.). The overall scores range from 4-20 with 4 indicating very low self-efficacy and 20 indicating very high self-efficacy.

Response Efficacy

For this study, response efficacy is defined as the belief students have about the effectiveness of mitigation behaviors. The response efficacy scale was also be measured using an ordinal 5-point Likert scale with 1 indicating not very effective and 5 indicating extremely effective. This scale consists of 4 items and will include questions about whether respondents deem the specific mitigations behaviors (lifting furniture, making a preparedness kit, etc.) to be effective when implemented. The overall scores range from 4-20 with 4 indicating very low response efficacy and 20 indicating very high response efficacy.

Previous flood experience

Previous flood experience was measured using a dichotomous nominal measure with 0 indicating "no" and 1 indicating "yes". The dichotomous scale will include 6 items asking about specific experiences respondents may have encountered (losing power for 1 or more days, unable to travel to school, etc.) The overall scores range from 0-6; 0 indicating no previous flood experience, and 6 indicating more flood experience.

Threat Perception

Threat perception was measured on an ordinal 5-point Likert scale with 1 indicating not very likely and 5 indicating very likely. This scale including 7 items that asked respondents to indicate whether they believe certain events in response to flooding will occur while they are attending Texas State University. Sample questions include,

"how likely do you think it is that you will experience major damage to your parked vehicle because of a flood", etc. The overall scores range from 7-35; 7 indicating very low threat perception, and 35 indicating very high threat perception.

Hazard Knowledge

Hazard knowledge and information was measured using an ordinal 5-point Likert scale with 1 indicating not informed and 5 indicating very informed. The scale includes 4 items asking respondents how well they are informed about consequences of floods and response strategies (intrapersonal or from the University). The overall scores range from 4-20; 4 indicating very little hazard knowledge and 25 indicating very high hazard knowledge.

Behavioral Intention

Behavioral intention was measured on an ordinal 5-point Likert scale with 1 indicating not very likely and 5 indicating very likely. This scale includes 4 items asking respondents whether they intend to perform specific mitigation behaviors (lifting furniture, making a preparedness kit, etc.) in the event of a flood. The overall scores range from 4-20; 4 indicating very low intention and 20 indicating very high intention.

Hazard Information

Hazard information is measured on a dichotomous scale, where 1 indicates not preferred and 2 indicates preferred. The hazard information scale was a culmination of different types of information dissemination methods that could be used to receive and access flood information. Respondents were asked if different types of media were their preferred method of receiving flood information.

Data Collection

To begin the study phase, students were randomly selected to receive the email to request participation in the electronic survey. The student researcher and the faculty advisor requested access to student emails from the Office of Institutional Research using the procedures from the student list management tool. A stratified randomized sampling function using the Microsoft Excel randomization function was utilized to select students from the list of emails that were sent the survey link for participation. The emails with the participation link was sent to 15,000 students identified from the randomized sampling frame. Due to restrictions within Outlook and student status, emails had to be sent out in 250 increments, not exceeding 1,000 emails in an hour. The first round of 15,000 emails sent out was completed within a week, based on the restrictions outlined above. After 2 weeks of collecting responses, another 15,000 emails were sent as a follow up to request participation if the students had not already completed the survey. The same restrictions applied to the second round, and 250 email increments were used to send 1,000 emails per hour.

Data collection, including pilot tests, began in December 2019. Data collection for the final project and thesis defense started in February 2020. A survey instrument evaluating self-efficacy, hazard knowledge, and previous flooding experience, and perceived flood threat sought to understand intention to engage in flood mitigation behaviors among respondents. The survey sought to understand the level of perceived threat from university students that live on and off campus. Additionally, the research project sought to understand the differences in perceived risk based on place of residence and in relation to their actual risk based on physical address. The survey instrument was

administered to selected participants that were identified as on and off campus via email requesting participation. The pilot survey was administered to graduate and undergraduate students that are accessible and can test readability, validity, and reliability before finalizing the instrument. Survey answers were recorded and transferred for statistical analysis via SPSS version 26.

All identifiable information was kept on a password protected document that was located on Udrive, a server secured by Texas State University. All residential and place of residence information was kept on an additional secured document that will also be password protected and saved on Udrive. The documents were stored on the faculty advisor's secured computer. During focus groups, verbal consent was given by any participants that shared their experience or feedback about the survey before any focus group questions were asked. Participants were able to not participate in the discussion without repercussions. The document containing email addresses and identifiable information, as well as residential information, was destroyed after survey completion. Any information that would lead to the possible identification of the respondent was replaced by neutral terms or other codes before analyzing the data. All data analyzed by the researcher was edited to remain neutral to protect the identity of respondents and maintain their privacy. No attempt was made to use IP addresses to identify participants. The feature to identify and access IP addresses was turned off within Qualtrics.

During the study phase, email addresses were kept confidential, and the responses were anonymous. All responses and email addresses were input into secured password protected documents that was be accessible by the researcher. These protected documents were kept on the faculty advisor's secured computer. Any information that could have led

to the possible identification of the respondent was replaced by neutral terms or other codes before analyzing the data. All data analyzed by the researcher was edited to remain neutral to protect the identity of respondents and maintain their privacy. No attempt was made to use IP addresses to identify participants. The feature to identify and access IP addresses was turned off within Qualtrics.

Data Analysis

Threat perception refers to the amount of threat students perceived in regard to flooding occurrences, and the current perception of the possibility of flooding in San Marcos. Past flood experience is the number of flooding occurrences students have experienced, and specific barriers that are presented during a flood (not being able to go to school, losing power, etc.). Hazard knowledge is the amount of knowledge students have about flooding and if they informed about consequences of flooding and strategies to remain safe. Coping appraisal is a combination of both self-efficacy and response efficacy. Self-efficacy is the capability of individuals to engage in behaviors and be successful; and response efficacy is whether students believe the behavior they are engaging in to be effective. Behavioral intention is the likelihood students will engage in flood mitigation behaviors.

Survey items and responses were analyzed with SPSS v.26 descriptive and inferential statistics. Descriptive and inferential statistics were used to analyze themes and relationships between the independent and dependent variables. The theoretical framework (*Figure 1)* was used to perform statistical analyses to evaluate relationship between independent and dependent variables. The relationships evaluated included those between threat perception of flood risk, past flood experience, coping appraisal, and

hazard knowledge, and the impacts on likelihood or intention of engaging in mitigation behaviors.

Frequencies and descriptive statistics were calculated to determine central tendency and variability for model variables. Reliability analyses and Cronbach alpha statistics were conducted for each construct, which is detailed along with additional descriptive statistics in Table 2.

Bivariate regression analyses were used to investigate each of the research questions and help to understand relationships between each variable as independent and dependent variables. The bivariate regression analyses provided insight into the effect of each independent variable outlined in Figure 2 and the impact it has on the other variables individually. Multiple linear regression analyses were also used to examine the influence perceived threat, hazard knowledge, previous flood experience, and coping appraisal on behavioral intention. Two models were used to explore these relations; Model 1 (Table 6) included perceived threat, hazard knowledge, previous flood experience, and coping appraisal as independent variables and behavioral intention as the dependent variable. Model 2 (Table 7) included perceived threat, hazard knowledge, previous flood experience, and coping appraisal (self-efficacy and response efficacy) as independent variables and behavioral intention as the dependent variable.

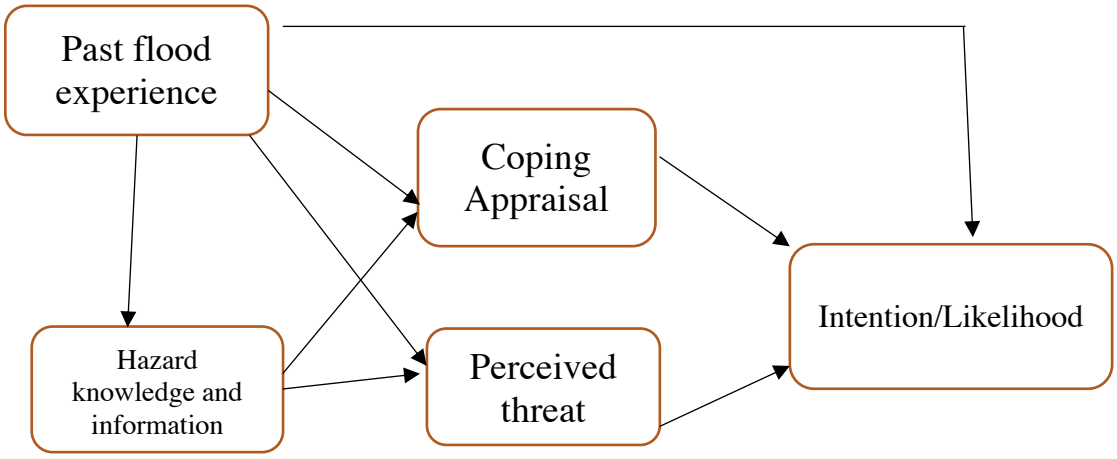

Figure 2. Adapted PMT model used to test relationships of independent and dependent variables.

IV. RESULTS

Ninety-seven of 498 respondents completed less than half of the survey; therefore, these cases were removed, resulting in a sample of 401. Remaining missing data for respondents who remained in the sample were coded as -9 to indicate missing data in SPSS. Most participants were female (67.6%), White (Non-Hispanic; 55.6%) and either a Senior (23.2%) or Post Grad (25.4%). Table 1 details further demographic responses from student respondents.

Table 2: Descriptive Statistics of Student Respondents

	N=401	**%**
Sex		
Male	92	22.9
Female	271	67.6
Class Status		
Freshman	40	10
Sophomore	56	14
Junior	74	18.5
Senior	93	23.2
Post Grad	102	25.4
Race/Ethnicity		
White (Non-Hispanic)	223	55.6
White (Hispanic Origin)	101	25.2
Black or African American	28	7.0
American Indian or Alaskan Native	1	.2
Asian	8	2.0
Native Hawaiian or Other Pacific Islander	1	.2
Current Living Situation		
On Campus (dorm)	60	15
On Campus (rent)	6	1.5
Off Campus (rent)	222	55.4
Off Campus (own)	77	19.2
Age		
17-20	135	33.7
21-24	125	31.2
25+	99	24.7

Descriptive analyses were conducted for all independent variables, including separate constructs for self-efficacy, response efficacy, and coping appraisal. Perceived

threat indicated that respondents reported a slightly lower (M=13.8) perception of threat based on items scaled 1-5 for 7 total items. Hazard knowledge was low (M=9.1) when measured on a scale from 1-5 for 4 items. Both self-efficacy (M=16.9) and response-efficacy (M=15.3) indicated high coping appraisal overall on a scale from 1-5, with 4 items for each variable. Coping appraisal had the highest overall score (M=32.3), which resulted in the sum of both self-efficacy and response efficacy results. Behavioral intention was also relatively high (M=13.7) on a scale of 1-5 for 4 items. Cronbach reliability analyses indicate acceptable alpha values for most scales, with the exception of previous flood experience (a=.634) and behavioral intention (a=.641). Table 3 details Mean, Standard Deviation, and Cronbach Alpha scores for all variables for all constructs.

Table 3: Descriptive and Reliability Analyses for Independent Variables

Variable	M	SD	Cronbach Alpha
Perceived Threat	13.8	5.5	.862
Hazard Knowledge	9.1	4.2	.876
Previous Flood Experience	2.2	1.6	.634
Self-efficacy	16.9	3.3	.734
Response efficacy	15.3	3.3	.705
Coping Appraisal	32.3	5.4	.785
Behavioral Intention	13.7	3.7	.641

Table 4: Respondents Preferred Source for Receiving Flood Information

Variable	F		%	
	Preferred	Not Preferred	Preferred	Not preferred
Local News	293	72	73.1%	18%
Local Radio	228	137	56.9%	34.2%
Weather Website	352	12	87.8%	3%
University News	314	48	78.3%	12%
Bobcat Alert	232	130	57.9%	32.4%
Emergency Phone Notifications	327	32	81.5%	8%
Newspaper	81	284	20.2%	70.8%
Contacting family and friends	296	68	73.8%	17%

Table 4, continued

Social Media (Family & Friends)	279	86	69.6%	21.4%
General Social Media	287	77	71.6%	19.2%

Preferred Source of Information

Frequencies were used to determine the most preferred method of communication among student respondents. Majority of students indicated that looking at weather websites (the Weather Channel, etc.) was the most preferred (87.8%). Receiving emergency phone notifications was the second most preferred method of communication (81.5%), followed closely by respondents stating that they prefer to contact their family and friends directly for information (73.8%). Social media platforms (71.6%) and contacting family and friends via social media (69.6%) were also among the highest reported method of information reception. These results indicate that students prefer to seek information from credible sources, such as weather websites and notifications sent to their phone from the National Weather Service. However, contacting family and friends, as well as social media, describe three of the highest rated information reception methods, indicating that though students do check credible sources for information, the default is to seek information from family and friends. Results of this study demonstrate this finding by showing that hazard knowledge is one of the strong predictors of behavioral intention, but perceived threat is not. Receiving information from family and friends may contribute to increased knowledge about hazards in regard to responding to a flood occurrence, but this method of information reception does not influence their threat perception.

Research Questions

Bivariate regression analyses were used to test the strength of relationships and influence of constructs as independent and dependent variables, depending on the research question. Each research question is presented below with results from the bivariate regression analyses.

Q1: To what extent does previous flood experience influence the knowledge of hazards in university students?

Bivariate regression analyses were used to determine the extent flood experience influences hazard knowledge in student respondents. Q1 explained only 7.2% of variance between flood experience and hazard knowledge and presented one of the stronger relationships between the two variables (ß=.269) among the other research questions. Q1 showed that there is little variance explained for hazard knowledge by previous flood experience, and flood experience was a weak predictor of whether students have increased hazard knowledge.

Q2: To what extent does previous flood experience influence self-efficacy in university students?

Q2 focused specifically on the influence of previous experience on self-efficacy based on previous literature identifying self-efficacy alone as being a strong predictor of behavioral intention (Tanner & Árvai, 2018). Based on bivariate regression analyses, Q2 explained only 1% of variance in self-efficacy due to previous flood experience. Previous experience was also shown to be a weak predictor (ß=.099) of self-efficacy. These results can be attributed to lower efficacy due to flood experience, however, this would most likely have resulted in an inverse relationship. Q2 overall shows that students who may

have higher self-efficacy most likely is not attributed to previous flood experience.

Q3: To what extent does previous flood experience influence perceived threat of flooding in university students?

Bivariate regression analyses concluded that previous flood experience explained 9.5% of variance in perceived threat of flooding. However, flood experience is shown to be a stronger predictor (ß=.309) of perceived threat. Based on the results shown in Table 2, flood experience can be considered to be an influential predictor of perceived threat in students. Students who have experienced flooding occurrences in the past will be more likely to perceive a threat of flooding than students who do not have flood experience.

Q4: To what extent does hazard knowledge influence self-efficacy in university students?

Similar to Q2, only self-efficacy alone was used to evaluate the extent of influence from hazard knowledge in students. Q4 shows that hazard knowledge explains 2% of variance in self-efficacy among student respondents. Hazard knowledge is also a weak predictor of self-efficacy (ß=.140). The results conclude that students who have more knowledge do not necessarily feel capable enough to successfully carry out mitigative behaviors. This research concludes that in order to increase self-efficacy for mitigation behaviors, hazard knowledge cannot be the only target of change.

Q5: To what extent does hazard knowledge influence perceived threat of flooding in university students?

Q5 concluded that hazard knowledge was one of the overall weakest predictors of perceived threat (ß=.037), and only explained .1% of variance. An inverse relationship can be seen in the adjusted R^2 (-.001). The analysis shows that students who do not have

hazard knowledge are less likely to perceive threat of flooding in San Marcos. As seen in Model 1, hazard knowledge is one of the strongest predictors of behavioral intention, but perceived threat is not a strong predictor. This conclusion shows that students with hazard knowledge have more intention to perform mitigation behaviors, whether or not they perceive a threat of flooding.

Q6: To what extent does previous flood experience influence the intention to engage in flood mitigation behaviors for university students?

Bivariate regression analyses for Q6 show that flood experience explains 1.7% of variance in behavioral intention. It is also shown to be a weak predictor of behavioral intention (ß=.129). These results are consistent with results from multivariate regression analyses in Models 1 & 2, concluding that previous flood experience does not influence students within their intention to engage in mitigation behaviors.

Q7: To what extent does self-efficacy influence the intention to engage in flood mitigation behaviors for university students?

Self-efficacy alone was used to evaluate the extent of influence on behavioral intention in students. Bivariate analyses for Q7 showed that self-efficacy alone explained 15.8% of variance in behavioral intention. Additionally, self-efficacy has a strong relationship and is a strong indicator (ß=.398) for behavioral intention in student respondents. Q7 resulted in the strongest relationship between the independent and dependent variables, and the most variance was explained between variables. Based on the results, self-efficacy is seen to be the strongest predictor of behavioral intention among all research questions, which is also outlined in Models 1 & 2. The models, mentioned previously, show that stronger relationships with behavioral intention are

explained by response efficacy, and then collectively with coping appraisal.

Q8: To what extent does perceived threat influence the intention to engage in flood mitigation behaviors for university students?

Bivariate regression analyses for Q8 exhibit only .1% of variance explained by perceived threat in relation to behavioral intention. Perceived threat (ß=.035) demonstrated the weakest relationship with behavioral intention, and among all other research questions. Q8 was the only other research question to have an inverse relationship explained with the adjusted R^2. The results provide insight that student respondents who perceive no threat are not likely to engage in flood mitigation. Furthermore, the results show that student respondents do not perceive a threat of flooding within San Marcos or at their current locations, and therefore are less likely to engage in mitigation behaviors when faced with a flood occurrence.

Table 5: Bivariate Regression Analyses for Research Questions

Variable	R	R square	Adjusted R square	Beta
RQ1	.269	.072	.720	.269
RQ2	.099	.010	.007	.099
RQ3	.309	.095	.093	.309
RQ4	.140	.020	.017	.140
RQ5	.037	.001	-.001	.037
RQ6	.129	.017	.014	.129
RQ7	.398	.158	.156	.398
RQ8	.035	.001	-.001	.035

Two models were also used to examine the influence of all independent variables, collectively on university students' intention to engage in flood mitigation behavior. Model 1 consisted of independent variables perceived threat, hazard knowledge, flood experience, self-efficacy, response efficacy, and dependent variable behavioral intention. Multiple linear regression results for Model 1 indicated the independent variables

accounted for 52.3% of variance in behavioral intention.

Multiple linear regression analyses for Model 1 illustrated strong relationships between students' behavioral intention and their self-efficacy, response efficacy, and hazard knowledge, all of which were statistically significant. Response efficacy (ß=.588) demonstrated the strongest relationship to behavioral intention among respondents in Model 1. This demonstrates that among the students who responded, the majority place value in the effectiveness of mitigative behaviors, in addition to their knowledge of hazards and their ability to successfully carry out the behaviors. Previous flood experience was the only variable inversely related to behavioral intention in Model 1 (ß=-.017) indicating respondents with greater flood experience were less likely to engage in mitigative behavior, which could also be associated with a lack of perceived threat (ß=.041).

Multiple linear regression analyses were also used for Model 2. Model 2 indicated that the independent variables accounted for 68.3% of variance in behavioral intention. Results suggest that coping appraisal (ß=.616) and hazard knowledge (ß=.222) are the strongest predictors of behavioral intention. This is consistent with Model 1, resulting in coping appraisal, which is the combination of self-efficacy and response efficacy, remaining the strongest predictor of behavioral intention. Perceived threat (ß=.064) remains a weak predictor of behavioral intention, and previous flood experience (ß=-.024) suggests an inverse relationship for intention. Hazard knowledge and coping appraisal are the only constructs to be statistically significant. Model 2 suggests that the introduction of coping appraisal results in a weaker relationship with behavioral intention than response efficacy alone, as shown in Model 1. Model 2 shows perceived threat

among students is low, and previous flood experience may result in students not engaging in mitigative behaviors due to past experiences. Students with high coping appraisal and more hazard knowledge, overall, are more likely to engage in mitigation behaviors. The inverse relationship between previous flood experience and behavioral intention may suggest that students who have previous flood experience are less likely to engage in the behaviors because of familiarity, or experience in underwhelming effects of flood occurrences.

Table 6: Model 1 (R^2=.523; df=5; F=80.031)

Variable	**ß**	**b**	**t**	**Sig.**	**95% confidence**
Perceived Threat	.041	.028	1.072	.284	-.023-.078
Hazard Knowledge	.226	.195	5.956	.000	.131-.260
Previous Flood Experience	-.017	-.040	-.434	.664	-.223-.143
Self-efficacy	.158	.181	4.071	.000	.093-.268
Response efficacy	.588	.644	15.215	.000	.561-.727

Table 7: Model 2 (R^2=.683; df=4; F=80.150)

Variable	**ß**	**b**	**t**	**Sig.**	**95% confidence**
Perceived Threat	.064	.042	1.567	.118	-.011-.096
Hazard Knowledge	.222	.192	5.538	.000	.124-.260
Previous Flood Experience	-.024	-.056	-.573	.567	-.249-.137
Coping Appraisal	.616	.421	15.893	.000	.369-.473

V. DISCUSSION

Protection Motivation Theory served as the framework for the theoretical model used in this study to evaluate the likelihood of students would engage in flood mitigation behaviors based on intrapersonal and environmental variables, based on variables such as perceived threat, flood experience, hazard knowledge, and coping appraisal. Results indicated intention to engage in flood mitigation behavior was mostly explained by response efficacy, coping appraisal, and hazard knowledge. Perceived threat and previous flood experience were weak indicators of behavioral intention. Findings from this study indicate that response efficacy and coping appraisal are the greatest indicators of intention to engage in flood related mitigative behaviors.

Previous literature has focused on various sample groups, such as homeowners, individuals living in high-risk areas, and older adults (Fatti & Patel, 2013; Tanner & Árvai, 2018). This study adds to the literature by examining flood mitigation behaviors among a less studied population, college students, who offer a unique perspective on flood mitigation by introducing new demographics and attitudes that may only exist within college students. This study also introduced current living situation as a new variable, since previous literature shows differences between flood perception in individuals who own homes, and those that rent (Thistlethwaite et al., 2018). Previous literature has also found self-efficacy to be the most influential factor for engaging in mitigation behaviors, which was supported by the results of this study; however, findings from this study also provided a new perspective on coping appraisal and how response efficacy plays a role in the value that college students place on the effectiveness of mitigation behaviors.

The majority of respondents claimed that receiving information directly from family and friends was the most preferred method of dissemination. However, students indicated that the overall preferred methods of information seeking are from credible sources like weather websites and emergency phone notifications. These results coincide with the strength of relationship between hazard knowledge and behavioral intention, as well as the overall lack of threat perception. This can be attributed to the information being incorrect or a lack of knowledge by the family and friends that is then passed to the students, which ultimately could result in low threat perception. The lack of perceived threat, as well as the preferred method of information seeking behavior, can also be explained by previous flood experience. Additional literature explains the link between previous flood experience and perception of threat to be lower due to the expectations and history with flooding events, and higher self-efficacy for mitigation behaviors since those individuals have the experienced flood occurrences before. Experienced individuals may not see the importance of mitigation behaviors when they have experience flooding events before because they were able to remain safe. However, the opposite can also be seen with individuals who do not have experience, and the effect on perceiving threat of flooding. Because these individuals do not have experience with flooding, they are less likely to perceive the true threat of flooding.

Tanner & Árvai (2018) theorized that evacuation behaviors are increased in people who have higher perceived threat and previous experience. However, this study indicated that perceived threat and previous experience to be the weakest predictors of mitigation behaviors among student respondents. Many other studies found that individuals who have more flood experience are more indicative of people adopting

mitigation behaviors, and even resulting in an increase in hazard knowledge (Ghanbarpour, Saravi, & Salimi, 2014; Siegrist & Gutscher, 2008; Thistlethwaite et al., 2018; Whitmarsh, 2008). The study results also contradicted previous study findings, due to flood experience being one of the weakest indicators and having an inverse relationship with behavioral intention. Students in this study were also found to have increase hazard knowledge, which proved to be a significant indicator in understanding and perceiving a threat of flooding in high risk flood plains (Horney et al., 2010; Kellens, Zaalberg, & De Maeyer, 2012). However, this study showed that students do not perceive a threat of flooding despite living in a high-risk flood plain, but students also indicated having increased hazard knowledge overall.

This study adds to evidence indicating that coping appraisal and response efficacy are the most influential factors for flood mitigation behavior. Future research should focus on identifying mechanisms and strategies for improving coping appraisal among university students. Additionally, understanding the influence of situational awareness and how this may play a role in the understanding of hazards and perception of threat for anticipated threat can further information flood mitigation behavior interventions. Intervention strategies can be created and implemented to increase awareness, knowledge, and provide more helpful resources to help students become proactive in seeking information on what to do for the next flooding event. Universities can also utilize the information from this study to understand where the gap in knowledge is in their students and how they can create resources and be more involved in mitigation strategies that protect all students.

APPENDIX SECTION

APPENDIX A

This email message is an approved request for participation in research that has been approved or declared exempt by the Texas State Institutional Review Board (IRB).

I am a graduate student here at Texas State University that is conducting research about flooding in high-risk areas and behavioral intention. We are looking at behavioral intention for mitigation behaviors in the event of a flood, like the ones we often see her at Texas State University. We want to understand the perception of threat for students who live in high-risk areas, and the influence of several determinants on behavioral intention.

Participation is voluntary. The survey will take approximately 10 minutes or less to complete.

This study involves no foreseeable serious risks. We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please leave the answer blank. Your responses are anonymous.

Reasonable efforts will be made to keep the personal information in your research record private and confidential. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team, the funding agency (remove funding agency if study is not funded), and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants.

Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

To ask questions about this research please contact Sara Smith at sas291@txstate.edu or Dr. Jeff Housman at housman@txstate.edu. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Denise Gobert 512-716-2652 – (dgobert@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).

APPENDIX B

Sara Smith, a graduate student at Texas State University, is conducting a research study to identify the determinants of behavioral intention to engage in flood mitigation behaviors. You are being asked to complete this survey because you are currently enrolled at Texas State University.

Participation is voluntary. The survey will take approximately 30 minutes or less to complete.

This study involves no foreseeable serious risks. We ask that you try to answer all questions; however, if there are any items that make you uncomfortable or that you would prefer to skip, please leave the answer blank. Your responses are anonymous.

Reasonable efforts will be made to keep the personal information in your research record private and confidential. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants.

Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

If you have any questions or concerns, feel free to contact Sara Smith or her faculty advisor:

Sara Smith, graduate student
Health and Human Performance
281.467.0800
sas291@txstate.edu

Dr. Jeff Housman, Professor
Health and Human Performance
512.245.1314
housman@txstate.edu

This project #6945 was approved by the Texas State IRB on December 4th, 2019. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Denise Gobert 512-716-2652 – (dgobert@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 - (meg201@txstate.edu).

If you would prefer not to participate, please do not fill out a survey.

If you consent to participate, please complete the survey.

APPENDIX C

INTERVIEW/FOCUS GROUP SCRIPT

Study Title: Determinants of intention to engage in flood mitigation behaviors: An analysis of students at Texas State University

Principal Investigator: Sara Smith

Co-Investigator/Faculty Advisor: Jeff Housman

Sponsor:

Investigator will collect consent forms.

Sample for focus groups:

"Welcome and thank you for participating in this focus group."

Modify per your needs

"The purpose of this focus group is to understand your perceptions of risk while living in a high-risk flood area, as well as get your feedback on the electronic survey you completed recently. This focus group will help facilitate conversations about the readability of questions, as well as any additional feedback you have about the content of the items and the overall study project.

I appreciate any and all feedback and questions you have about the study. I hope you go over any issues that arose while taking the pilot test, whether it be confusion on questions, or technical issues with the electronic items. The blank sheets of paper that were given at the beginning of the survey that you filled out will help with the facilitation of discussion to identify common problems during the survey experience.

"We'd like to remind you that to protect the privacy of focus group members, all transcripts will be coded with pseudonyms and we ask that you not discuss what is discussed in the focus group with anyone else."

"The focus group/will last between 30 minutes to an hour and we will record the discussion via to make sure that it is recorded accurately."

"Do you have any questions for us before we begin?"

APPENDIX D

Focus Group Questions

1. Was the language used in the items easy to read and understand throughout the survey?
2. Were the questions outlined in a way that the transition from one question to the next was clear?
3. Did the survey provide information that will influence your future encounters with flooding while at Texas State?
4. What are some of the strengths within the survey? Are you able to offer any areas of development for the study phase?
5. Were there any sections of the survey that were unclear, or you feel as though they should be edited for clarity?

APPENDIX E

Pilot Survey

1. What location do you consider to be your hometown?
    a. City/Town/County: _____
    b. State: _____
    c. Name of Neighborhood, Community, or Rural Area: _____

2. What city/town do you live in now (your current residence)?
    a. City/Town/County: _____
    b. Name of Neighborhood, Community, or Rural Area: _____
    c. State: _____
    d. How long have you lived in this city/town? _____

3. This question refers to your current location, which may, or may not be your permanent home address. Would you say that the number of flooding incidents that have impacted your local San Marcos community have decreased, stayed the same, or increased as in the past?

    Decreased Stayed the same Increased
    Not sure

4. How high or low would you rate your risk of flooding in your current residence?

    1 2 3 4 5
    None Average High

5. How many times have you experienced flooding while living in your current residence?

    0 1 2 3 4 5+

6. How many times have you experienced flooding in your lifetime (i.e. have you ever experience a flood)?

    0 1 2 3 4 5+

7. For the years that you plan to attend Texas State University, how likely do you think it is that you will experience any of the following inconveniences due to a flood at your current place of residence? On a scale of 1 to 5, where 1 is "Not Very Likely" to 5 "Extremely Likely", please circle your response:

    a. major damage to property (i.e. trees, landscaping, pools, etc.)

    1 2 3 4 5

    Not very likely Extremely likely

    b. major damage to your parked vehicle

    1 2 3 4 5

    Not very likely Extremely likely

    c. power outages for a day

    1 2 3 4 5

    Not very likely Extremely likely

    d. power outages for more than a day

    1 2 3 4 5

    Not very likely Extremely likely

    e. inability to travel to classes

    1 2 3 4 5

    Not very likely Extremely likely

    f. inability to obtain food and basic necessities

    1 2 3 4 5

    Not very likely Extremely likely

    g. damage to your personal property (clothes, electronics, furniture, etc.)

    1 2 3 4 5

    Not very likely Extremely likely

8. In your lifetime, have you experienced any of the following due to a floor occurrence? Please circle 1 for "YES" or 2 for "NO"

    a. My personal property was damaged

    1 2

b. My vehicle, or means of transportation, was damaged in a flood

1 2

c. My immediate family had property damaged in a flood

1 2

d. I experienced disruption from the university that kept me from attending classes

1 2

e. I had to evacuate my residence due to a flood occurrence

1 2

f. Other people that I felt close to (family, friends, coworkers) have been affected (property damage, evacuation) by flooding

1 2

9. How confident do you feel you can complete the following in the event of a flood? On a scale of 1 to 5, where 1 is "Not Very Capable" to 5 "Extremely Capable", please circle your response:

a. I am capable of taking personal action to keep myself safe during a flood

1 2 3 4 5

Not very capable Extremely capable

b. It is worth the effort to take personal action aimed at lowering my risk of future flood damage

1 2 3 4 5

Not very capable Extremely capable

c. I am knowledgeable about the range of personal actions I could take in order to lower my risk of future flood damage1 2 3 4 5

Not very capable Extremely capable

d. I am motivated to take action in order to lower my risk of future flood damage.

1 2 3 4 5

Not very capable Extremely capable

10. How well do you think you are informed about this information as it relates to flood occurrences? On a scale of 1 to 5, where 1 is "Not Informed" to 5 "Very Informed", please circle your response:

a. The consequences of river floods/flash floods

1 2 3 4 5

Not informed Very Informed

b. The strategies to reduce damage to your home due to flooding

1 2 3 4 5

Not informed Very informed

c. The response strategies from the University in regard to flooding

1 2 3 4 5

Not informed Very Informed

d. The response strategies from the University in regard to flooding

1 2 3 4 5

Not informed Very Informed

11. In the event of a flood, how likely will you be to take these actions when faced with a major flood? On a scale of 1 to 5, where 1 is "Not Very Likely" to 5 "Extremely Likely", please circle your response:

    a. lift furniture and belongings from the floor

    1 2 3 4 5

    Not very likely Extremely likely

    b. check media for evacuation notices

        i. 1 2 3 4 5

        Not very likely Extremely likely

    c. evacuate your premises

        i. 1 2 3 4 5

        Not very likely Extremely likely

    d. use a homemade emergency preparedness kit (prescription medicine, water bottles, first aid supplies, etc.)

        i. 1 2 3 4 5

        Not very likely Extremely likely

12. Of the several measures that a person can take to protect the household from flood damage listed above, please tell me, how effective do you consider these measures to be? On a scale of 1 to 5, where 1 is "Not Very Effective" to 5 "Extremely Effective", please circle your response:

    a. lift furniture and belongings from the floor

1 2 3 4 5

Not very effective Extremely effective

b. check media for evacuation notices

i. 1 2 3 4 5

Not very effective Extremely effective

c. evacuate your premises

ii. 1 2 3 4 5

Not very effective Extremely effective

d. Prepare/create homemade emergency preparedness kit (prescription medicine, water bottles, first aid supplies, etc.)

iii. 1 2 3 4 5

Not very effective Extremely effective

13. To what extent are you or a member of your household able to actually carry out the measures listed below?

a. lift furniture and belongings from the floor

1 2 3 4 5

Not very able Extremely able

b. check media for evacuation notices

i. 1 2 3 4 5

Not very able Extremely able

c. evacuate your premises

i. 1 2 3 4 5

Not very able Extremely able

d. Prepare/create a homemade emergency preparedness kit (prescription medicine, water bottles, first aid supplies, etc.)

i. 1 2 3 4 5

Not very able Extremely able

14. For each of the following media types, please check the box that indicates your preference as an information source during a hurricane or flood.

	Preferred	**Useful**	**Not Preferred**
a. Watching local news or weather			
b. Hearing information on local radio			
c. Checking for updated on weather-related			
~~d.~~ websites (National Weather Service, Accuweather)			
e. Looking for notifications by E-mail			
f. Checking the Bobcat Campus ALERT app			
g. Looking for other emergency notifications on my phone			
h. Reading newspaper stories about the flood			
i. Directly Contacting friends/family			
j. Indirectly communicating with friends/family (social media) Viewing general social media postings by anyone			
k. experiencing the flood			

15. What is your academic class status?

16. a) Freshman b) Sophomore c) Junior d) Senior e) Graduate Student
Other _____

17. What is your age? _____
18. What is your sex?
i. Male Female

19. What is your race/ethnicity?
i. White (Not-Hispanic)
ii. White (Hispanic Origin)
iii. Black or African American
iv. American Indian or Alaskan Native
v. Asian
vi. Native Hawaiian or Other Pacific Islander

20. How would you best describe your current living situation?

a. On campus (dorm)
b. On campus (rent)
c. Off campus (rent)
d. Off campus (own)

APPENDIX F

Study Survey

1. What location do you consider to be your hometown?
    e. City/Town/County: _____
    f. State: _____
    g. Name of Neighborhood, Community, or Rural Area: _____

2. What city/town do you live in now (your current residence)?
    h. City/Town/County: _____
    i. Name of Neighborhood, Community, or Rural Area: _____
    j. State: _____
    k. How long have you lived in this city/town? _____

3. This question refers to your current location, which may, or may not be your permanent home address. Would you say that the number of flooding incidents that have impacted your local San Marcos community have decreased, stayed the same, or increased as in the past?

    Decreased Stayed the same Increased
    Not sure

4. How high or low would you rate your risk of flooding in your current residence?

    1 2 3 4 5
    None Average High

5. How many times have you experienced flooding while living in your current residence?

    0 1 2 3 4 5+

6. How many times have you experienced flooding in your lifetime (i.e. have you ever experience a flood)?

    0 1 2 3 4 5+

7. For the years that you plan to attend Texas State University, how likely do you think it is that you will experience any of the following inconveniences due to a flood at your current place of residence? On a scale of 1 to 5, where 1 is "Not Very Likely" to 5 "Extremely Likely", please circle your response:

   a. major damage to property (i.e. trees, landscaping, pools, etc.)

   1 2 3 4 5

   Not very likely Extremely likely

   b. major damage to your parked vehicle

   1 2 3 4 5

   Not very likely Extremely likely

   c. power outages for a day

   1 2 3 4 5

   Not very likely Extremely likely

   d. power outages for more than a day

   1 2 3 4 5

   Not very likely Extremely likely

   e. inability to travel to classes

   1 2 3 4 5

   Not very likely Extremely likely

   f. inability to obtain food and basic necessities

   1 2 3 4 5

   Not very likely Extremely likely

   g. damage to your personal property (clothes, electronics, furniture, etc.)

1 2 3 4
5
Not very likely
Extremely likely

8. In your lifetime, have you experienced any of the following due to a floor occurrence? Please circle 1 for "YES" or 2 for "NO"

    a. My personal property was damaged

    1 2

    b. My vehicle, or means of transportation, was damaged in a flood

    a. 2

    c. My immediate family had property damaged in a flood

    a. 2

    d. I experienced disruption from the university that kept me from attending classes

    a. 2

    e. I had to evacuate my residence due to a flood occurrence

    a. 2

    f. Other people that I felt close to (family, friends, coworkers) have been affected (property damage, evacuation) by flooding

    a. 2

9. How well do you think you are informed about this information as it relates to flood occurrences? On a scale of 1 to 5, where 1 is "Not Informed" to 5 "Very Informed", please circle your response:

    a. The consequences of river floods/flash floods

    1 2 3 4 5

Not informed Very Informed

b. The strategies to reduce damage to your home due to flooding

1 2 3 4 5

Not informed Very informed

c. The response strategies from the University in regard to flooding

1 2 3 4 5

Not informed Very Informed

d. The response strategies from the University in regard to flooding

1 2 3 4 5

Not informed Very Informed

10. In the event of a flood, I intend to check the media for evacuation notices. (Please indicate how likely you are to take the described action in the event of a flood).

1 2 3 4 5

Not very likely Extremely likely

11. In the event of a flood, I intend to evacuate my premises (Please indicate how likely you are to take the described action in the event of a flood).

1 2 3 4 5

Not very likely Extremely likely

32. In the event of a flood, I intend to use a homemade emergency preparedness kit (prescription medicine, water bottles, first aid supplies, etc.) (Please indicate how likely you are to take the described action in the event of a flood).

1 2 3 4 5

Not very likely Extremely likely

33. In the event of a flood, I intend to lift my furniture and belongings from the floor. (i.e. furniture, electronics, personal items, etc.) (Please indicate how likely you are to take the described action in the event of a flood).

1 2 3 4 5

Not very likely Extremely likely

34. How effective do you believe it is to check the media for evacuation notices in the event of a flood?

1 2 3 4 5

Not very effective Extremely effective

35. How effective do you believe it is to evacuate your premises in the event of a flood?

1 2 3 4 5

Not very effective Extremely effective

36. How effective do you believe it is to create/prepare a homemade emergency preparedness kit in the event of a flood? (prescription medicine, water bottles, first aid supplies, etc.)

1 2 3 4 5

Not very effective Extremely effective

37. How effective do you believe it is to lift your furniture and belongings from the floor in the event of a flood? (i.e. furniture, electronics, personal items, etc.) Please indicate your answer below on a scale of 1 (Not very effective) to 5 (Extremely effective).

1 2 3 4 5

Not very effective Extremely effective

38. To what extent are you or a member of your household able to check the media for evacuation notices?

1 2 3 4 5

Not very able Extremely able

39. To what extent are you or a member of your household able to evacuate your premises?

1	2	3	4	5
Not very able				Extremely able

40. To what extent are you or a member of your household able to create/prepare a homemade emergency preparedness kit? (prescription medicine, water bottles, first aid supplies, etc.)

1	2	3	4	5
Not very able				Extremely able

41. To what extent are you or a member of your household able to lift your furniture and belongings from the floor? (i.e. furniture, electronics, personal items, etc.) Please indicate your answer below on a scale of 1 (Not very able) to 5 (Extremely able).

1	2	3	4	5
Not very able				Extremely able

42. For each of the following media types, please check the box that indicates your preference as an information source during a hurricane or flood.

	Preferred	**Useful**	**Not Preferred**
a. Watching local news or weather			
b. Hearing information on local radio			
c. Checking for updated on weather-related			
~~d.~~ websites (National Weather Service, Accuweather)			
e. Looking for notifications by E-mail			
f. Checking the Bobcat Campus ALERT app			
g. Looking for other emergency notifications on my phone			
h. Reading newspaper stories about the flood			
i. Directly Contacting friends/family			
j. Indirectly communicating with friends/family (social media)			
k. Viewing general social media postings by anyone			
l. experiencing the flood			

43. What is your academic class status?

44. a) Freshman b) Sophomore c) Junior d) Senior e) Graduate Student Other _____

45. What is your age? _____
46. What is your sex?
    i. Male Female

47. What is your race/ethnicity?
    i. White (Not-Hispanic)
    ii. White (Hispanic Origin)
    iii. Black or African American
    iv. American Indian or Alaskan Native
    v. Asian
    vi. Native Hawaiian or Other Pacific Islander

48. How would you best describe your current living situation?
    a. On campus (dorm)
    b. On campus (rent)
    c. Off campus (rent)
    d. Off campus (own)

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