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FROM FEAR TO ACTION: EXPLORING THE ROLE OF EMOTION DURING IMMINENT THREAT EVENTS USING THE EXTENDED PARALLEL PROCESS MODEL

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DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Communication and Information
at the University of Kentucky

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ABSTRACT OF DISSERTATION

FROM FEAR TO ACTION:
EXPLORING THE ROLE OF EMOTION DURING IMMINENT THREAT EVENTS
USING THE EXTENDED PARALLEL PROCESS MODEL

The extended parallel process model (EPPM) is a popular health and risk communication theory that explicates the relationship between perceived threat, perceived efficacy, fear, and adaptive and maladaptive responses. This study examines the EPPM in an imminent threat context and focuses on how warning message content influences EPPM perceptions and how these perceptions, in turn, influence both protective action and information seeking intentions.

The first objective of this study focuses on applying the EPPM to an imminent threat context by designing EPPM informed tornado and flash flood warning messages. After message pretesting with 42 undergraduate students, 312 undergraduate students completed an online experiment intended to test the effects of tornado and flash flood warning messages with high (vs. low) threat and efficacy information. Results indicate that the high threat-efficacy message led to increased feelings of perceived threat. However, message manipulations failed to exert a significant effect on perceived efficacy. Furthermore, perceptions significantly differed in terms of hazard topic, whereby the tornado warnings were perceived as more threatening and scarier than the flash flood warnings.

The second objective of this study examines the role of fear in predicting protective action intentions as a form of danger control response. Results of mediation analyses suggest that the high threat-efficacy message increased threat perceptions, which led to fear and ultimately increased protective action intentions. These results, along with recent work in the EPPM literature, suggest that fear plays a closer role in motivating behavior and may not inhibit positive decision making as originally predicted in the EPPM.

The third objective of this study is to determine the extent to which perceived threat, perceived efficacy, and anxiety predict motivation to seek information. Information seeking is important to examine in an imminent threat context, as it is often the first action people perform upon being alerted to the existence of a hazard. Results of mediation analyses suggest that high perceived threat can lead to anxiety, which increases motivation to seek additional information. If message writers want to lessen the likelihood of information seeking, as this behavior can delay behavioral response, strong efficacy information should be included in a warning message.

By analyzing the linkages between message, perception, and outcome, this study provides theoretical and applied contributions to the EPPM and warning message design literatures, respectively. These theoretical and practical implications are discussed for all three objectives, along with limitations and future directions for this line of research.

KEYWORDS: Extended Parallel Process Model, Message Design, Warning Message Design, Fear Appeals, Information Seeking

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CHAPTER 1. INTRODUCTION

1.1 Rationale

The extended parallel process model (EPPM) is a popular fear appeal theory commonly used to design and evaluate risk communication messages. The EPPM indicates the types of information a fear appeal message ought to include and predicts why fear appeals succeed or fail. However, the EPPM still faces several theoretical issues and limitations that are addressed in this study.

First, the EPPM has primarily been used to design risk communication messages focused on distal health threats (e.g., cancer; Chen & Yang, 2019; cardiovascular disease; McKay et al., 2004). However, the EPPM has yet to be applied to threats whereby one must act immediately to effectively protect themselves. Therefore, this study further develops the EPPM by focusing on imminent environmental hazards[1] (e.g., tornadoes, flash floods)—or threats that require message recipients to act immediately (often within a few minutes) to successfully protect themselves. Thus, this study will help determine the generalizability and predictive capability of EPPM propositions in new contexts.

Second, despite the claim that the EPPM "[puts] the fear back in fear appeals" (Witte, 1992), the EPPM largely neglects the role of fear in its 12 theoretical propositions that predict danger control and fear control responses (Popova, 2012). Furthermore, EPPM scholars focus extensively on the interactive relationship between the cognitive

[1] A hazard is "an event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss" (Blanchard, 2006) or "some aspect of the physical environment that threatens the well-being of individuals and their society" (Nigg, 1996).

components of the theory (i.e., perceived threat and perceived efficacy) and overlook the propositions related to emotion. Therefore, the fear-based propositions of the EPPM have not been widely examined and lack the same amount of empirical testing.

In particular, the EPPM proposes that fear has an indirect role in predicting message acceptance and danger control responses. However, work in allied fields, such as the risk perception literature, argues that emotion plays a central role in determining how one perceives a particular risk and reacts to danger (Slovic et al., 2004). In addition, a growing number of studies in the communication literature demonstrate that emotion is a key predictor of adaptive responses (e.g., So et al., 2016). Given that people facing imminent threats are often motivated to act based on their affective or emotional responses, in addition to cognitively evaluating their susceptibility to a severe situation, emotion is critical to examine in this context. Therefore, this study answers the call to examine the less studied, emotion-based propositions of the EPPM by examining the role of fear in predicting danger control responses during imminent threats (Popova, 2012).

Third, the EPPM proposes that a fear appeal message can either cause danger control responses or fear control responses, or in certain cases, a message may not elicit any response. However, only allowing for three possible reactions to a message sent during an imminent threat is not realistic in practice, as people commonly seek additional information as the first action upon being alerted to the existence of a hazard (Hammer & Schmidlin, 2002; Jauernic & Van Den Broeke, 2017; McGee & Gow, 2012; Sherman-Morris, 2010; Wood et al., 2018). Therefore, the last theoretical contribution of this study is to examine whether EPPM variables can also predict information seeking behaviors.

Finally, this study also makes applied contributions to the warning message

design literature. Specifically, messages sent during imminent threats can be classified as warning messages, which represent a fundamental form of risk communication that aims to provide at-risk individuals with the information they need to make protective action decisions (Schumann et al., 2018). Effective warning messages help motivate action by informing the public's perception of a hazard and providing information that indicates how warning recipients can effectively protect themselves (Mileti & Peek, 2000). Therefore, warning messages should help warning recipients perceive danger by indicating the severity and probability of experiencing a hazard while simultaneously motivating them towards action (Dash & Gladwin, 2007). Thus, there is a degree of similarity between the EPPM and warning design literature and their perspectives on (a) the types of information that should be included in a message and (b) how those types of information are conceptualized and defined. Yet, the EPPM is a theory of message effects, rather than message design (O'Keefe, 2003), meaning the EPPM literature does not focus on how these types of information best translate to message characteristics. In contrast, the warning literature does focus on message design aspects, and therefore, it can help fill this gap (Mileti & Peek, 2000; Mileti & Sorensen, 1990). In other words, the EPPM can suggest the types of information that should be included in a warning message to lessen the likelihood that fear will lead to maladaptive responses, whereas the warning design literature can indicate how best to convey these types of information. Therefore, this study will also attempt to answer how EPPM variables should translate to warning message characteristics.

In summary, this study makes several theoretical contributions to the EPPM by (a) focusing on the role of fear in predicting danger control responses, therefore

responding to recent calls to examine the more understudied propositions of the EPPM;

(b) examining the EPPM in a novel context; and

(c) considering behaviors outside of danger and fear control responses.

Furthermore, this study will provide message design advice for warning messages. This study will examine how specific message design components affect their subsequent perceptions and then, using the EPPM as a theoretical guide, determine how those perceptions may encourage protective action during imminent threats. The following chapters provide a review of the relevant literature and overview of the methods that will be used to answer these questions.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This chapter begins by providing an overview of emotional appeals and fear appeals, after which an in-depth discussion of the extended parallel process model (EPPM) and its theoretical propositions is provided. After discussing the EPPM, this chapter introduces how the EPPM can inform messages sent during imminent threats and proposes the specific message characteristics that will be used in this study. Next, this chapter examines the importance of fear in persuasion, which culminates in the hypotheses and research questions used to test the role of fear, perceived threat, and perceived efficacy in predicting danger control responses. This chapter concludes with an overview of how EPPM variables can also predict information seeking intentions and the importance of this behavior, resulting in a final set of hypotheses and research questions used to examine these relationships.

2.2 Emotional and Fear Appeals in Persuasive Message Design

Persuasive messages include micro- and macro-structure features. Microstructure features include message content, format, and structure (Harrington, 2016). Although there is a call to define precisely what constitutes message content, format, and structure and develop a taxonomy of these message components (Harrington et al., 2015), examples have been provided that elaborate on what constitutes these variables (Harrington, 2016), whereby

- Message content can include argumentation scheme, evidence, or qualifying language
- Message structure can include message sidedness, standpoint articulation, or

inoculation

- Message format can include channel and audiovisual factors, such as the inclusion of images or other visuals, and spoken or written language.

Given the seemingly endless number of ways these components can be combined to achieve persuasive outcomes (e.g., changes in cognitive, affective, attitudinal, and/or behavioral outcomes), designing persuasive messages and determining precisely which message components are responsible for persuasion is complex (Cappella, 2006; Harrington et al., 2015). Although it is impractical to test all possible ways these components interact with one another, using message design theories, rather than theories of behavior change (e.g., the health belief model) and information processing (e.g., elaboration likelihood model), can provide a better guide for constructing persuasive messages and help message designers choose appropriate message content, structure, and format to achieve desired outcomes (Cappella, 2006).

Specifically, message design theories elaborate upon potential message effects, which not only allows for better message testing but also isolates which message components are responsible for persuasive outcomes. Message design theories include theories and frameworks such as narrative messages and message framing (Harrington, 2016). One popular message design theory is emotional appeals (e.g., Dillard & Li, 2020; Nabi et al., 2008), which attempts to elicit discrete emotions as a persuasive device. The following section further elaborates on emotional appeals.

2.3 Emotional Appeals

Emotions are "internal mental states representing evaluative, valenced reactions to events, agents, or objects that vary in intensity…they are typically short-lived, intense,

and directed at external stimuli" (Nabi, 2015, p. 114). The persuasion literature primarily examines emotions from a cognitive perspective—or as cognitive appraisals and thought patterns (Nabi, 2002a). This way of examining emotion results in several key characteristics to consider: (a) emotions include a cognitive appraisal of external changes and/or situations (e.g., identifying a threat), (b) emotions include an affective appraisal of external changes and/or situations (e.g., a negative appraisal of a threat can result in fear), (c) emotions can influence behavior (e.g., fear results in protective actions; Mongeau, 2013; Nabi, 2015).

Emotional appeals attempt to elicit discrete emotions as a way to influence persuasive outcomes (e.g., changes in attitudes) and are a popular message design strategy (Dillard & Nabi, 2006; Dillard & Peck, 2000; Nabi, 2002b; Nabi et al., 2008; Turner, 2012). Discrete emotions are defined as "categorical emotional states, typically identified by the unique set of cognitive appraisals…that underlie them" (Nabi, 2015, p. 115). Compared to other emotional appeals, such as guilt (Turner & Underhill, 2012), disgust (Leshner et al., 2011), and anger (Nabi, 2002a), fear appeals are by far the most popular type of emotional appeal, particularly in the health communication literature (Harrington, 2016; So, 2013). The following section further discusses fear and fear appeals.

2.4 Fear Appeals

Fear has been defined as a "negatively valenced discrete emotional state that is an inherent part of the human experience" (Myrick & Nabi, 2017, para. 1). Fear has also been defined as "negatively valenced emotion accompanied by a high level of [physiological] arousal and is elicited by threat that is perceived to be significant and

personally relevant" (Witte, 1992, p. 331). These definitions offer three key insights: (a) fear is a form of negative affect (Lazarus, 1991b); (b) fear can result in physiological reactions (e.g., increased heart rate); and (c) fear is caused by a threat.

Whereas fear describes an emotion, fear appeals are messages used to evoke fear. Fear appeals typically indicate that a threat exists and, in some cases, provide ways to protect oneself. For example, fear appeals have been defined as "persuasive messages designed to scare people by describing the terrible things that will happen to them if they do not do what the message recommends" (Witte, 1992, p. 329). Indeed, fear appeals suggest that if a hazard has serious consequences that are likely to affect an individual, they will experience fear and become motivated to perform the recommended action(s). Thus, fear appeals are a popular strategy with message designers, as it is expected that "scary" or fear inducing messages will motivate individuals to act in accordance with message recommendations (Ruiter et al., 2014).

Beginning in the 1950s, several key theories have emerged that attempt to predict how and why fear appeals succeed or fail. These theories include the following:

- Fear-as-acquired drive model (i.e., drive model; Hovland et al., 1953)
- Parallel response model (Leventhal, 1970, 1971)
- Protection motivation theory (Rogers, 1975, 1983)
- Extended parallel process model (EPPM; Witte, 1992)

Of these theories, the EPPM is one of the more widely used fear appeal theories in risk communication and health communication. The EPPM has been used to address a variety of health-related topics, including promoting behaviors to reduce sexually transmitted diseases (Carcioppolo et al., 2013), increase colorectal cancer screenings

(Birmingham et al., 2015), promote exercise (Hatchell et al., 2013) and healthy eating (Batchelder & Matusitz, 2014), and many more health promotion and disease prevention behaviors. Furthermore, the EPPM has also been used during public health crises and pandemics to create and evaluate public health interventions and health campaigns, such as pandemic influenza (Barnett et al., 2010), Zika (Vos et al., 2018), and more recently, the coronavirus pandemic (Khazaei et al.; Shirahmadi et al., 2020). Outside of the health domain, scholars have applied the EPPM to contexts such as cyber-security risks (Zhang & Borden, 2019) and increasing preparedness behaviors prior to disasters (Adame & Miller, 2015; Miller et al., 2013).

However, the EPPM has not been examined in relation to behaviors that one must perform *immediately* to prevent harm. The ideal context to examine these types of behaviors is imminent environmental hazards, such as tornadoes or flash floods. These types of incidents are often described as "short fuse" events, whereupon being alerted to the existence of a hazard (either through a warning message or other means), one must act immediately. For example, tornado warnings are often issued just minutes before a tornado occurs, meaning there is a very short amount of time between being alerted to the existence of the hazard and its potential impacts (Brotzge & Donner, 2013). From a theoretical perspective, these threats represent a new context in which to examine EPPM propositions and assess its generalizability—or determine whether its theoretical propositions and conclusions are accurate across other contexts (Chaffee & Berger, 1987; Dubin, 1978).

The following section first provides an in-depth overview of the EPPM and its theoretical propositions before turning to a discussion of the three central aims of this

study.

2.5 The Extended Parallel Process Model

The EPPM builds on its theoretical predecessors by arguing that fear appeal messages should contain severity, susceptibility, response efficacy, and self-efficacy information. In turn, these types of message content predict their respective cognitive perceptions (Witte, 1992). These perceptions then form a "feedback loop" with fear and interact with one another in a way that leads to protection motivation and message acceptance or defensive motivation and message rejection. The following section further addresses these components.

2.5.1 *Threat*

The EPPM uses the term "threat" to describe either a message component or a cognition (Witte, 1992). Threating message components (i.e., threatening messages) include severity and susceptibility information. When a message effectively communicates severity and susceptibility information, the EPPM predicts that message recipients will have higher perceptions of severity and susceptibility, respectively. *Perceived severity* is the belief that the magnitude and/or consequences of a threat will be serious and harmful (Witte, 1992, 1996). Based on this definition, perceived severity often is assessed by asking message recipients the extent to which they feel that the threat is severe, serious, and significant (e.g., Roberto et al., 2002; Witte et al., 1998; Zhang et al., 2018), as well as dangerous (e.g., Bell et al., 2014; Stephenson & Witte, 1998). *Perceived susceptibility*, or the belief that one is at risk and/or will potentially experience the threat (Witte, 1992, 1996), is often assessed by asking message recipients how likely, possible, and at risk they are for experiencing the threat (e.g., Bell et al., 2014; Witte,

1996).

Research demonstrates that individuals are more likely to take protective action if they perceive an overall degree of threat (Drabek, 1999; Perry, 1979; Witte & Allen, 2000). When message recipients do not feel susceptible to a serious threat—or have low perceived severity and susceptibility—they will stop processing the message (Witte, 1992). However, when perceived threat is high, the EPPM argues that message recipients will then assess their efficacy, or their confidence to perform the behavior(s) they deem to be effective in reducing the adverse outcomes of a threat.

2.5.2 *Efficacy*

The EPPM characterizes efficacy as a message component or a cognition. Efficacy message components (i.e., efficacy messages) contain response efficacy and self-efficacy information. According to the EPPM, response efficacy and self-efficacy information will lead to their respective cognitive perceptions. Perceived response efficacy is one's belief about the effectiveness of the recommended response in mitigating or eliminating a threat (Witte, 1996), often measured by assessing the extent to which message recipients feel the recommended response works, is effective, and reduces the likelihood of experiencing a threat (e.g., Bell et al., 2014; Roberto et al., 2002; Ruiter et al., 2004; Witte, 1996). Perceived self-efficacy is the belief about one's ability to perform the recommended response to avert the threat (Witte, 1996, 1998b), often measured by asking message recipients about the extent to which they feel they are able to perform the recommended response, as well as the extent to which they feel the recommended response is easy and convenient (Bell et al., 2014; Liu, Egnoto, et al., 2019; Nabi et al., 2008; So et al., 2016; Witte, 1996).

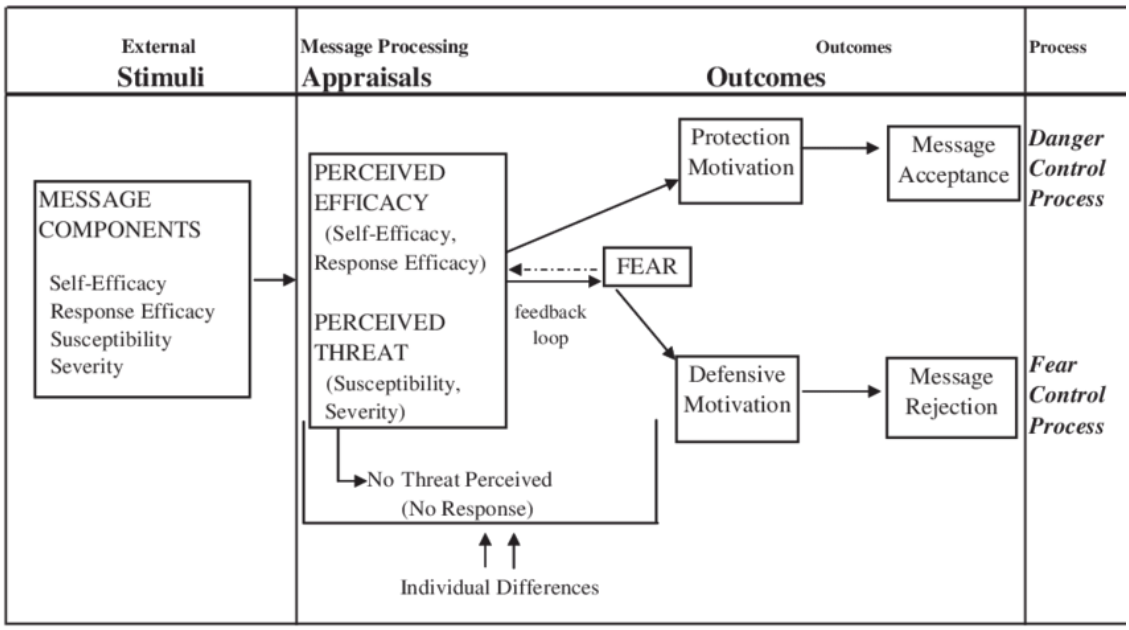
2.5.3 *Fear*

The EPPM defines fear as both a psychological and physiological negative emotional reaction that manifests due to a perceived threat (Witte, 1992). The physiological dimensions of fear can be evaluated through measures such as heart rate (Ordoñana et al., 2009). The psychological dimensions of fear are most often assessed through self-reported measures. For example, Witte (1996) proposes that fear should be measured by asking message recipients how "frightened," "scared," and "anxious" they felt in response to a threat. However, as will be discussed in greater detail below, both Myrick and Nabi (2017) and So (2013) argue that fear and anxiety are conceptually distinct discrete emotions. For example, through performing a confirmatory factor analysis and structural equation modeling, So et al. (2016) found that fear and anxiety are distinct constructs that exert different effects on protective action intentions. Therefore, including both fear and anxiety items into an overall fear measure or index may have confounded previous EPPM research. Instead, So et al. propose that fear is better assessed by asking message recipients how "fearful," "afraid," "frightened," and "scared" a message made them feel.

2.6 EPPM Propositions

The EPPM advances 12 theoretical propositions that illustrate the relationship between threat and efficacy message components, emotion (fear), cognition (perceived threat and perceived efficacy), message processing (danger and fear control), and message acceptance or rejection (Witte, 1992). These propositions are represented visually in Figure 2.1 and focus on predicting the relationship between the processing and outcomes of fear appeal messages (Popova, 2012).

Figure 2.1 The Extended Parallel Process Model



Note. From Witte (1992)

The EPPM argues that message recipients who perceive a high degree of threat will experience fear. In turn, fear motivates message recipients to take some type of action to reduce their fear arousal (Witte, 1998b). Perceived efficacy determines whether these actions will be adaptive or maladaptive. More specifically, perceived efficacy determines whether message recipients will become motivated to protect themselves from the danger posed by a threat or attempt to reduce their fear through maladaptive responses. When both perceived threat and efficacy are high, message recipients will attempt to control the inherent danger caused by a threat—or engage in danger control responses. When perceived threat is high and perceived efficacy is low, message recipients will attempt to reduce their fear through defensive and maladaptive means—or

fear control responses. The following sections further elaborate on these processes.

2.6.1 *Danger Control*

When message recipients believe they can effectively avert a perceived threat by performing the recommended behavior(s) proposed in a message, Witte (1992) suggests they will experience danger control. Danger control is described as a cognitively based process, whereby message recipients consciously confront danger by examining ways they can protect themselves (Witte, 1992). The EPPM then predicts that message recipients will perform danger control responses—or have changes in attitude(s), behavioral intention(s), and behavior(s) in line with message recommendations (Witte, 1992, 1996; Witte & Allen, 2000; Witte et al., 1998).

Attitude refers to favorable or unfavorable evaluations toward the recommended behavior(s). Attitudes that are favorable toward the recommended action(s) are classified as a danger control response. Attitude is often assessed through semantic differential scales (Popova, 2012). For example, in a study examining condom use to prevent genital warts, attitudes toward condoms as a protective measure was assessed by asking participants the extent to which they felt using condoms is bad/good, desirable/undesirable, and favorable/unfavorable (Witte et al., 1998).

Changing behavioral intentions is another danger control response, often used as a proxy to measure behavior, especially when measuring behavior is not feasible. Indeed, theories like the theory of reasoned action conclude that behavioral intentions are a primary determinant of actual behavior (Ajzen & Fishbein, 1977). However, newer models of behavior change acknowledge that the relationship between one's behavioral intention and actual behavior may be influenced by factors other than motivation. For

example, the integrated model of behavioral prediction postulates that skills and environmental constraints moderate the relationship between intention and behavior, whereby these factors influence one's ability to act (Yzer, 2012).

In the context of imminent environmental threats, skills can include having adequate knowledge of how to perform the behavior. Environmental constraints can include not having a safe shelter, which is especially common for mobile home residents, for example (Liu et al. 2019). Additional constraints may include having dispersed family members at the time of an event, whereby individuals may not want to act until they are reunited with their household. Therefore, an individual's social and physical environment can impede their ability to protect themselves, even if they want to or intend to act (Lindell & Perry, 2012).

In addition, a disaster or imminent threat event can cause a large degree of stress for individuals, as these sudden and uncontrollable events may be one of the most threatening experiences a person encounters due to their potential to cause loss of life and severe property damage. In turn, stress can impair one's cognitive functioning in a way that influences their ability to act (Sandi, 2013). The stress that one experiences in response to an imminent environmental threat cannot be ethically replicated through experimental means.

Overall, this short review suggests that there is complexity behind protective decisions in this context that may not be captured fully through experimental methods, leading to concern that behavioral intention may not capture people's actual behavior during imminent threat events. However, research is beginning to suggest that behavioral intentions *could* provide a proxy measure for actual behavior in this context. Specifically,

previous research demonstrates that there is a positive relationship between people's behavioral intentions and actual behavior during an imminent threat. For example, Weyrich et al. (2020) conducted an experiment comparing two types of weather warnings with members of the Swiss public. Data was collected through a real-time field experiment and through a scenario-based experiment, whereby participants were asked to imagine that they were in a hypothetical severe weather situation. Results indicate that differences in behavior and behavioral intention between field and scenario-based experiments were non-significant. In other words, whether the data collection was field or scenario based "[made] no difference with respect to studying the effects of warning type on behavior" (Weyrich et al., 2020, p. 240). Such parallels between behavioral intention and behavior may be further established using realistic and effective scenarios or vignettes, which includes describing hypothetical events that (a) are not too complex, (b) are plausible to participants, and (c) have enough context so participants can understand the situation (Barter & Renold, 1999). Indeed, using scenario-based experiments and measuring behavioral intention, rather than behavior, is a common methodological strategy (e.g., Cuite et al., 2017; Morss et al., 2018), especially for those examining imminant threats such as tornadoes (Ash et al., 2014; Lindell et al., 2016; Perreault et al., 2014); however, more research is needed in this area to further establish the relationship between intention and behavior for imminent environmental threats.

Finally, EPPM studies can also assess behavior change in response to fear appeals. For example, Witte et al. (1998) asked participants two weeks following exposure to a genital wart fear appeal message about their current condom use and whether any behavior change occurred. Specifically, participants were asked whether

they are currently using condoms and whether their behavior changed since exposure to the message. Results from this study indicate that participants exposed to a genital wart fear appeal message, and who also had high preexisting levels of efficacy to use condoms, reported the greatest degree of behavior change.

In summary, when perceived efficacy outweighs perceived threat, message recipients will engage in danger control responses. However, the EPPM suggests that when perceived threat exceeds perceived efficacy—or message recipients believe they are at risk for a significant threat yet feel unable to effectively protect themselves—individuals will shift from trying to protect themselves and instead attempt to reduce their fear, which results in fear control.

2.6.2 *Fear Control*

When message recipients have high perceived threat and low perceived efficacy, the EPPM predicts that they will engage fear control—or a type of defensive motivation caused by overpowering feelings of fear (Witte, 1992). In a fear control state, message recipients abandon trying to control the danger posed by a threat and instead attempt to reduce their feelings of fear. Unlike danger control, fear control is an emotional experience that occurs either consciously or unconsciously, whereby message recipients automatically attempt to control and/or minimize their fear rather than avert the inherent danger(s) caused by the threat.

The EPPM predicts that those experiencing fear control will either consciously or unconsciously engage in certain fear control responses, defined as defensive mechanisms that are used to minimize fear (Witte, 1992). Unlike danger control, fear control can be achieved without taking any protective actions. More specifically, fear control responses

are defined, and therefore measured, as denial, defensive avoidance, and reactance, which includes issue and/or message derogation and perceived manipulation (Ruiter et al., 2004; Witte, 1996). In a fear control state, individuals will adopt these maladaptive strategies (described in the following paragraphs) as a way to reduce their emotional experience of fear, rather than reduce the danger posed by a threat (Witte, 1998b).

First, some in a fear control state may deny their level of risk. For example, in thinking about skin cancer as a potential threat, some may believe "I'm not at risk for getting skin cancer, it won't happen to me" (Witte & Allen, 2000, p. 594) or "I'm not going to get skin cancer, no one else I know has it" (Stephenson & Witte, 1998, para. 10). Second, others may avoid or refuse to think about the threat through defensive avoidance. For example, message recipients might assert that "this [threat] is just too scary, I'm simply not going to think about it" (Witte & Allen, 2000, p. 594) or "I'm just not going to think about [this threat]—it scares me too much" (Witte, 1996, p. 321), whereby the less time devoted to thinking about a topic, the more defensive avoidance is occurring. Therefore, researchers often measure defensive avoidance by asking message recipients the extent to which they spent time thinking about the threat upon receiving the message (e.g., McMahan et al., 1998). Finally, message recipients may experience reactance, which has been conceptualized, and therefore measured, as issue derogation and manipulation (Witte, 1996). Issue derogation is the extent to which someone discredits the information in the message or feels that the message is overblown, exaggerated, and/or overstated (Nabi et al., 2008; Ruiter et al., 2004; Witte, 1996). Manipulation is commonly assessed by asking participants the extent to which they believe that the message is manipulative, misleading, or distorted (Witte, 1996, 1998b). For example,

message recipients may state “they’re just trying to manipulate me, I’m going to ignore them” (Witte & Allen, 2000, p. 594), “they’re just trying to manipulate us, there’s no threat” (Witte, 1996, p. 321), or “they are just trying to scare me, but it won't work on me” (Stephenson & Witte, 1998, para. 10).

2.6.3 *Summary*

In summary, the EPPM proposes that danger control leads message recipients to accept message recommendations, whereas fear control causes message recipients to reject message recommendations (Witte, 1992). Danger control and fear control are inversely related, meaning that fear control impedes danger control (Witte, 1996). Fear is thought to play a role in these responses; fear directly causes fear control responses, yet indirectly influences danger control responses when perceived efficacy is high. More specifically, threatening messages serve as a cue that leads to perceived threat and fear. When perceived efficacy is high, this fear will be “cognitively appraised as a situational cue” (Witte, 1992, p. 343) and lead message recipients to increase their level of perceived threat and further motivate adaptive outcomes. However, when message recipients do not believe they can effectively perform the recommended response(s), the EPPM predicts that fear will become overwhelming to a point where message recipients engage in maladaptive responses.

It is important to note that these propositions use the concept of perceived threat and perceived efficacy to predict danger control and fear control responses. Therefore, the EPPM focuses less on the specific message components that lead to these perceptions, resulting in those who wish to design an EPPM message having little guidance as to how to do so. The following section further outlines the theoretical consequences of this issue,

culminating in the specific message design strategies that will be used to convey severity, susceptibility, response efficacy, and self-efficacy information in this study.

2.7 Designing an EPPM Message

As previously mentioned, "fear appeals" are often defined as messages that induce fear by illustrating that message recipients will experience harm if they do not follow message recommendations (Witte, 1994). Yet in practice, fear appeal researchers often use the term to refer to different things, including (a) a message with certain intrinsic message characteristics, (b) a message that is expected to lead to a high degree of perceived threat (i.e., severity and susceptibility) and fear, or (c) a message that caused fear in message recipients (Dillard et al., 2017).

The variability in these definitions demonstrates that there is confusion in the literature regarding fear appeal message design and fear appeal message effects. In other words, fear appeals can describe a message characteristic (i.e., intrinsic message quality or component) that caused fear or a message defined by its ability to induce fear in message recipients (Myrick & Nabi, 2017). With the latter, a fear appeal is successful if it leads to fear; however, the exact message characteristics that caused fear are relatively unimportant and largely unexamined, as Witte (1993) notes that the "majority of fear appeal researchers are only interested in the effects of fear arousal and perceived threat on message acceptance. For these researchers, a fear appeal is simply a vehicle for arousing fear and inducing perceptions of threat in a subject. They would argue that it matters less how one arouses fear as long as it is aroused" (p. 148). However, O'Keefe (2003) argues that the focus on message effects rather than message characteristics "impede[s] progress in understanding persuasion processes and effects and hence should

be avoided in favor of definitions expressed in terms of intrinsic message features" (p. 251), as scholars cannot determine how specific message characteristics lead to message effects. In other words, defining fear appeals in terms of its effects provides little guidance as to how to design a fear appeal message.

Therefore, the EPPM may be classified as a theory of message effects rather than message design, whereby the theory argues that perceptual states, rather than messages, are the catalyst toward protective action (Witte, 1992; Witte & Allen, 2000). Specifically, O'Keefe (2003) introduces three classes of research claims concerning message effects and message design. Claim one involves the relationship between a psychological state and a persuasive outcome (e.g., the relationship between empathy and message acceptance); claim two involves the relationship between a message manipulation and a persuasive outcome (e.g., the use of a metaphor and message acceptance); claim three combines claims one and two and involves the relationship between how a message manipulation (e.g., use of a metaphor) influences a psychological state (e.g., empathy), which in turn impacts a persuasive outcome (e.g., message acceptance). The EPPM literature largely focuses on claim one—or how perceived threat, perceived efficacy, and fear influence danger control and fear control responses. However, EPPM researchers, and communication researchers more broadly, should instead prioritize research examining claims two or three in order to make both theoretical and applied contributions to message design.

Furthermore, it is uncommon for EPPM studies to manipulate both threat and efficacy using a 2 (high threat vs. low threat) × 2 (high efficacy vs. low efficacy) factorial design. This trend is evident in early EPPM research (e.g., Stephenson & Witte, 1998;

Witte et al., 1998b) and has since appeared in later investigations. Specifically, Popova (2012) notes that EPPM studies often only manipulate threat information and either (a) ignore efficacy information (Lewis et al., 2010), (b) keep efficacy information high across all conditions (Ruiter et al., 2004; Witte & Morrison, 1995), and/or (c) fail to manipulate efficacy information and instead create high or low efficacy groups through a median split (McKay et al., 2004; Witte et al., 1998). Other scholars only manipulate one component of threat and efficacy; for example, only manipulate susceptibility (Wright et al., 2006) or self-efficacy (Wong & Cappella, 2009). Roberto et al. (2019) summarized previous fear appeal meta-analyses and found that only between 24% to 33% of the included studies manipulate *both* threat and efficacy. A similar percentage of studies manipulate both severity and susceptibility, whereas only 3–11% manipulate both self-efficacy and response efficacy.

Finally, single message design studies are a common practice in the EPPM literature (e.g., McKay et al., 2004; Stephenson & Witte, 1998; Witte et al., 1998); yet, to make generalizable conclusions about message effects and message outcomes, message replication should be used, meaning that multiple message variations per experimental condition need to be included in one's experimental design (O'Keefe, 2015; Slater, 1989). Indeed, there have been multiple calls for researchers to use a multi-message approach (Jackson et al., 1994; Jackson et al., 1988; O'Keefe, 2015), as using a single message per condition leads researchers to draw untenable claims about generalizability. Specifically, researchers cannot discern whether it was a particular message, a particular topic, or the underlying theoretical construct(s) that are responsible for message effects (Slater, 1989).

Furthermore, as a theory of message effects, there is little guidance as to how to effectively design an EPPM message. This focus on message effects has also led to a large degree of variability in the intrinsic message characteristics used to increase threat and efficacy perceptions. Considering that the EPPM does not advance message design principles, other bodies of literature may be used and/or may be better suited to help fill this gap and strengthen our understanding of how to design messages sent during imminent environmental threats.

Specifically, the warning design literature can help inform how to design EPPM messages for this context, as there is considerable overlap in the core components or variables deemed important between these two bodies of literature. The following section provides a brief overview of warning messages, followed by a discussion about the overlap between each body of literature and the specific message design strategies that will be used in this study.

2.7.1 *Warning Messages*

Messages sent during threats, including environmental, technological, and public health threats, for example, are called warning messages. As a form of risk communication, a warning message can influence public response through both its style and content (Mileti & Sorensen, 1990; Sorensen, 2000), which has led to an extensive body of literature that examines the effects of warning message language and style components (e.g., Bean et al., 2016; Drabek, 1999; Frisby et al., 2013; Lindell et al., 2016; Liu et al., 2020; Mileti & Darlington, 1997; Sellnow et al., 2017; Sutton et al., 2015; Wood et al., 2018). Like EPPM messages, warning messages help incite action by forming the public's perception of a hazard and providing information that indicates how

warning recipients can effectively protect themselves (Mileti & Peek, 2000). In other words, warning messages should help message recipients perceive danger by signifying the severity and probability of a hazard while simultaneously motivating them towards action (Dash & Gladwin, 2007). Therefore, the types of information the EPPM indicates are important in a fear appeal and the types of information that should be included in a warning message are also comparable. Specifically, there is overlap between these two bodies of literature and their perspectives on (a) the types of information that should be included in a message and (b) how those types of information are conceptualized and defined. Specifically, Table 2.1 outlines how the EPPM and warning design literature defines each variable, as well as how these variables translate to the specific message design used in this study.

However, unlike the EPPM literature, the warning literature prioritizes how to best design these types of messages (Mileti & Peek, 2000; Mileti & Sorensen, 1990). Specifically, the EPPM indicates which types of information are important, yet the warning literature indicates how best to convey it. Indeed, a large body of warning design research focuses on manipulating warning message content (e.g., Morss et al., 2018), style (e.g., Williams & Eosco, 2021), and/or format (e.g., Liu et al., 2017) in a way that increases the likelihood the public engages in protective action(s). Therefore, the warning design literature can help inform the design of messages sent during imminent threats in a way that aligns with the theoretical underpinnings of the EPPM. The following section further elaborates upon the connection between these two bodies of literature for each EPPM variable, culminating in the specific message design strategies that will be employed in this study.

Table 2.1 Message Design Components for Low and High Fear Appeal Warnings

EPPM Variable & Conceptual Definition*	Warning Content & Definition	Message Characteristics
Severity • Significance or magnitude of the threat and/or the consequences that can result from the threat (Witte, 1996, 1998a) • Consequences should a specified event occur (Roberto et al., 2000)	*Description of the Hazard* • "Information about the impending hazard by describing the event that may occur and how it poses a danger to people" (Mileti & Sorensen, 1990, p. 3-9) • "A description of the event that is expected to occur and an explanation of how it is a threat to people's safety" (Mileti & Peek, 2000, p. 185)	*High Threat-Efficacy Warning* • Magnitude/strength of the hazard (using scales if applicable to the hazard) • Impacts or consequences to one's environment, safety, or life due to the hazard (e.g., "life threatening") *Low Threat-Efficacy Warning* • Impacts using less intense language
Susceptibility • Risk of experiencing the threat (Witte, 1996, 1998a)	*Location* • "Warnings must define the location of who is not at risk as well as those who are at risk, and this should be done in ways readily understandable to those who are intended to receive the warning" (Mileti &	*High Threat-Efficacy Warning* • Specific location information (e.g., physical landmarks) • Direction, speed, and current location of a storm) and predicted

	Peek, 2000, p. 185)	location(s) that may be at risk • "You" *Low Threat-Efficacy Warning* • No specific location information; simply indicating one is under a "warning" • No use of "you"
Response Efficacy • Beliefs about the effectiveness of the recommended response in deterring or avoiding the threat (McMahan et al., 1998; Roberto et al., 2000; Witte, 1996, 1998a)	*Guidance* • What people should do to maximize their safety in the face of impending disaster • "Information about what people should do to protect themselves from the impending hazard — a protective action recommendation" (Mileti & Peek, 2000, p. 185)	*High Threat-Efficacy Warning* • Guidance information • Indicating that the behavior is effective in protecting oneself *Low Threat-Efficacy Warning* • Only the recommended behavior
Self-efficacy • Beliefs about one's ability to	*Guidance* • What people should do to	*High Threat-Efficacy Warning* • Barriers to response, if

perform the recommended response to avert the threat (Gore & Bracken, 2005; Witte, 1996, 1998a)	maximize their safety in the face of impending disaster • "Information about what people should do to protect themselves from the impending hazard — a protective action recommendation" (Mileti & Peek, 2000, p. 185)	applicable • Encouraging ability to perform behavior *Low Threat-Efficacy Warning* • Only the recommended behavior

* Adapted from Popova (2012)

2.7.2 *Severity*

As previously mentioned, perceived severity is the belief that an event, its magnitude, and/or its consequences are serious and harmful (Witte, 1992, 1996). Therefore, a high threat message should include information related to how a particular threat will result in serious consequences for message recipients (Murray-Johnson & Witte, 2011). Indeed, there is overlap between the EPPM and warning literature regarding Witte's (1992) definition of severity information and Mileti and Sorensen's (1990) recommendation to include a *description of the hazard* in a warning message (see Table 2.1). Specifically, both Witte (1992) and Mileti and Sorensen (1990) recommend including information related to the consequences of a hazard and/or information that depicts which characteristics of the hazard will endanger individuals. Witte (1992) argues that this type of information will cause fear in message recipients, whereas Mileti and Sorensen suggest that this type of information provides justification for the recommended protective actions, as "people are better able to understand the logic of protective actions" if the hazard is well described (p. 3.9). Therefore, severity information in warning messages could include both environmental impacts and the degree to which the hazard will affect one's safety (Mileti & Peek, 2000; Mileti & Sorensen, 1990). In addition, severity information may also manifest through including information related to the strength of a hazard, often using hazard specific scales that indicate the magnitude of a hazard (e.g., the Richter scale for earthquakes).

First, in describing the hazard's severity, sufficient detail should be provided that illustrates the specific environmental impacts of a hazard (e.g., roofs will be destroyed). For example, Mileti and Sorensen (1990) state,

> A warning message must provide the public with information about the impending hazard by describing the event that may occur and how it poses a danger to people. It is insufficient, for example, for a warning to simply state that a dam may break. This warning must also describe the height and speed of impact of the floodwaters that will ensue. (pp. 3-9)

For example, during the May 27, 2019, Central Ohio tornado event, a National Weather Service (NWS) tornado warning message stated, "mobile homes will be destroyed. Considerable damage to homes, businesses and vehicles is likely and complete destruction is possible" (message retrieved from Iowa Environmental Mesonet, Iowa State University). If a warning message provides vague or ambiguous environmental impact information, warning recipients may interpret the severity of the hazard in various ways and perform behavior(s) contrary to the recommended protective actions (Mileti & Peek, 2000).

Second, severity information in a warning message may also indicate how a hazard threatens one's personal safety. For example, warning messages for "catastrophic tornadoes," defined as tornadic events that are rare, short lived, threaten human life, and can result in devastating damage (National Weather Service, n.d.-a), have included statements that indicate the consequences of a storm will be life-threatening and/or significantly impact one's safety. For example, during the same tornado event mentioned above, the NWS included the following language: "You are in a life-threatening situation. Flying debris may be deadly to those caught without shelter." Previous empirical research has used similar language in experimentally manipulated warning messages. For example, Perreault et al.'s (2014) "threatening" tornado warning message stated

> This is a life-threatening situation. You could be killed if not underground or in a tornado shelter. Complete destruction of entire neighborhoods is likely. Many well-built homes and businesses will be completely swept from their foundations. Debris will block most roadways. Mass devastation is highly likely making the area unrecognizable to survivors. (pp. 488-489)

These language choices have previously been defined as "intense language" within the warning literature—or message choices that highlight the life-threatening and catastrophic nature of a particular storm. Prestley et al. (2020) argue that intense language is used to create negative emotions such as fear; however, this has yet to be empirically tested.

Finally, severity information can also be expressed through indicating the strength or magnitude of a hazard by using hazard specific scales, such as the Saffir-Simpson scale for hurricanes. However, for certain hazards such as tornadoes, the magnitude on their scale (e.g., the Enhanced Fujita scale) is only known after an event occurs. Furthermore, other hazards, like flash floods, do not have a pre-established scale that could be included in a warning message. Therefore, severity information in warning messages can manifest through indicating (a) the consequences and/or impacts to life and property and (b) the strength/magnitude of the hazard (through scales or other means, if applicable). Therefore, the messages employed in this study will test the effects of adding impact information using intense language as a form of severity information.

2.7.3 *Susceptibility*

Perceived susceptibility is "an individual's belief about his or her chances of experiencing the threat" (Witte, 1992, p. 332). Recent work has argued that for

environmental hazards, likelihood is composed of two dimensions: (a) the likelihood of being exposed to a particular hazard and (b) the likelihood of experiencing the consequences of a hazard once exposed (Walpole & Wilson, 2021). Therefore, susceptibility information ought to convey that message recipients are both at risk of being exposed *and* experiencing the consequences of a hazard. Specifically, for environmental hazards, one's spatial proximity (i.e., being at a certain place at a certain time) is what makes someone susceptible to being exposed and/or experiencing hazard impacts. Simply, if someone is in an at-risk location, their probability of experiencing the hazard's consequences increases.

Accordingly, susceptibility information is akin to *location* information within a warning message (Mileti & Peek, 2000). Location information refers to the specific geographical location(s) and boundaries (i.e., warning area) at risk for a hazard to occur. Ideally, location information should be as specific as possible, such as including physical landmarks and/or street name (e.g., "the area of town that will flood will be between Second and Fifth Streets, from Elm Avenue to Magnolia Boulevard," Mileti & Sorensen, 1990, p. 311). Furthermore, a warning could include geographical locations not at risk, which reduces the likelihood those outside a warning area will respond (e.g., "people who live in other parts of the city will not experience any danger," Mileti & Peek, 2000, p. 185). In addition, message designers may use personalized references (i.e., "you" or "your," Murray-Johnson & Witte, 2011), which is a strategy that has been found to increase susceptibility perceptions (Stephenson & Witte, 1998). Therefore, the messages employed in this study will test the effects of adding specific location information and personalized language (i.e., "you"), as a form of susceptibility information.

2.7.4 *Response Efficacy*

Perceived response efficacy is the belief that the recommended behavior(s) will effectively reduce or eliminate a threat. To increase response efficacy perceptions, certain message design strategies can be used.

First, the recommended behavior(s) should be stated. For warning messages, Mileti and Sorensen (1990) refer to this type of information as *guidance*—or information related to what action(s) warning recipients ought to perform. Guidance is an important type of information, as "it cannot be assumed that the public will know what would constitute an appropriate protective action" (Mileti & Peek, 2000, p. 186). In addition, guidance must provide sufficient detail to reduce ambiguity and confusion about the recommended protective action(s). For example, Mileti and Peek (2000) state that guidance information

> Must do more than tell people in danger that they should evacuate. For some, "evacuate" may be to the front yard. Instead, the evacuation route, destination, (and for those who lack their own vehicles) method of transportation should be clearly defined. (p. 185)

Although important, guidance is just one component of response efficacy information. Indeed, response efficacy information could also state the association between the hazard and the recommended protective action—or include information related to *why* the behavior is effective. Indeed, Mileti and Peek (2000) argue that individuals should not have to infer why the behavior is recommended. Similarly, Witte (1993) suggests that if an individual with a high degree of perceived threat is left to infer why the recommended response is effective, maladaptive responses may occur; therefore, messages should

indicate why a particular behavior is crucial in mitigating or eliminating a threat.

Specifically, although many response efficacy messages indicate that a behavior will lessen or eliminate the consequences a threat (e.g., using a condom every time you will help prevent the spread of HIV), these messages often fail to indicate the steps one needs to perform to successfully execute a behavior (e.g., how to correctly use a condom); therefore, messages may also have to address the procedural knowledge surrounding the recommended behavior(s). Indeed, the majority of prior EPPM studies center on "[the] factual knowledge that X is the threat and Y will avert X rather than procedural knowledge [that there are] the seven steps to Y" (Murray-Johnson & Witte, 2011, p. 483). Therefore, the steps to successfully perform a behavior should be (a) included in the message, (b) logically ordered, and (c) actionable in order to increase perceived response efficacy (Frisby et al., 2013, 2014).

Therefore, the messages employed in this study include (a) guidance information and (b) that the recommended action(s) are the best way to protect oneself as a form of response efficacy information.

2.7.5 *Self-Efficacy*

Perceived self-efficacy refers to an individual's "perceived ability to achieve an outcome through one's own action" (Murray-Johnson & Witte, 2011, p. 481), or an individual's belief or confidence in their ability to execute a behavior (Bandura, 1997). Often, EPPM self-efficacy messages indicate that the proposed behavior is both easy (e.g., Nabi et al., 2008; Stephenson & Witte, 1998; Witte, 1993) and convenient (e.g., Ramirez et al., 2000). For example, in a study encouraging using sunblock as a way to protect oneself from skin cancer, Stephenson and Witte's (1998) high efficacy message

(i.e., a message that includes both response and self-efficacy) indicated that sunblock is easy to use in protecting oneself against skin cancer. The low efficacy message indicated that sunscreen is inconvenient due to its messiness and the extra time it takes to apply.

However, other factors should also be considered when designing self-efficacy messages. Specifically, self-efficacy messages should also (a) acknowledge the context in which the recommended behavior will be performed and (b) address any perceived barriers or obstacles that exist and/or that may inhibit the message recipient's ability to perform a behavior (Janz & Becker, 1984; Murray-Johnson & Witte, 2011; Rosenstock et al., 1988). These barriers, whether real or perceived, can include financial, physical, social, or environmental constraints (Murray-Johnson & Witte, 2011). Addressing barriers may be especially important to consider for protective actions during imminent environmental threats, as barriers have been found to be a key inhibitor in people's protective actions (e.g., Huang et al., 2016).

Furthermore, messages that address barriers to action can be an effective strategy in increasing one's perceived self-efficacy. For example, Prestin and Nabi (2012) developed self-efficacy message interventions that address the key barriers to exercise for college aged students. Results indicate that participants who received a message that matched their primary barrier to exercise (i.e., lack of time or motivation) reported a higher degree of self-efficacy than participants who received messages that did not address their main barrier to exercise.

Finally, messages of encouragement or hope that one can overcome a challenge, or in this case a threat, may also increase self-efficacy (Nabi, 2015; Nabi & Myrick, 2019; Wong et al., 2019). In this context, this type of message may translate to indicating

that one can perform recommended the behavior(s). Therefore, the messages employed in this study will also test the effect of adding information about barriers to performing the recommended action, as well as highlighting one's ability to perform a behavior, as a form of self-efficacy information.

2.7.6 *Summary*

In summary, the first purpose of this study is to determine whether the message design strategies mentioned above and included in what is called an "high threat-efficacy warning" (see Table 2.1 for high vs. low threat-efficacy warning message components) increase perceived threat, perceived efficacy, and fear. Such distinctions are important, as the EPPM differentiates between inherent message features or manipulations and their corresponding perceptions. Therefore, the following hypothesis is proposed:

> **Hypothesis 1**: Compared to the low threat-efficacy warning, the high threat-efficacy warning will be positively associated with increases in (a) perceived threat, (b) perceived efficacy, and (c) fear.

The second aim of this study is to examine how these perceptions—or fear, perceived threat, and perceived efficacy—predict one's intended behavioral responses during imminent threats in order to further refine the EPPM theoretically. The following section outlines how these variables can both directly and indirectly influence behavioral intentions, beginning with an overview of the relationship between perceived threat, perceived efficacy, and persuasion. Figure 2.2 provides a visual representation of these proposed relationships.

2.8 Behavioral Intentions and the EPPM

2.8.1 *Perceived Threat and Perceived Efficacy*

As previously noted, the majority of EPPM work to date on the has focused on the cognitive aspects of the theory (i.e., the relationship between perceived severity, perceived susceptibility, perceived response efficacy, and perceived self-efficacy) while neglecting the role of fear in influencing adaptive and maladaptive responses. Specifically, of the 12 EPPM propositions (see Appendix A), the relationship between perceived threat and perceived efficacy has received most of the attention in the EPPM literature (Popova, 2012). This relationship's predictions are captured in two of the 12 propositions: "as perceived threat increases when perceived efficacy is high, so will message acceptance" (proposition 2) and "cognitions about threat and efficacy cause attitude, intention, or behavior changes" (proposition 3; Witte, 1992, p. 340). These propositions are the same as the key predictions in protection motivation theory (PMT); thus, both the PMT and EPPM suggest that cognitions are important predictors of persuasion.

Taken together, these two propositions assert that there is an interaction between perceived threat and perceived efficacy, whereby perceived efficacy moderates the relationship between perceived threat and danger control responses. In other words, those with high perceived threat and high perceived efficacy will be the most motivated to accept message recommendations and engage in danger control responses. Although individual studies have found a significant interaction between threat and efficacy (e.g., Roberto & Goodall, 2009), this relationship lacks overall meta-analytic support (see De Hoog et al., 2007; Mongeau, 1998; Tannenbaum et al., 2015; Witte & Allen, 2000).

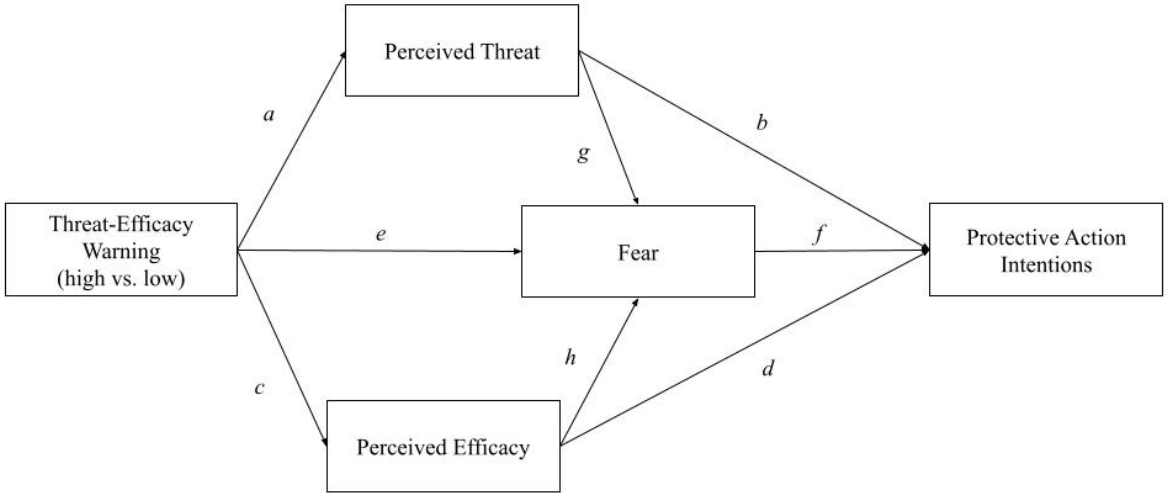
Indeed, of the meta-analyses that examine the relationship between perceived threat and perceived efficacy, only Peters et al. (2013) found a significant interaction effect; however, this meta-analysis had strict inclusion criteria, whereby studies had to employ a fully orthogonal design and include behavior change as an outcome variable ($k = 6$).

Overall, these results suggest that threat and efficacy are not as "mutually contingent" as originally postulated in the EPPM (Nabi et al., 2008, p. 192), meaning that the effects of perceived threat may not depend on one's level of perceived efficacy. Instead, research suggests that there is a positive, linear relationship between perceived threat, perceived efficacy, and danger control responses (i.e., intention and behavior; see De Hoog et al., 2007; Tannenbaum et al., 2015) and these effects are independent of one another. Thus, the following hypotheses are proposed:

Hypothesis 2: Perceived threat will mediate the relationship between the high threat-efficacy warning and protective action intentions (path *ab*).

Hypothesis 3: Perceived efficacy will mediate the relationship between the high-threat efficacy warning and protective action intentions (path *cd)*.

Figure 2.2 Model for Protective Action Intentions (H2–5 and RQ1)



2.8.2 *Fear*

Although the EPPM is classified as a fear appeal theory, researchers often neglect the role of fear in predicting adaptive and maladaptive responses (Popova, 2012). Therefore, many of the fear-based propositions of the EPPM lack empirical support. However, fear is important to examine for messages sent during imminent threats, as individuals often rely on their emotional responses to make protective action decisions in this context (e.g., Gutteling et al., 2018). Indeed, decades of work by Slovic and colleagues indicates that individuals often react to imminent threats based on their "fast, instinctive, and intuitive reactions to danger" (Slovic et al., 2004, p. 311), suggesting that affect is an important way people make decisions when time is limited (Slovic & Peters, 2006).

In addition, prior research has found that of the possible discrete emotions that can influence action, fear plays a key role in protective action decisions during imminent threats. Specifically, prior research demonstrates that warning messages can cause fear in

message recipients (Ash et al., 2014; Schumann et al., 2018; Sutton et al., 2018). However, researchers often operationalize fear differently. For example, Ash et al. (2014) and Schumann et al. (2018) operationalized fear using a single item, or "how afraid would you be for life and property," measured on a 5-point Likert scale, whereas Sutton et al. (2017) operationalized fear using four items (afraid, scared, anxious, frightened) measured on a 7-point scale ranging from 1 = *none of this feeling* to 7 = *a great deal of this feeling*.

Importantly, fear is a common response when warning messages are perceived as containing incomplete information. For example, using think-out-loud interviews and focus groups to examine 90-character Wireless Emergency Alert (WEA) messages and 140-character Tweets about an improvised nuclear device, Bean et al. (2016) found that one of the initial responses upon receipt of a warning was fear. For example, participants stated,

> "Before it even opens [the email message], I see 'radiological hazard,' and I'm like, holy crap!" said one participant. Another declared, "Okay, my thoughts are: What the f***? That's my first thought. Because I don't know what a 'radiological warning' is. But that did get my attention, and it was scary." (p. 141)

In this study, participants described both the 90-character WEA messages and 140-character Tweets as "fear inducing, uninformative, and confusing" (Bean et al., 2016, p. 141). Other notable responses include "to me, it just doesn't seem complete. It seems like just enough to terrify you, but not to really help you do anything," "I'd be

freaked out if I got that message," and finally "My thoughts? ... fear, panic" (Bean et al., 2016, p. 141).

Although fear and/or confusion in this study may be attributed to the unfamiliar hazard (Bean et al., 2016), other work suggests that fear is a common response for those experiencing disaster/imminent environmental threats (Chrisman & Dougherty, 2014; Lovekamp & McMahon, 2011; Tang et al., 2017). Furthermore, fear has been found to be a significant predictor in warning recipients' protective action intentions (Gutteling et al., 2018). Therefore, it is important to incorporate and examine the role of fear in predicting adaptive responses for messages sent during imminent threats.

However, there is a notable lack of EPPM research that has examined how fear influences danger control responses (Popova, 2012), despite long standing calls to examine the role of fear in predicting adaptive *and* maladaptive responses (Dillard, 1994) and more recent work that suggests emotion plays a key role in how people make protective action decisions (e.g., Ooms et al., 2015; So et al., 2016; Totzkay et al., 2022). Indeed, previous meta-analyses have found a direct relationship between fear and persuasion, whereby there is a positive, linear relationship between fear and changes in attitude, behavioral intention(s), and behavior. For example, Boster and Mongeau (1984) synthesized the relationship between fear appeal manipulations and their influence on perceived fear (i.e., manipulation checks on psychological states), attitudes, and behavior change ($k = 40$). Results indicate that the high fear messages lead to higher levels of fear ($r = .36$), attitude change ($r = .21$) and behavior change ($r = .10$) than lower fear messages. However, these effect sizes are considered small to medium (Cohen, 1988). Similar results can be found in Sutton (1982).

Other meta-analyses support these earlier findings and suggest that fear has a positive effect on persuasive outcomes. For example, Witte and Allen (2000) found a positive linear relationship between fear and persuasion, whereby higher levels of fear led to higher levels of attitude change ($k = 34$; $r = .15$), protective action intentions ($k = 43$; $r = .13$), and behavior change ($k = 28$; $r = .16$). Similarly, Tannenbaum et al.'s (2015) meta-analysis found that fear had a significant, positive effect on persuasion, whereby moderate to high levels of fear were more effective in changing attitudes, behaviors, and behavioral intentions than low fear/control messages. Taken together, previous research and meta-analyses suggest that fear is an important predictor of persuasive outcomes, such as protective action intentions. Thus, the following hypothesis is proposed:

Hypothesis 4: Fear will mediate the relationship between the high threat-efficacy warning and protective action intentions (path *ef*).

And although the EPPM suggests that one's cognitive perceptions of threat and efficacy, along with fear, are important factors in persuasion, how these components relate to one another and holistically promote attitude, behavioral intention, and behavior change requires additional testing to further develop and refine the EPPM theoretically (Popova, 2012). Using more robust tests of mediation allows researchers to examine how these different factors relate to one another simultaneously via calculating indirect effects, which according to Myrick and Nabi (2017) will "truly test the effect of fear-based appeals" (p. 23).

Specifically, the EPPM postulates that fear is an important predictor and/or mediator in fear control and danger control responses, respectively. So (2013) succinctly outlines the four EPPM propositions that include fear by stating "fear directly causes fear

control responses (proposition 6), indirectly causes danger control responses via perceived threat when perceived efficacy is high (proposition 7), has a reciprocal relationship with perceived threat when perceived efficacy is high (proposition 8), and mediates perceived threat and fear control responses (proposition 10)" (p. 77). Thus, the EPPM argues that fear plays an indirect role in danger control responses, whereby perceived threat mediates the relationship between fear and danger control; however, this only occurs when perceived efficacy is high. Specifically, Witte (1992) argues that messages with threatening information will lead to perceived threat, which in turn causes fear. If efficacy is low, fear leads individuals to engage in maladaptive or fear control responses. If efficacy is high, fear is instead cognitively addressed and leads individuals to further increase their degree of perceived threat. Therefore, Witte (1992) argues, "when perceived efficacy is high, fear indirectly influences adaptive outcomes, as mediated by perceived threat" (p. 343). In other words, although there must be a degree of fear for both danger control and fear control to occur, fear does not directly predict danger control responses in the EPPM.

However, previous research does not support the notion that perceived threat mediates the relationship between fear and danger control responses under high efficacy conditions (proposition 7; Ooms et al., 2015; Totzkay et al., 2022). Instead, prior research findings are more in line with Lazarus' (1991a) cognitive appraisal theory, which argues that the way an individual cognitively appraises their environment causes certain discrete emotions. Depending on message content, individuals will experience discrete emotion(s) in line with the information in the message; for example, messages that contain threatening information will lead to fear (Nabi, 2015). In turn, fear then mediates the

relationship between perceived threat and danger control (Arthur & Quester, 2004; De Hoog et al., 2007; Rippetoe & Rogers, 1987; So et al., 2016; Totzkay et al., 2022). Thus, the following hypothesis is proposed:

Hypothesis 5: Perceived threat and fear will sequentially mediate the relationship between the high threat-efficacy warning and protective action intentions (path *agf*).

Finally, the EPPM argues that those who do not feel they can effectively deal with a threat (i.e., have low perceived efficacy) may have higher levels of fear than individuals with high perceived efficacy. However, few investigations have examined the relationship between perceived efficacy and fear or have examined this relationship independent of perceived threat. Of the research that has examined this relationship, findings are mixed. Specifically, some research suggests that high perceived efficacy can lower one's degree of fear (Hartmann et al., 2014). However, other studies and meta-analyses have found a non-significant relationship between efficacy and fear (see De Hoog et al., 2007).

In addition, prior work has examined the extent to which perceived efficacy mediates or moderates the relationship between fear and persuasive outcomes (instead of fear mediating the relationship). Results from these studies suggest perceived efficacy is not a significant mediator between fear and message acceptance (Lewis et al., 2010) or a significant moderator between fear and behavior (Arthur & Quester, 2004). Thus, given the lack of consistent research findings in this area, the following research question is proposed:

Research Question 1: Does perceived efficacy and fear sequentially mediate the relationship between the high threat-efficacy warning and protective action intentions (path *chf*)?

The final aim of this study is to examine the role of perceived threat, perceived efficacy, and emotion in predicting one's motivation to obtain additional information. Indeed, a noteworthy shortcoming of the EPPM is that it only predicts three possible outcomes in response to a fear appeal message (i.e., danger control responses, fear control responses, or no response). However, only allowing three outcomes in response to messages sent during imminent threats is not realistic in practice, as a large body of literature suggests that information seeking is often the first act upon receipt of a warning message, rather than immediately engaging in protective behaviors, such as sheltering in place (e.g., Jauernic & Van Den Broeke, 2017; McGee & Gow, 2012; Sherman-Morris, 2010; Walters et al., 2020). In this context, information is defined as "stimuli from a person's environment that contribute to his or her knowledge or beliefs" (Brashers et al., 2002, p. 259). The following section further elaborates upon information seeking, culminating in the final set of hypotheses for this study.

2.9 Information Seeking and the EPPM

Information seeking is often motivated by uncertainty (Brashers et al., 2002; Brashers et al., 2000), which is an especially common feeling during infrequent events, such as tornadoes (Mileti & Sorensen, 1990). Indeed, forecasts and warnings contain an inherent degree of uncertainty due to the complex nature of accurately predicting changes in the atmosphere (Morss et al., 2019); therefore, warning recipients can also experience uncertainty about the hazard's current location, its future path, and/or its impacts

(O'Brien & Schultz, 2015; Weyrich et al., 2018). In addition, uncertainty can arise when warning recipients do not know how to effectively protect themselves, leading them to draw upon their prior knowledge or seek protective action recommendations from other sources (Lindell & Perry, 2012).

In this context, information seeking is akin to milling (Mileti & Darlington, 1997)—or "intensified collective information seeking in which participants seek to develop new 'definitions of the situation' when they perceive that something is out of the ordinary and potentially threatening is happening" (Tierney, 2019, p. 94). Milling is a type of collective sense-making activity, whereby individuals seek additional information from various sources and channels to make meaning of uncertain situations and information (Bean et al., 2016; Turner & Killian, 1957; Wood et al., 2018). Milling can also occur in the absence of warning messages, whereby individuals who observe environmental cues (i.e., the sights, smells, or sounds that signify a hazard; Lindell & Perry, 2012) and social cues (i.e., observing others performing behaviors) may also seek additional information to confirm the existence of a hazard (Mileti & Peek, 2000).

Importantly, when there is a difference between one's current level of uncertainty and one's desired level of uncertainty, information seeking will occur (Afifi & Weiner, 2004). Indeed, the concepts of *information insufficiency* or *uncertainty discrepancy* are commonly cited motivators for information seeking (Afifi et al., 2006; Griffin et al., 2004; Lindell & Perry, 2012; Mileti & O'Brien, 1992; Wood et al., 2018; Yang et al., 2014), whereby uncertainty about the hazard and/or a lack of knowledge about the situation and/or the recommended response(s) lead message recipients to seek additional information. For example, information sufficiency, which can be experienced at any point

in the decision-making process (Mileti & Sorensen, 1990), is described as an underlying psychological need that one must fulfill prior to action (Yang et al., 2014).

Specifically, information insufficiency can occur when a warning message does not properly close the gap between what is known about the current situation and what needs to be known to adequately protect oneself (Dunwoody & Griffin, 2015); furthermore, the greater the gap between one's current knowledge and the knowledge message recipients feel is needed, the greater the likelihood people will seek additional information (Griffin et al., 2004). A related concept is uncertainty discrepancy—or the difference between one's current level of uncertainty and one's desired level of uncertainty (Afifi & Weiner, 2004).

Overall, this suggests that when warning recipients are uncertain about their risk, its potential outcomes, and how to protect themselves, they will become motivated to seek additional information about these topics (Lindell & Perry, 2003; Seeger et al., 2018). Furthermore, given the pivotal role uncertainty plays in information seeking during imminent threats, theories of uncertainty can help explain who is (and who is not) motivated to seek additional information. For example, uncertainty management theory (UMT; Brashers, 2001) postulates that when uncertainty is perceived as dangerous or threatening, negative affective responses (e.g., fear or anxiety) can occur (Brashers et al., 2000). These feelings can lead individuals to engage in two primary responses: (a) seek additional information to reduce their uncertainty and negative emotions (Lindell & Perry, 2003; Seeger et al., 2018; So, 2013) or (b) avoid information to maintain their current level of uncertainty (Brashers et al., 2002). Therefore, scholars have argued that information seeking is a danger control response, whereby those who seek additional

information are motivated to reduce their uncertainty and negative feelings (So, 2013). Likewise, not seeking additional information—or information avoidance—may be considered a fear control response (Afifi & Weiner, 2004).

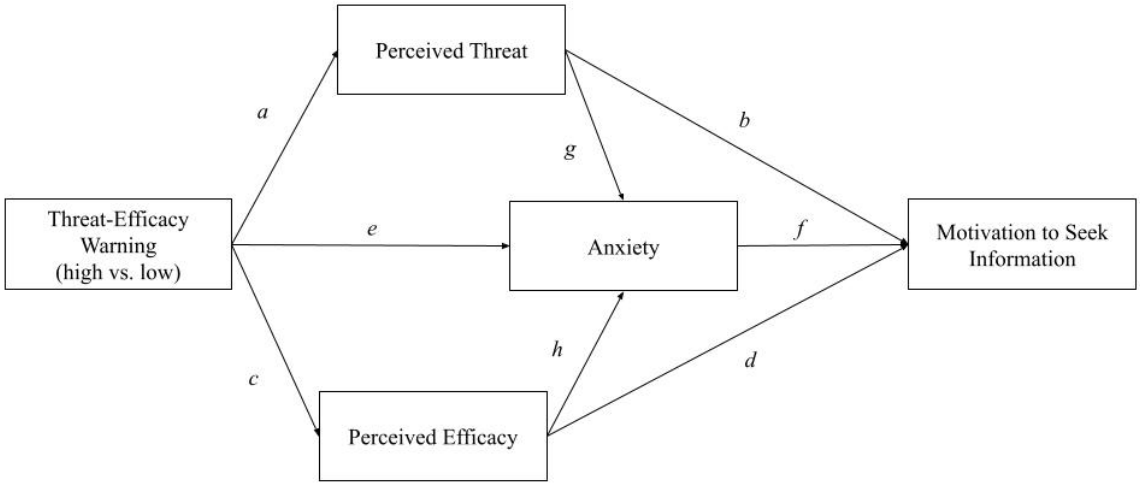
However, such classifications may not be appropriate for information seeking during imminent threats. Health related threats, for example, typically have a longer timeline between message receipt and the need to perform protective action(s); in other words, individuals have time to seek additional information before acting to help inform their decisions. However, during imminent environmental threats, there is a finite and short amount of time in which one must act (often only minutes). Therefore, there may not be enough time to seek additional information if people want to effectively protect themselves. In fact, information seeking can delay protective action, as Lindell and Perry (2012) argue: "[S]successful warning confirmation can ultimately increase compliance with recommended protective actions but does, inherently, delay them" (p. 622). Therefore, warning messages should attempt to shorten or eliminate the information seeking or milling period by addressing one's uncertainty, which then increases the likelihood that individuals will perform protective actions within the appropriate time frame (Liu et al., 2019).

Furthermore, message recipients who do not seek additional information may not be avoiding the situation but instead (a) feel they have adequate knowledge of the threat, (b) view the threat as relevant and serious, or (c) feel confident to act; therefore, they feel they do not need additional information. Given this possibility, it may be more beneficial to determine whether individuals desire or are motivated to seek additional information

by measuring their degree of information insufficiency or uncertainty discrepancy, rather than their intention to seek more information.

Finally, although primarily guided by the EPPM, this study also draws upon several key theories of uncertainty and risk information seeking to better understand how their shared theoretical constructs—perceived threat, perceived efficacy, and emotion—predict information seeking. These theories include the risk information seeking and processing model (RISP; Griffin et al., 1999; Griffin et al., 2004; Yang & Zhuang, 2020), planned risk information seeking model (PRISM; Hubner & Hovick, 2020; Kahlor, 2010; Kahlor et al., 2018), the risk perception attitude framework (RPA; Rimal, 2001; Sewell et al., 2020), and the extended-extended parallel process model (E-EPPM; So, 2013; So et al., 2016, 2019). Although these theories differ in their main predictors and paths of information seeking, all four theories share three common elements—that (a) how one views a risk, (b) one's perceived efficacy (either to seek additional information or perform the recommended behavior), and (c) affect are important drivers of information seeking intentions and behaviors. The following section provides an overview of how these variables may influence information seeking. Figure 2.3 provides a visual representation of these proposed relationships.

Figure 2.3 Model for Motivation to Seek Information (H6–9 and RQ2)



2.9.1 *Perceived Threat*

Research that has examined how perceived threat (or perceived severity and perceived susceptibility) predicts information seeking behavior (e.g., So et al., 2016) and information insufficiency (e.g., Gutteling et al., 2018) suggests that perceived threat is positively associated with information seeking intentions and behavior (Sherman et al., 2011), whereby those who feel susceptible to a serious threat are more likely to seek additional information than those with low perceived threat. For example, for terrorist threats, Kievik et al. (2012) found a significant main effect for risk perception (i.e., perceived severity and susceptibility) and information seeking behavior, meaning those with higher risk perceptions were more likely to seek additional information. Similar findings have emerged from the RPA literature. The RPA framework is informed by the EPPM and postulates that information seeking is the result of perceived susceptibility and perceived-self efficacy (Rimal, 2001). Prior RPA research has found a significant main

effect of susceptibility on participants' intention to seek information, whereby those with high susceptibility perceptions were more likely than those with low susceptibility perceptions to seek additional information (Rimal & Real, 2003). Thus, the following hypothesis is proposed:

Hypothesis 6: Perceived threat will mediate the relationship between the high threat-efficacy warning and motivation to seek information (path *ab*)

2.9.2 *Perceived Efficacy*

Prior research has also examined the extent to which perceived efficacy directly influences and/or moderates the relationship between perceived threat and information seeking intentions and behaviors. Much of this work has employed the RPA framework (mentioned above), which categorizes individuals into four groups: (a) *responsive* (high perceived susceptibility, high perceived self-efficacy), *proactive* (low perceived susceptibility, high perceived self-efficacy), *avoidance* (high perceived susceptibility, low perceived self-efficacy), and *indifference* (low perceived susceptibility, low perceived self-efficacy). Drawing on the propositions of the EPPM, Rimal (2001) argues that those with high susceptibility/high self-efficacy (i.e., responsive) perceptions should be the most likely to seek information. And like fear control, those with high susceptibility/low self-efficacy (i.e., avoidance) perceptions would be the least likely to seek information and may even avoid information on purpose.

Interestingly, prior RPA research has found that there is a significant interaction between perceived susceptibility and perceived self-efficacy, whereby those with high perceived susceptibility and low perceived self-efficacy (i.e., avoidance) have been found to be as likely to seek additional information as those in the indifference, proactive, and

responsive groups (Turner et al., 2006). These findings contradict predictions in both the RPA and EPPM. In other words, the RPA and EPPM would argue that those with high perceived susceptibility and low perceived self-efficacy would be *least* likely to seek additional information because they theoretically should engage in maladaptive responses, such as information avoidance. Therefore, these findings suggest that information seeking may operate differently than other types of EPPM outcomes, such as attitude or behavior change.

These results also suggest that there may be an interaction between perceived threat and perceived efficacy for information seeking behaviors. However, other studies do not support the notion of an interactive effect between threat and efficacy and instead suggest that a significant main effect for efficacy exists (e.g., Kuang & Gettings, 2021; So et al., 2019). Specifically, when information contained in a message includes uncertainty, perceived threat and perceived efficacy have been found to have independent effects on information seeking. For example, Goodall and Reed (2013) manipulated the level of uncertainty in threat and efficacy information contained in a hypothetical news story about bed bugs. These message manipulations primarily focused on manipulating hedging language (e.g., might vs. could); for example, a more certain statement indicated that "bed bugs...are going to turn parts of our lives upside down," whereas a more uncertain statement stated, "bed bugs...might turn parts of our lives upside down" (Goodall & Reed, 2013, p. 67). Results indicate that when messages include uncertainty language, there is no interaction effect between threat and efficacy. Therefore, when uncertainty is present in a message, threat and efficacy independently impact information

seeking.

However, for studies that found a significant main effect for perceived efficacy, its relationship to information seeking is inconsistent. For example, Goodall and Reed (2013) found that those with lower efficacy are more likely to avoid information. However, research has found that self-efficacy negatively predicts information seeking, whereby lower self-efficacy leads to information seeking behaviors (So et al., 2019). Given these inconsistent findings, the following research question is posed:

Research Question 2: Does perceived efficacy mediate the relationship between the high threat-efficacy warning and motivation to seek information (path *cd*)?

2.9.3 *Affect*

Next, information seeking may also be dependent on or heavily influenced by affect. Indeed, risk information seeking theories such RISP and PRISM incorporate "negative affect" as a key predictor in information seeking intentions and behavior. For example, within the RISP literature, negative affect has included emotions such as worry (Yang et al., 2014), anger (ter Huurne et al., 2009), and sadness, anxiety, or guilt (Yang et al., 2014; Yang et al., 2015). Within the PRISM literature, negative affect often refers to fear, dread, anxiety, or worry (Hubner & Hovick, 2020; Kahlor, 2010; Kahlor et al., 2018). Prior research employing these theories consistently finds that negative affect is positively related to information seeking for a variety of topics (Yang et al., 2014), including climate change (Yang & Kahlor, 2013), the Zika virus, (Hubner & Hovick, 2020), and health threats such as cancer (Hovick et al., 2014).

However, in these theories, "negative affect" is a single predictor composed of many discrete emotions. By collapsing different discrete emotions into a single variable,

researchers cannot fully capture the nuance or underlying thought patterns that underpin each emotion (Nabi, 2010), as different discrete emotions have "unique appraisal patterns, motivational functions, and behavioral associations" (Nabi, 2002b, p. 3). Therefore, by examining discrete emotions separately, researchers are better able to determine the specific emotions elicited in a particular situation, predict its associated behavioral outcome(s), and develop specific message strategies to elicit or inhibit certain emotional experiences.

Specifically, anxiety is an important discrete emotion to examine in relation to uncertainty, and by extension, information seeking. Lazarus (1991a) refers to what elicits a discrete emotion as its "core relational theme" and argues that imminent threat elicits fear, whereas uncertainty elicits anxiety. Thus, fear and anxiety are separate discrete emotions with distinct core relational themes (So, 2013). Furthermore, theories like the theory of motivated information management (TMIM) suggest that anxiety plays a key role in information seeking (Afifi et al., 2006; Afifi & Weiner, 2004). In addition, Turner et al.'s (2006) work on the RPA found that those with high susceptibility/low efficacy perceptions have greater levels of anxiety than the other RPA groups, which lead to higher motivations to seek additional information.

Given the importance of anxiety in predicting information seeking, So (2013) furthered this line of inquiry by introducing an extension of the EPPM (called the E-EPPM), which links the fear appeal literature to the information seeking literature by incorporating information seeking as a key outcome in response to a fear appeal message. The E-EPPM advances several theoretical arguments. First, fear and anxiety are distinct discrete emotions. Second, fear and anxiety are associated with different components of a

threat, whereby perceived severity leads to heightened levels of fear (compared to anxiety) and perceived susceptibility leads to heightened levels of anxiety (compared to fear). In turn, fear and anxiety influence one's motivation to seek additional information. Although prior research has found that *both* fear and anxiety are positively associated with motivation to gather information, anxiety exerts a greater influence on motivation to seek information than fear (So et al., 2016). Thus, anxiety may be a more appropriate discrete emotion to examine in relation to information seeking.

And despite being developed to explain fear appeals, the EPPM still provides a useful framework to explain reactions to other discrete emotions, such as anxiety. Indeed, scholars have argued that the EPPM provides an appropriate theoretical approach to predict reactions to both positive and negative emotional appeals (Lewis et al., 2013; Popova, 2012). Thus, to "broaden our sights beyond a single emotion" and "aim for a general theory of affect and persuasion" (Dillard, 1994, p. 316), this study incorporates anxiety, rather than fear, as the key emotional predictor of information seeking. Therefore, the following hypothesis is proposed:

> **Hypothesis 7**: Anxiety will mediate the relationship between the high threat-efficacy warning and motivation to seek information (path *ef*).

Furthermore, risk information seeking theories (e.g., RISP, PRISM, E-EPPM) suggest that emotion can also mediate the relationship between threat appraisals and information seeking. Specifically, these theories argue that perceived threat or risk perceptions are antecedent to affect, which in turn influences variables such as information insufficiency and information seeking. Research in this area demonstrates that risk perceptions (e.g., dread, perceived severity, perceived susceptibility) are

positively associated with negative affect (e.g., worry, concern; Turner et al., 2006; Yang et al., 2014) and affect, in turn, can influence the relationship between perceived threat/risk perceptions and information insufficiency (Kahlor, 2010) and information seeking (So et al., 2016). E-EPPM research demonstrates that similar patterns hold true for anxiety and perceived threat, whereby perceived threat (i.e., perceived severity, perceived susceptibility) increases feelings of anxiety, which in turn positively influences one's motivation to seek additional information (So, 2013; So et al., 2016, 2019). Thus, to test the overall role of anxiety in predicting information seeking as postulated in these theories, the following hypothesis is proposed:

> **Hypothesis 8**: Perceived threat and anxiety will sequentially mediate the relationship between the high threat-efficacy warning and motivation to seek information (path *agf*).

Finally, anxiety can also influence the relationship between perceived efficacy and information seeking intentions, as prior research has found that lower levels of efficacy can increase anxiety, which then positively predicts information seeking intentions and/or behaviors (Turner et al., 2006). For example, if individuals feel there is nothing they can do to protect themselves, they will experience anxiety; in turn, individuals will seek additional information to relieve their anxiety, reduce their uncertainty, and find ways to effectively protect themselves (So, 2013; So et al., 2016, 2019; Turner et al., 2006). Thus, those with low perceived efficacy may not avoid information as the EPPM would predict, but they instead feel anxious and seek additional information to reduce their anxiety and increase their efficacy. To test this possible relationship between perceived efficacy and anxiety, the following hypothesis is

proposed:

Hypothesis 9: Perceived efficacy and anxiety will sequentially mediate the relationship between the high threat-efficacy warning and motivation to seek information (path *chf*).

2.10 Chapter 2 Summary

This chapter provided an overview of the EPPM and posed nine hypotheses and two research questions that examine the relationship between fear appeal message content, fear appeal message effects, and protective action intentions and information seeking during imminent threats. The next chapter proposes the methods that will be used to test these relationships.

CHAPTER 3. METHOD

This chapter provides an overview of the experimental design, sample, creation of message stimuli, survey instruments, and experimental procedure.

3.1 Experimental Design

This study uses an experimental, posttest-only, between subjects design. This study employs a multi-message approach (discussed in more detail below), resulting in a 2 (threat-efficacy message: high vs. low) x 2 (hazard topic: tornado vs. flash flood) factorial design.

For Hypothesis 1, the independent variable is condition/message type, and the outcome variables are perceived threat, perceived efficacy, and fear.

For Hypotheses 2 through 5 and Research Question 1, condition/message type is the independent variable. Perceived threat (M_1) and perceived efficacy (M_2) are the first parallel mediators, which are serially antecedent to fear (M_3). Protective action intention is the dependent variable.

For Hypotheses 6 through 9 and Research Question 2, condition/message type is the independent variable. Perceived threat (M_1) and perceived efficacy (M_2) are the first parallel mediators, which are serially antecedent to anxiety (M_3). Motivation to seek information is the dependent variable.

3.2 Participants

Participants were recruited from the University of Kentucky's College of Communication and Information undergraduate research participant pool. Participants received course credit in exchange for their participation. Participants had to be at least

18 years old to participate.

3.3 Message Stimuli

As outlined in the previous chapter, only employing one message per experimental condition does not allow for generalizable conclusions about underlying theoretical constructs (Jackson et al., 1988, 1994); therefore, this study uses a multi-message approach, whereby the researcher created messages about two types of hazards: tornadoes and flash floods. The researcher selected these hazards for two primary reasons. First, these types of environmental hazards are both "short fuse events," meaning that at-risk individuals must act in a shorter time frame than with other types of hazards. Specifically, for tornadoes and flash floods, there is often little time between an official recognizing a hazard and issuing a warning and the event itself (McEntire, 2001; Ruin et al., 2009). Second, some tornadoes and flash floods can be classified as an "emergency," which is reserved for events where there is a severe threat to human life and/or catastrophic damage may occur (National Weather Service, n.d.-b).

Severity and susceptibility information was informed by the language contained in messages sent during actual tornado and flash flood emergencies in 2019. These messages were retrieved from the Iowa Environmental Mesonet National Weather Service text product finder, hosted by Iowa State University. Efficacy information was created based on safety information provided by the National Weather Service, the Federal Emergency Management Agency, and other weather information providers, including the Weather Channel (Breslin, 2022). These sources provide information that helps illustrate the direct benefits and effectiveness of the recommended behaviors.

3.4 Instrumentation

The following section provides an overview of the measures that were employed in this study.

3.4.1 *Extended Parallel Process Model (EPPM) Variables*

The following EPPM variables were measured using the Risk Behavior Diagnosis (RBD) Scale, as introduced in Witte (1996). These measures are widely employed in the EPPM literature and follow both the conceptual and operational definitions of each variable (Popova, 2012). The hazard included in the items varied depending on whether participants receive a tornado or flash flood warning.

3.4.1.1 Perceived Threat

Perceived threat is composed of two constructs: perceived severity and perceived susceptibility. Three items were used to assess perceived severity and perceived susceptibility, respectively, which results in a total of six items for perceived threat. These items were averaged to create an overall perceived threat index (Witte, 1996).

First, perceived severity is often assessed in the EPPM literature by asking participants how *serious, significant,* and *severe* they believe a particular threat is. This measure of severity has been found to be reliable in health contexts, such as sexually transmitted diseases (Witte, 1996; $\alpha = .90$). Furthermore, components of this measure have been applied to more immediate threats, such as public health crises (e.g., food contamination; Zhang et al., 2018; $\alpha = .91$), COVID-19 (Liu et al., 2021; $\alpha = .83$), and natural hazard contexts (e.g., hurricanes; Demuth et al., 2016; $\alpha = .87$) with good

reliability.

Therefore, severity is measured using three items: “I believe that the danger posed from [the tornado/the flash flood] is serious,” I believe that the danger posed from [the tornado/the flash flood] is significant,” and “I believe that the danger posed from [the tornado/the flash flood] is severe,” measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

Next, Witte (1996) proposes that perceived susceptibility should be measured by asking participants how *at risk*, *likely*, and *possible* they believe they will experience a threat, measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). Witte found this measure of susceptibility to be reliable for threats like sexually transmitted diseases ($\alpha = .90$). Therefore, susceptibility is measured using three items: “I am at risk for being affected by [the tornado/the flash flood],” “It is likely I will be affected by [the tornado/the flash flood],” and “It is possible I will be affected by [the tornado/the flash flood],” measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

3.4.1.2 Perceived Efficacy

Perceived efficacy is composed of two constructs: perceived response efficacy and perceived self-efficacy. Three items were used to assess percieved response efficacy and percieved self-efficacy, respectively, which results in a total of six items for perceived efficacy. These items were averaged to create an overall perceived efficacy index (Witte, 1996).

First, Witte (1996) proposes that response efficacy should be measured using three items: “[Recommended response] works in preventing [threat],” “[doing

recommended response] is effective in preventing [threat]," and "If I [do recommended response], I am less likely to get [threat]," measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

Importantly, the recommended behaviors for flash flooding and tornadoes are different, and sometimes, contradict each other. Therefore, to prevent having two different types of behavioral intention measures, this study instead asked participants about the overall message recommendations, rather than the specific behaviors for each hazard. Bell et al. (2014), who also employed a multi-message approach, found this to be a reliable way to assess response efficacy (α = .86). Therefore, response efficacy is measured using three items: "The recommendations in the message are an effective way to protect myself," "If I follow the recommendations in the message, I am less likely to get hurt," and "The message presents strategies for protecting myself that actually work," measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

Next, within the EPPM literature, self-efficacy is often assessed by asking participants how *easy* and *convenient* they feel a recommended response is, as well as their ability to perform the behavior (Witte, 1996). However, as previously discussed, this conceptualization of self-efficacy may be inappropriate for imminent threat contexts, as other factors may need to be considered, such as barriers to response.

Subsequently, scholars have begun operationalizing self-efficacy measures that are more tailored for crisis situations, such as those for food-borne illness (Frisby et al., 2013; α = .87), weather emergencies, and infectious disease threats (Avery & Park, 2016; α = . 87). Thus, these measures better fit this study's context than those originally

proposed by Witte (1996).

Therefore, this study adapted measures from both Avery and Park (2016) and Frisby et al. (2013) by measuring self-efficacy using three items: "I am able to follow the recommendations in the message," "I am confident I can follow the recommendations in the message," and "I know I can follow the steps in the message and protect myself," measured on a 5 point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

3.4.1.3 Fear

Within the fear appeal literature, fear is commonly measured using "adjectives as items" (So, 2013). Of these types of measures, Dillard and Peck's (2000) and Dillard et al.'s (1996) fear measure has undergone more rigorous forms of psychometric testing (including confirmatory factor analyses and testing for content homogeneity, internal consistency, and external consistency) than other measures. Therefore, this study adapted this measure of fear, whereby participants were asked if the message made them feel *afraid*, *scared*, and *frightened*, measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

3.4.2 *Behavioral Intention*

Behavioral intention is assessed by asking participants about the extent to which they intend to comply or follow the overall message recommendations, rather than their intention to perform the specific behavior for each hazard. For crisis messages containing instructional information, measuring message compliance—or one's intention to follow recommendations—is a common way to assess overall behavioral intentions (e.g., Fischer et al., 2019; Liu et al., 2015; Liu et al., 2017; Ophir, 2019; Park et al., 2019; Yoo,

2019).

Thus, behavioral intention is measured using three items adapted from Liu et al. (2015; α =. 83), Park et al. (2019; *r* =.76), and Yoo (2019; α =.96): "I will follow the directions in the message," "I will do what the message recommends," and "I intend to follow the recommendations in the message in order to protect myself," measured on a 5-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*).

3.4.3 *Anxiety*

Previous researchers who have incorporated anxiety as a predictor of information seeking have adapted items from Spielberger's (1983) State Anxiety Scale, finding the scale reliable (e.g., So et al., 2019; α = .95). Therefore, this study adapted this measure of anxiety, whereby participants were asked if the message made them feel *anxious*, *worried*, and *nervous*, measured on a 5-point Likert scale (1 = *strongly disagree,* 5 = *strongly agree*).

3.4.4 *Motivation to Seek Information*

Motivation to seek information is operationalized as the difference between one's desired and current level of uncertainty. This concept is referred to as uncertainty discrepancy in the theory of motivated information management (TMIM; Afifi & Weiner, 2004) and information insufficiency in the risk information seeking and processing (RISP) model. Both TMIM and RISP argue the difference between one's desired and current level of uncertainty is a direct cause and driving force behind information seeking (So et al., 2019). Thus, the larger the gap between what a person knows and what they want to know about a risk, the more likely they are to seek additional information (Afifi

et al., 2006; Dunwoody & Griffin, 2015; Griffin et al., 2004; Griffin et al., 2008).

Measuring one's gap in uncertainty is a similar approach to So et al.'s (2016), who used an adapted measure of uncertainty discrepancy to operationalize motivation to obtain protection related information (α = .86). Thus, one's motivation to seek additional information is measured using items adapted from Afifi et al. (2006), which is intended to assess motivation to obtain information about the threat and protective actions: "I know less than I'd like to know about the [tornado/flash flood]," "I want to know more than I currently know about the [tornado/flash flood]," and "I wish I knew more about [the tornado/the flash flood]" for threat and "I know less than I'd like to know about how to protect myself," "I want to know more than I currently know about how to protect myself," and "I wish I knew more about how to protect myself" for protective action, measured on a 5 point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). A higher number indicates a higher level of uncertainty discrepancy (Afifi et al., 2006).

3.4.5 *Demographics*

Finally, participants were asked the following demographic questions. The wording of these questions was at the direction of the University of Kentucky Institutional Review Board.

Participants were first asked to indicate their age at the time of completing the study. They were also asked to indicate their gender (woman, man, genderqueer, non-binary, not listed, prefer not to reply) and whether they were trans or cis gender. Finally, they were asked to indicate their ethnicity (American Indian/Alaska Native, Asian/Asian American, Black/African American, Native Hawaiian or Pacific Islander, Latino/Hispanic, White/Caucasian, or not listed).

3.5 Procedure

3.5.1 *Message Pretesting*

Using the online data collection tool Qualtrics, the researcher first conducted message pretesting to verify that each message led to the desired message effects and identify any weaknesses in the messages (e.g., the messages being difficult to understand; Atkin & Freimuth, 2013). For EPPM pretesting, Basil and Witte (2012) recommend using both qualitative and quantitative measures, as "any pre-testing needs to answer the question: did the audience really come away with the intended reaction?" (p. 51). In other words, message pretesting must determine whether participants had high levels of perceived threat and perceived efficacy following message exposure. This approach has been adopted by other EPPM researchers (e.g., Roberto et al., 2019).

Message pretesting participants were recruited from University of Kentucky's College of Communication and Information undergraduate research participant pool. First, participants consented participate in the study. Then, participants were randomly assigned to one of the four conditions. Depending on the hazard they were assigned to, participants received different introductory information. For example, those in the tornado warning conditions read a hypothetical scenario intended to immerse them in a tornado event by indicating that a tornado is impacting the area. This introductory information said,

> Imagine it is 6 PM on a Tuesday and you are at the William T. Young Library on the University of Kentucky Campus. You receive the following alert on your cell phone. After you clink the link in the message, you receive the following warning.

The cell phone alert said, "Emergency Alert: NWS TORNADO EMERGENCY for this

area until 6:30 EDT. Visit weather.gov/warning for more information." To continue with the survey, participants had to click the "next" button and were then randomly assigned either the low threat-efficacy tornado warning or the high threat-efficacy tornado warning (see Appendix B for full scenario and message stimuli). Given the length of the warning messages, the screen was locked for 30 seconds to ensure that participants fully read the message.

An identical procedure was used for those in the flash flooding conditions, whereby participants received a hypothetical alert indicating a flash flood emergency is in effect for the area. They were then randomly assigned to receive either a low threat-efficacy flash flood warning or a high threat-efficacy flash flood warning.

Message pretesting participants then answered a series of open-ended qualitative questions intended to assess their overall feelings of risk, belief in the effectiveness of the recommended response, confidence in and barriers to action, and whether the message is easy to understand (see Appendix B for the full pretesting study protocol).

3.5.2 *Scenario*

Previous experimental warning research has either (a) randomly assigned participants to a message condition without an introductory scenario (e.g., Perreault et al., 2014; Weyrich et al., 2018) or, after introducing the situation, (b) simply told participants that they have received a warning message without indicating *how* they received the warning (e.g., Morss et al., 2018). For example, Potter et al. (2018) told participants, "It is 7pm on a Monday. You see the following Severe Weather Warning issued by New Zealand's MetService for the next day (Tuesday) for your area." However, failing to tell participants the mechanism or channel through which they receive a warning may

potentially reduce the realism of the scenario.

Thus, this study alerted participants to the existence of a threat through a Wireless Emergency Alert (WEA). WEAs currently support having clickable links or URLs in the message (Fowlkes, 2018), thus allowing for a convenient and realistic way for participants to receive longer experimental warning messages, as cell phone alerts are a common way college students hear about high impact weather situation(s). For example, in surveying both students and employees at a large university following a near miss tornado that required those on campus to shelter in place, Sherman-Morris (2010) found that both students and employees first heard about the warning through a cell phone alert. Furthermore, respondents also indicated that they would prefer to receive warnings through their cell phone in the future.

3.5.3 *Experiment*

Using the feedback from message pretesting, the researcher edited the final experimental messages and scenarios. These changes are discussed in detail in the next chapter. After these changes were made and IRB approval was obtained for the altered messages, a posttest only, between subjects' experiment was used to test these updated messages and the study's hypotheses and research questions.

Specifically, a similar procedure to message pretesting was used, whereby participants were randomly assigned to one of the four experimental conditions, using different introductory information depending on hazard topic. After reading their assigned warning message, participants then completed the questionnaire using the measures in the order they are presented in the previous section (see Appendix C for full experimental protocol).

3.5.4 *Data Analytic Approach*

Before conducting hypothesis testing, a series of two-way ANCOVAs were first conducted to test for potential differences among message condition and hazard topic for perceived threat, perceived efficacy, fear, and anxiety. Specifically, data were examined for any interaction effects between message condition and hazard topic to determine whether hazard topic data could be collapsed for subsequent testing (see Bell et al., 2014). Given the results of message pretesting, which is discussed in the following chapter, prior experience with the hazard was entered as a covariate in these analyses.

Then, Hypothesis 1, which predicts that the high threat-efficacy warning will be positively associated with increases in (a) perceived threat, (b) perceived efficacy, and (c) fear, was tested via regression. Message condition was dummy coded, whereby a value of "0" indicates participants received a low-threat efficacy warning and "1" represents participants received a high threat-efficacy warning.

Finally, Hypotheses 2 through 9 and Research Question 1 and 2 were tested using SPSS 28 macro PROCESS version 3.0 Model 80. PROCESS uses an ordinary-least-squares regression path analysis approach and provides estimates of model coefficients, standard errors, *t* and *p* values, confidence intervals, and indirect effects (Hayes, 2018). This approach, when compared to other mediation approaches (e.g., Sobel, casual steps), has a higher degree of power and lower Type 1 error rate (Precher & Hayes, 2008). Following Hayes' (2013) recommendation, 10,000 bootstrap samples were used to produce bias-corrected 95% confidence intervals for indirect effects (Preacher & Hayes, 2008). An indirect effect is considered significant if its confidence interval does not

contain zero (Hayes, 2013). The message condition was also entered as a dummy (i.e., categorical independent) variable in these analyses.

CHAPTER 4. MESSAGE PRETESTING RESULTS

To help strengthen this study's message stimuli, message pretesting was conducted with a small number of participants (n = 42, or ~10% of the overall sample; Connelly, 2008). Message pretesting participants answered questions intended to assess their degree of perceived severity, perceived susceptibility, perceived response efficacy, perceived self-efficacy, fear, and anxiety using the measures outlined in the previous chapter. Participants were also asked a series of open-ended qualitative questions intended to assess their overall feelings of risk, belief in the effectiveness of the recommended response, confidence in and barriers to action, and whether the message is easy to understand (see Appendix B for the full message pretesting study protocol).

4.1 Quantitative Results

Message manipulations were considered successful if those in the high threat-efficacy conditions had a higher mean than the midpoint of the scale for perceived severity, perceived susceptibility, perceived response efficacy, perceived self-efficacy, fear, and anxiety (see Shi & Smith, 2016; McKay et al., 2004). Because these measures use a 1 (*strongly disagree*) to 5 (*strongly agree*) Likert scale, any value exceeding three could be considered above the midpoint. Based on this criterion, message manipulations were successful for all variables except fear in the high threat-efficacy flash flood warning condition (see Table 4.1)

Table 4.1 Pretesting Means for Threat-Efficacy Conditions

Variable	Condition 1: Tornado Low Threat-Efficacy Warning		Condition 2: Tornado High Threat-Efficacy Warning		Condition 3: Flash Flood Low Threat-Efficacy Warning		Condition 4: Flash Flood High Threat-Efficacy Warning	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Perceived Severity	4.63	0.46	4.67	0.67	3.91	1.09	4.03	0.55
Perceived Susceptibility	4.40	0.47	4.53	0.76	3.67	1.01	3.58	1.03
Perceived Response Efficacy	4.57	0.50	4.47	0.69	4.09	0.54	4.15	0.64
Perceived Self-Efficacy	4.50	0.53	4.47	0.86	4.21	0.60	4.19	0.54
Fear	4.20	0.42	4.20	0.76	2.88	0.86	2.93	1.22
Anxiety	4.33	0.44	4.33	0.71	3.52	0.64	3.27	1.08

Note. Items measured on a 1 (strongly disagree) to 5 (strongly agree) Likert Scale

4.2 Qualitative Results

Message pretesting participants were also asked a series of open-ended questions intended to capture what motivated their perceptions of threat, efficacy, fear, and anxiety. Participants were also asked whether they felt the hypothetical scenario was realistic and messages were easy to understand.

4.2.1 *Scenario*

Participants were first asked about the realism of the channel, location, and hazard. First, participants felt that being alerted to a threat via their cell phones was realistic, as many participants have received a warning this way in the past. For example, one participant stated, “it is very realistic because not too long ago I got a tornado

emergency warning on my phone." Another participant said, "I have had emergency alerts like this come up on my phone at random times." Next, participants felt that the scenario—or being at the main library on the University of Kentucky campus at 6 PM on a weekday—was realistic. Specifically, participants stated that "lots of students spend time at the library in the middle of the week," and "being in the library, or anywhere on campus at 6, seems to be very realistic."

Next, participants felt that the tornado scenario was realistic, yet there were mixed results for the flash flooding conditions. Specifically, for flash flooding, one participant said, "I feel like it rains a good bit in Kentucky and there could be a time where the rain is so bad that it will create flash floods so yes, I think it is realistic it can happen anywhere at any time." Another participant mentioned "this scenario is absolutely realistic because flash floods are common in Kentucky. This is something that I've experienced in my life many times." However, other participants noted that "if I receive [the warning] at 6 pm that gives half an hour for torrential downpour to happen, which is the only semi-unrealistic thing. Then again, I don't know much about weather so it could be extremely plausible." Another participant said, "no if it is 6 already and in 30 minutes it is supposed to flood, the time slot doesn't make sense."

Finally, those in the tornado conditions felt that a tornado was a plausible threat, especially given the high impact tornado event that impacted the state in December 2021. Specifically, participants mentioned that tornadoes are possible in the area "because there was a tornado that happened recently in Bowling Green." Furthermore, one participant stated "yes, it is very realistic because not too long ago I got a tornado emergency warning on my phone while I was on campus about a tornado that was on the ground in

western Kentucky that torn [sic] through the community." Thus, it appears that participants either had direct or indirect experience with these hazards.

4.2.2 *Severity*

Next, participants were asked, "Do you feel that this situation will be severe? Why or why not?" Those in the high threat-efficacy tornado warning condition felt the situation would be especially severe, as many participants appeared to focus on the "life threatening" language in the warning. Specifically, participants noted that "the tone of the message and language indicating 'life-threatening' situation makes that [severity] clear" and "the message says, 'you are in a life-threatening situation,' so I would be led to believe that the tornado would be severe enough to put my life at risk."

Those in the low threat-efficacy tornado warning condition also believed that the situation is severe due to (a) the tornado's proximity to their location, (b) the fact that the tornado was spotted (i.e., confirmed on the ground), and (c) the speed at which the tornado is moving. Therefore, participants felt the situation would be severe given the characteristic(s) of the hazard, rather than the language in the message. As one participant noted, they felt the situation will be severe "simply because I know the dangers of tornadoes."

Importantly, there appears to be a difference in how participants perceived the severity of a tornado versus flash flood, whereby those who read a flash flood warning felt the situation would be less severe than those in the tornado conditions. For example, one participant said "I think tornadoes and hurricanes and severe thunderstorms and ice storms are severe weather. I think a flash flood is something that comes and goes and doesn't tend to effect [sic] peoples' lives for an extended period of time." In addition,

other participants noted that it is "only 1-3 inches [of rain]" and "I do not think it will be severe because it's just rain." Furthermore, one participant noted the timeframe of the warning by noting, "I think it could be severe, but it says it is only a warning from 5:30-6:30 so I am not sure how much rain could occur in the short time period." However, participants indicated that including information about water rescues occurring made the flash flood situation seem more severe. For example, one participant noted that "if roads are being considered about closing [sic], this weather could be taken into consideration for your own safety."

4.2.3 *Susceptibility*

The majority of participants felt that they were at risk of being affected by the hazard, regardless of message condition. Many participants noted that they live close to or on campus, so even if they were not at the library (per the hypothetical scenario), they would still feel susceptible to the threat if they received their assigned message.

4.2.4 *Fear and Anxiety*

There was a notable difference in the level of fear and anxiety between those in the tornado and flash flood conditions.

First, those in the low threat-efficacy tornado warning condition indicated that it was less of the language and more of the situation (or hazard) that made them afraid. For example, one participant said, "it made me feel both frightened and worried but not because of the content of the message necessarily. I have always been fearful of big weather events like tornados, so the details of the message certainly worry me. It seems very close to me." Similarly, another participant said that "this makes me feel scared due to my already existing fear of tornadoes." In contrast, those in the high threat-efficacy

tornado condition mentioned that it was mainly the wording of the warning that made them afraid. For example, one participant stated, “it does [make me feel frightened or worried] because it states I am in a life-threatening situation.” Furthermore, other participants stated, “[this message makes me] worried because it is potentially life threatening” and “this message would be concerning if I received it in reality.”

In contrast, those in the flash flood conditions appeared to have less fear and anxiety. When asked whether the message they read made them feel frightened or worried, participants in the low threat-efficacy flash flood warning condition said things like “no, because I've received many of these,” “it made me slightly worried, but not too much because I have experienced these before,” and “it makes me anxious at first, but not too concerned about rain.” Also, those in the high threat-efficacy flash flood warning condition did not feel anxious or afraid, as shown by responses such as “I feel like I see these messages so frequently and a lot of times I just am able to look outside and see how severe the weather really is,” “not really, mostly because its rain and it floods to a certain degree a lot,” and “not too terribly. I am used to crazy, severe weather so I was not frightened by it. However, it is not something to ignore either.”

4.2.5 *Response Efficacy*

Participants were asked, “Do you feel that the behaviors recommended in the message are an effective way for you to protect yourself? Why or why not?” This question was used to assess participant’s perceived level of response efficacy.

For tornadoes, many noted that the action(s) included in the message are what are typically recommended; furthermore, these actions have “been proven to help in these situations” and are “the simplest and best options.” One participant also noted that the

"National Weather Service knows what they are doing and have dealt with sending out instructions to people all over the country for similar situations."

For flooding, the majority of participants said the recommended actions are effective for several reasons. First, as one participant stated, "you should definitely stay where you are unless you are in a place where flooding would occur." Another participant said it is effective not to travel or leave the building because "if you walked in the flooding it would make sense you may get hurt and fall so not walking in it seems reasonable." Furthermore, "if you stay inside the library, which is a stable building, the flooding would not be able to effect [sic] [you] that much."

4.2.6 *Self-Efficacy*

Participants in the tornado and flash flooding conditions felt that the associated behaviors were feasible for them to perform, especially because in this scenario they were inside; however, several participants said that if they were elsewhere, such as outside, they "would definitely freak out."

Specifically, for flash flooding, participants noted that the recommended behavior is easy because it requires little effort to not go outside or travel. For example, one participant said, "I am able to stay in a safe and dry environment without needing to travel." Furthermore, two participants said that plans can always be changed for the sake of one's safety.

Participants were also asked whether there was any way to improve the message so they would feel more confident to act. Most participants were favorable towards their assigned message by noting that the message was "straightforward," "good the way it is," and "couldn't do it better."

However, there were a few general suggestions for both types of warnings. For tornado warnings, participants suggested giving specific instructions for people in cars and telling people to "get in the fetal position and cover your neck with your arms, like they teach us in the tornado drills in elementary school."

For flash flooding, participants said, "it could just recommend staying inside for the time being," as well as "explicitly say how much time until the warning is up" and "which roads are blocked." Finally, a few participants suggested adding several "good" locations to go to. Those in the flooding conditions also wanted more preparedness actions and to receive the warning earlier.

4.2.7 *Barriers and Influences*

Participants were also asked, "What barriers exist that would influence or prevent you from performing the recommended actions?"

Participants who read the tornado warning messages did not perceive many barriers in their ability to shelter in place (as recommended in the message). Interestingly, these participants indicated that if they were outside or traveling via car, they would not know what to do. This lack of knowledge was listed as a potential barrier to action. However, because they were inside a familiar building in the hypothetical scenario, participants felt they had a fairly good idea of what to do. For example, one participant stated, "I am familiar with the library, which is where I am at, and I view it as a sturdy building—maybe the sturdiest on campus. Plus, I know that there is a basement that I can go do [sic] which should be pretty safe." However, a few participants wondered that if the library was busy, the basement/internal rooms could fill up and there would be no room for them to shelter. One participant also noted they would be "worried about not

being near my friends or getting my belongings stolen while everyone is taking cover." Thus, because few barriers to action were perceived for participants, this type of information was excluded from the final self-efficacy messages.

For the flash flooding messages, participants were urged to stay inside and not leave or travel. Many participants indicated if they had something urgent to do, had to go somewhere for work or school (if these activities were not canceled), or if they "absolutely had to leave the building," they would consider leaving the building, which is contrary to message recommendations.

Another important influence on protective action intentions was the extent to which participants felt safe in the building. Specifically, if participants believed they would be safer elsewhere, they would consider leaving. For instance, one participant in the low threat-efficacy flash flood warning condition said, "if I felt extremely unsafe, I would leave and go to [a] friend's house who lives in the area. I would only do this if I felt that it was necessary and felt that it was the best way to keep myself safe." Similarly, another participant in the same condition said, "if I looked outside and saw that it wasn't raining and I could leave, or if I was somewhere and close to my home I would leave and go to my home where I would feel safer." Thus, feeling safe in a location is an important consideration in following message recommendations.

4.2.8 *Understanding*

Participants across conditions felt the messages were clear, concise, and easy to understand. Specifically, these messages "get straight to the point," "give simple instructions," and "lists what you need to know and…[are] easy to read and follow."

Several participants noted that they have seen these types of messages before and are familiar with this type of message content.

Interestingly, there was a small degree of disagreement on the use of jargon (i.e., scientific language) in the messages, whereby one participant noted, "there are not a lot of scientific words used, the facts are specific and straight to the point," yet another participant suggested, "using plain language instead of 'impassable,' 'indicated,' and 'torrential' may be beneficial because some may not understand what that means." However, this participant concluded by saying, "overall though, I believe that it's an easy read because of most the language used and its short sentences."

4.3 Message Changes

Based on these results, several changes were made to the flash flood scenario and warning messages. First, participants mentioned looking outside to see how severe the situation is; if not perceived as severe (i.e., raining heavily), participants indicated they would not follow message recommendations. Furthermore, participants noted it was unlikely that severe flooding would occur in such a short timeframe if it was not already raining. Thus, the flash flooding scenario was modified to indicate that "It has been raining throughout the day and the ground appears saturated with water."

Next, participants questioned the length of the flash flood warning and how severe the amount of rainfall would be. Thus, the timing of the warning was extended by two hours (from 6:30 PM ET to 8:30 PM ET), as flash flood warnings are typically in effect for a longer amount of time than tornado warnings. Furthermore, the amount of predicted rainfall was increased to indicate "5 inches of rain have already fallen. Additional rainfall amounts of 2 to 4 inches are likely." This change was used to increase

the severity of the situation and was based on the more severe rainfall totals during actual flash flood emergencies in 2019. Finally, participants wanted to know what to do in this situation, as well as what *not* to do. Thus, the phrase "remain in a safe location" was added to the protective action portion of the message.

Finally, more intense language was added to the high threat-efficacy flash flooding condition. Specifically, the messages indicated that "basements and low-lying areas, including those around rivers, creeks, and streams could experience extreme flooding" and "extremely dangerous and devastating flooding has caused many roads to be impassable, resulting in several water rescues around Kroger Field on the University of Kentucky campus" (see Appendix C for final message stimuli).

4.3.1 *Prior Experience*

A key finding that emerged during message pretesting is the amount of influence prior hazard experience exerts on perceived threat, fear, and anxiety. However, the EPPM does not include individual differences, such as socio-demographic factors (e.g., gender, age, education, ethnicity, and income) and prior experience as theoretical units or concepts. Indeed, Witte and Allen's (2000) meta-analysis found little effect for individual differences and one's processing of fear appeal messages, resulting in an inconclusive picture between receiver characteristics and fear appeal outcomes. Thus, prior experience and socio-demographic characteristics were not originally proposed to be analyzed and/or controlled for in this study. Yet, theories of disaster behavioral response, such as the protective action decision model, do include these components and suggest they are influential in predicting one's risk perception and protective action intentions (Lindell & Perry, 2012).

However, prior reviews demonstrate that inconsistent and conflicting findings exist regarding the relationship between prior experience, risk perceptions, behavioral intentions, and behavior (Wachinger et al., 2013); for example, although some studies have found a positive relationship (e.g., Schumann et al., 2018), others have found no significant relationship between these variables (e.g., Nagele & Trainor, 2012). However, prior experience has been defined, and therefore measured, in various ways. Therefore, these contradictory findings and inconclusive relationship may be due to differences in measurement, resulting in findings that cannot be compared to one another (Demuth, 2018).

Specifically, when prior experience is defined, it is typically categorized as direct or indirect experience. Direct experience refers to someone personally experiencing the hazard—or "experiencing a hazard event with one's own eyes" (Wachinger et al., 2013, p. 1052). This type of experience may result in casualties and/or property damage (Lindell & Perry, 2012). Importantly, direct experience can influence risk perceptions and behavior either positively or negatively. For example, direct experience may help people conceptualize a hazard's impacts by exemplifying the consequences of a hazard, thus increasing one's feelings of risk (Wachinger et al., 2013). This association may be true for both cognitive risk perceptions (i.e., perceived severity and susceptibility), as well as affect. For instance, Potter et al. (2018) found that those who had direct experience with high winds had higher levels of perceived threat and concern than those who did not have direct experience. However, direct experience may also negatively impact one's risk perception by providing a false sense of security if one did not endure any adverse outcomes. Mileti and O'Brien (1992) note that in this event, one may experience

"normalization bias"—or the belief that if an event did not result in negative outcomes, future events will operate similarly. In other words, one may reason that "the first impact did not affect me negatively, therefore, subsequent impacts will also avoid me" (Mileti & O'Brien, 1992, p. 53). Thus, Wachinger et al. (2013) propose that the influence of one's direct personal experience may be related to the severity of the outcomes experienced.

This conclusion may help explain some of the qualitative findings from message pretesting, particularly for those in the high threat-efficacy flash flood warning condition, whereby participants expressed that they had experienced flooding in the past but were not concerned about its impacts. For example, in asking participants in this condition if the message made them afraid, participants responded by saying, "not really, I feel like I see these messages so frequently and a lot of times I just am able to look outside and see how severe the weather really is," "not really, mostly because its rain and it floods to a certain degree a lot," and "not too terribly. I am used to crazy, severe weather so I was not frightened by it." Thus, it appears that participants have experienced flash flooding without any severe impacts, leading them to feel that this hypothetical event is not threatening.

A second type of experience is indirect experience, defined as an "external" form of experience that is mediated through various channels and sources, such as the news media or friends and family (Demuth, 2018; Wachinger et al., 2013). These sources (or "stations") can amplify one's feelings of risk and shape how one views a hazard (Kasperson et al., 1988). Furthermore, this type of experience can affect one's mental model of a hazard—or "a set of concepts a person uses to generate inferences about a hazardous process" (Bostrom et al., 1992, p. 789). Accordingly, one does not need to

experience a hazard firsthand; instead, seeing or hearing information can influence how people view a hazard, its severity, and their susceptibility to its impacts (Zhao et al., 2019).

Relevant to this study is noting that a late season and deadly tornado outbreak occurred across portions of Kentucky approximately three months before participants took this survey. The National Weather Service described this event as "one of the worst tornado outbreaks ever recorded in the United States" (NWS, n.d.-c, para. 1), with over 70 confirmed deaths in the state. Those in the tornado warning conditions did note this event by stating, "there was a tornado that happened recently in Bowling Green" and "with the tornados that just destroyed western Kentucky, I feel as though there is a big risk with tornados." Thus, it may be the case that participants' indirect experience, such as seeing post-event damage through the news media, influenced their tornado risk perceptions. Specifically, "even if people have no direct experience with damages caused by natural hazards, they can still empathize with such experiences if stories of other people suffering through such damages are reported to them" (Wachinger et al., 2013, p. 1060); this may be especially true for these participants given the magnitude of the event that occurred in their own state.

Thus, to fully capture one's hazard experience, both direct and indirect prior experience are measured using Demuth's (2018) multiple experience scale (see Appendix C). However, it should be noted this scale was originally proposed to measure tornado prior experience, and to the author's knowledge, it has not been tested for flash flooding experience.

4.4 Summary

This chapter presented the results of message pretesting. Messages and scenarios, particularly for the flash flooding conditions, were slightly altered based on participant feedback. Furthermore, prior hazard experience emerged as a key force behind participants' perceptions. Thus, this variable was measured during the full experimental data collection portion of this study, the results of which are discussed in the following chapter.

CHAPTER 5. EXPERIMENTAL RESULTS

5.1 Participants

A total of 522 participants completed the survey. However, participants whose time to complete the survey was outside a plausible time frame were removed (n = 165). To determine a plausible timeframe for completion, a departmental research assistant took the survey and finished in approximately 9 minutes. Therefore, participants who completed the survey in under 3 minutes (n = 158; i.e., ⅓ of the time of expected completion) or over 2 hours (n = 7; i.e., participants did not finish the survey in one sitting) were removed from analysis (Greszki et al., 2015). Two participants were removed who did not finish the survey. Eliminating these participants from analysis also eliminated instances of missing data. Data was also examined for outliers by calculating Mahalanobis distances and comparing against chi-square critical values (Tabachnick & Fidell, 2007). Forty-three outliers were removed, resulting in a final sample of 312 participants retained for analysis. The average time it took the 312 participants to complete the survey was approximately 5 ½ minutes.

Of the 522 participants who completed the survey, 65.5% (n = 342) identified as a woman and 29.3% (n =153) identified as a man. Furthermore, 78.7% (n = 41) as identified as White/Caucasian, 7.1% (n = 37) identified as Black/African American, 3.8% (n =20) identified as Asian/Asian American, and 2.1% (n = 11) identified as Latino/Hispanic.

Of the 312 participants were retained for analysis, the majority of the participants identified as a woman (n = 217, 69.2%), followed by identifying as a man (n = 91, 29.2%), and non-binary (n =1, 0.3%), with four participants declining to respond to this

question (1.28%). Of the 312 participants, 80.8% (n = 253) identified as cisgender, followed by transgender (n = 1, 0.3%), with 59 participants (18.9%) declining to respond to this question. Participants ranged in age from 18 to 50, with an average age of 20.33 years. Participants primarily identified as White/Caucasian (n = 253, 80.8%), then Black/African American (n = 24, 7.7%), Asian/Asian American (n = 14, 4.5%), and Latino/Hispanic (n = 7, 2.2%). Thus, there demographic similarities between those who completed the survey and those who were retained for analysis.

Furthermore, according to University of Kentucky Institutional Research, Analytics, and Decision Support Office, as of the Spring 2021 semester, 57.0% of University of Kentucky undergraduate students were female, whereas 43.0% were male. Approximately 75% of University of Kentucky undergraduate students are White, followed by 6.9% Black, 5.6% Hispanic/Latino, and 3.2% Asian. Thus, this sample reflects the overall student body in terms of ethnicity but lacks a representative proportion of male participants.

5.1.1 *A Priori Power Analysis*

Prior to data collection, a power analysis was conducted using G*Power to determine the number of participants needed for the two-way ANCOVAs necessary to test for the interaction between hazard topic and message condition. Results indicated that the sample size needed is 269 (power = .80, alpha = 0.05, f = .25 or medium effect size).

However, determining the required sample size needed for mediation analysis is less straightforward than other types of tests (Pan et al., 2018), as software does not typically calculate the power needed to detect indirect effects (Aberson et al., 2019). In

particular, for more complex mediation (e.g., more than two mediators), power analysis is challenging and "computationally intensive," as many parameter estimates are required (Aberson et al., 2019).

Fortunately, researchers have begun to provide guidance on calculating a priori sample sizes needed to conduct simple mediation models (Fritz & MacKinnon, 2007) and more complex mediation models (e.g., for longitudinal data; Pan et al., 2018). Thus, these authors provide a degree of guidance in determining the sample sizes needed to detect small, medium, and large effects. Importantly, these studies have consistently found that bootstrapping, in particular bias-corrected bootstrapping, requires smaller sample sizes than other approaches (e.g., Sobel). Previous studies that have used the identical PROCESS model (i.e., Model 80) have had 306 participants (Chung & Kim, 2019), 226 participants (Crawford et al., 2019), 359 participants (Yildirim et al., 2021), and 154 participants (Ort et al., 2021). Thus, 312 participants was deemed to be an adequate sample size for data analysis.

5.2 Statistical Assumptions and Descriptive Statistics

Data were first examined for assumptions of normality. Skewness and kurtosis were generally found to be within the acceptable range (i.e., +/− 1; Hair et al., 2021; see Table 5.1); data were generally negatively skewed, as confirmed by visually inspecting histograms. Shapiro-Wilk tests found that all variables significantly deviated from a normal distribution ($p < .05$), most likely because of this minor skew. Q-Q plots were also examined to determine assumptions of normality, which found relatively little deviation from the diagonal line, except for at the ends. However, normality may be less

of an issue given that the sample size exceeds 300 participants (Blanca Mena et al., 2017; Sawyer, 2009).

Table 5.1 Descriptive Statistics

	α	*M*	*SD*	Skewness	Std. Error	Kurtosis	Std. Error
Perceived Threat	.89	4.07	0.71	−.575	.138	-.091	.275
Perceived Efficacy	.92	4.31	0.53	−.203	.138	-.738	.275
Fear	.95	3.15	1.04	−.055	.138	-.961	.275
Anxiety	.88	3.71	0.93	−.780	.138	.427	.275
Behavioral Intent	.96	4.18	0.75	−.888	.138	.749	.275
Info Seeking	.86	3.18	0.75	.034	.138	-.149	.275
Prior Experience	.87	3.48	0.69	.338	.138	-.229	.275

Next, multicollinearity was assessed by first creating a correlation matrix and analyzing bivariate correlation values (see Table 5.2). Correlations above 0.7 generally indicate an instance of multicollinearity; however, Variance Inflation Factor (VIF) calculations were below 10, indicating an absence of multicollinearity overall (O'Brien, 2007; Thompson et al., 2017). Finally, residual plots were examined to assess linearity, homoscedasticity, and homogeneity. Plots showed data satisfying these conditions.

Table 5.2 Correlation Matrix

	1	2	3	4	5	6
1. Perceived Threat	—					
2. Perceived Efficacy	.46**	—				
3. Fear	.62**	.24**	—			
4. Anxiety	.60**	.27**	.78**	—		
5. Behavioral Intention	.70**	.57**	.50**	.48**	—	
6. Motivation to Seek Info	.21**	−.07	.35**	.35**	.22**	—
7. Prior Experience	.31**	.20**	.32**	.33**	.22**	.12*

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

5.3 Hypothesis Testing

The following section presents the results of analyses used to test the hypotheses presented in Chapter 2. But first, a series of two-way ANCOVAs was conducted to examine whether interaction effects exist among message condition (high vs. low threat-efficacy warning message) and hazard topic (tornado vs. flash flood). This testing determines whether hazard topic data could be collapsed for subsequent testing (see Bell et al. 2014). Given the results of the message pre-testing outlined in the previous chapter, prior experience was controlled for and entered into the models as a covariate.

First, a two-way ANCOVA found no statistically significant interaction between the effect of message condition and hazard topic on perceived threat while controlling for prior experience, $F(1, 307) = .35$, $p > .05$. Second, a two-way ANCOVA found no statistically significant interaction between the effect of message condition and hazard topic on perceived efficacy while controlling for prior experience, $F(1, 307) = 1.41$, $p = .24$. Third, a two-way ANCOVA found no statistically significant interaction between the

effect of message condition and hazard topic on fear while controlling for prior experience, $F(1, 307) = 0.5$, $p = .48$. Finally, a two-way ANCOVA found no statistically significant interaction between the effect of message condition and hazard topic on anxiety while controlling for prior experience, $F(1, 307) = 0.77$, $p = .38$. Given that no significant interaction effects exist between message condition and hazard topic, hazard topic data is collapsed for calculating indirect effects.

Despite random assignment to conditions, there were significant differences between conditions and participants' reported amount of prior experience with a hazard, $F(3, 308) = 14.73$, $p < .01$. Tukey post-hoc tests revealed that those in the low threat-efficacy tornado warning had more prior experience with the hazard than those in the low threat-efficacy flash flood warning ($p < .001$) and the high threat-efficacy flash flood warning conditions ($p < .001$). Furthermore, participants in the high threat-efficacy tornado warning reported more prior experience with the hazard than those in the low threat-efficacy flash flood warning ($p < .05$) and the high threat-efficacy flash flood warning ($p <.001$). Given these differences, prior experience is included as a covariate in the following models.

5.3.1 *Protective Action Intentions*

The high threat-efficacy warning was positively associated with perceived threat ($b = .17$, $t = 2.27$, $p < .05$). Thus, hypothesis 1a, which predicted that the high threat-efficacy warning will be positively associated with increases in perceived threat, is supported. However, the high threat-efficacy warning did not exert a significant influence on perceived efficacy ($b = .01$, $t = .21$, $p >.05$). Thus, hypothesis 1b, which predicted that the high threat-efficacy warning will be positively associated with increases in perceived

efficacy, is not supported. Finally, the high-threat efficacy warning did not exert a significant direct effect on fear (b = .16, t = 1.75, p = .08). Thus, hypothesis 1c, which predicted that the high threat-efficacy warning will be positively associated with increases in perceived fear, is not supported. All direct effects, with standardized and unstandardized coefficients, are presented in Figure 5.1.

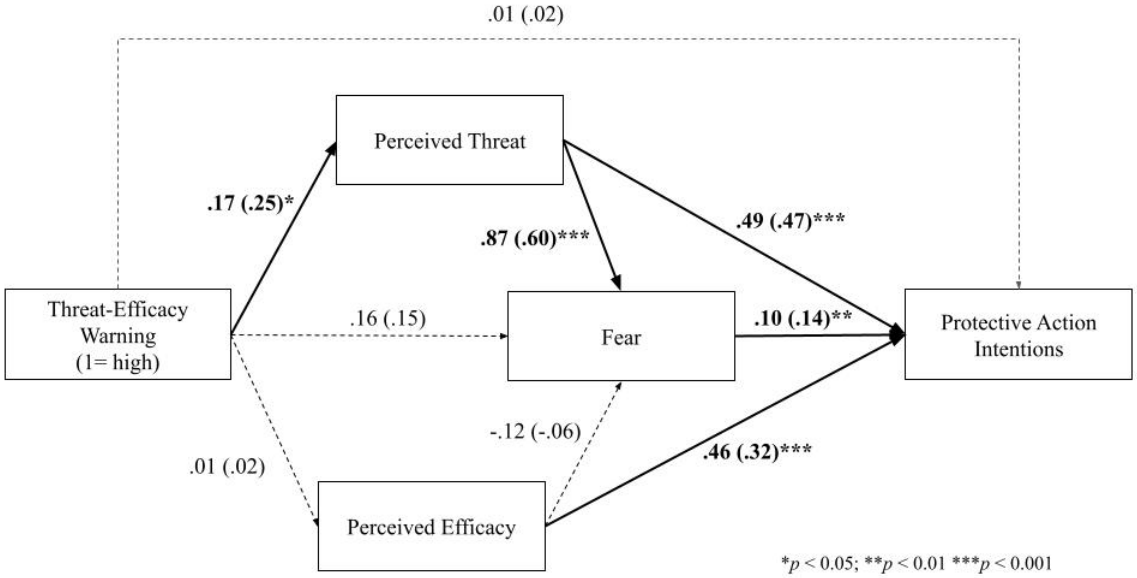


Figure 5.1 Effects of message condition on protective action intentions via perceived threat, perceived efficacy, and fear.

Note. Unstandardized coefficients are presented first, with standardized coefficients in parentheses. Significant effects are denoted by bolded lines, and nonsignificant effects are denoted with a dashed line.

5.3.1.1 Indirect Effects

Next, bootstrapping procedures for indirect effects, which are reported in Table 5.4 below, are used to test whether perceived threat, perceived efficacy, and fear mediate the message conditions and protective action (i.e., behavioral) intentions.

Table 5.3 Bootstrapped Indirect Effects for Message Condition on Behavioral Intention

Model 1 Path: Message Condition -> Perceived Threat -> Behavioral Intentions				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	**.0859**	.0384	.0122	.1646
Model 2 Path: Message Condition -> Perceived Efficacy -> Behavioral Intentions				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	.0057	.0275	-.0456	.0633
Model 3 Path: Message Condition -> Fear -> Behavioral Intentions				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	.0165	.0112	-0.002	.0410
Model 4 Path: Message Condition -> Perceived Threat -> Fear -> Behavioral Intentions				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	**.0155**	.0089	0.0015	.0364
Model 5 Path: Message Condition -> Perceived Efficacy -> Fear -> Behavioral Intentions				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	-.0002	.0010	-0.0023	.0021

Note: Unstandardized indirect effects shown. Significant indirect effects are bolded.

Hypothesis 2 predicted that perceived threat would mediate the relationship between the high threat-efficacy warning and protective action intentions. The unstandardized indirect effect was .0859, and the bootstrapped confidence interval did not include zero (.0122, .1646). Thus, the indirect effect is significant, and Hypothesis 2 is supported.

Hypothesis 3 predicted that perceived efficacy will mediate the relationship between the high threat-efficacy warning and protective action intentions. The unstandardized indirect effect was .0057, and the bootstrapped confidence interval did

include zero (−.0456, .0633). Thus, the indirect effect is not significant, and Hypothesis 3 is rejected.

Hypothesis 4 predicted that fear will mediate the relationship between the high threat-efficacy warning and protective action intentions. The unstandardized indirect effect was .0165, and the bootstrapped confidence interval did include zero (−.002 .0410). Thus, the indirect effect is not significant, and Hypothesis 4 is rejected.

Hypothesis 5 predicted that perceived threat and fear will sequentially mediate the relationship between the high threat-efficacy warning and protective action intentions. The unstandardized indirect effect was .0155, and the bootstrapped confidence interval did not include zero (.0015, .0364). Thus, the indirect effect is significant, and Hypothesis 5 is supported.

Finally, Research Question 1 asked whether perceived efficacy and fear sequentially mediate the relationship between the high threat-efficacy warning and protective action intentions. The unstandardized indirect effect was −0.002, and the bootstrapped confidence interval did include zero (−.0023, .0021). Thus, the high threat-efficacy warning does not indirectly affect protective action intentions via perceived efficacy and fear.

5.3.2 *Motivation to Seek Information*

Hypotheses 6 through 9 and Research Question 2 were tested using an identical analytic approach; however, anxiety replaces fear, and the outcome variable is motivation to seek information. All direct effects, with standardized and unstandardized coefficients, are presented in Figure 5.2.

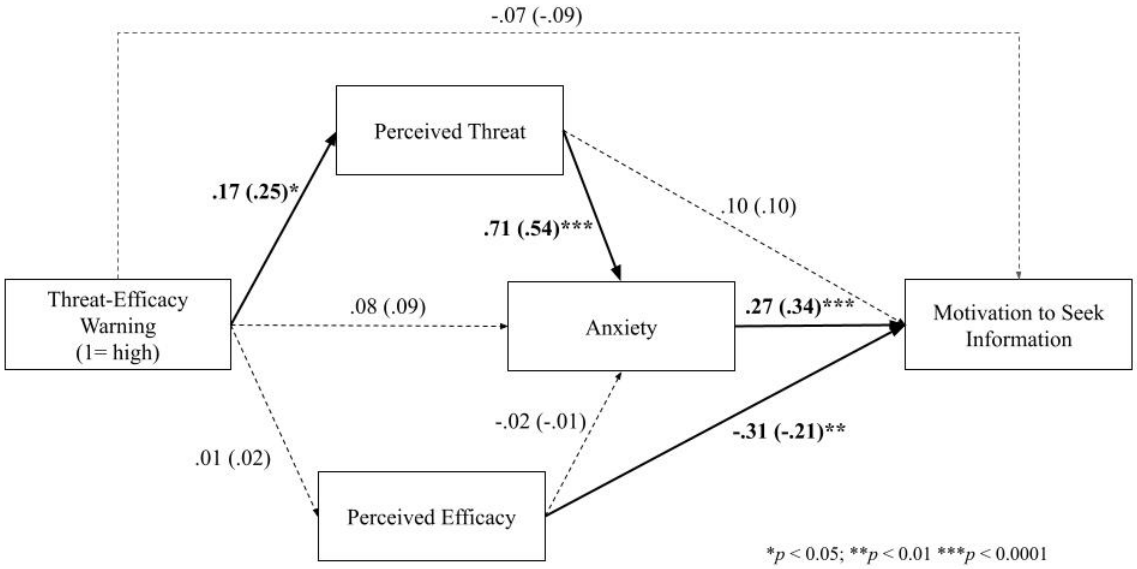


Figure 5.2 Effects of message condition on motivation to seek information via perceived threat, perceived efficacy, and anxiety.

Note. Unstandardized coefficients are presented first, with standardized coefficients in parentheses. Significant effects are denoted by bolded lines, and nonsignificant effects are denoted with a dashed line.

5.3.2.1 Indirect Effects

Indirect effects, which are reported in Table 5.6 below, are used to test whether significant mediation is occurring between variables.

Table 5.4 Bootstrapped Indirect Effects for Message Condition on Information Seeking

Model 1 Path: Message Condition -> Perceived Threat -> Motivation to Seek Info				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	.0188	.0168	-.0059	.0585
Model 2 Path: Message Condition -> Perceived Efficacy -> Motivation to Seek Info				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	-.0038	.0182	-.0402	.0336
Model 3 Path: Message Condition -> Anxiety -> Motivation to Seek Info				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	.0229	.2440	-0.0216	.0758
Model 4 Path: Message Condition -> Perceived Threat -> Anxiety -> Motivation to Seek Info				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	**.0340**	.0178	0.0049	.0740
Model 5 Path: Message Condition -> Perceived Efficacy -> Anxiety -> Motivation to Seek Info				
			95% Confidence Interval	
	Point Est.	Boot SE	Lower	Upper
Message (1 = High Threat)	-.0001	.0015	-0.0033	.0035

Note: Unstandardized indirect effects shown. Significant indirect effects are bolded.

Hypothesis 6 predicted that perceived threat will mediate the relationship between the high threat-efficacy warning and motivation to seek information. The unstandardized indirect effect was .0188, and the bootstrapped confidence interval did include zero (−.0059, .0585). Thus, the indirect effect is not significant, and Hypothesis 6 is rejected.

Research question 2 asked whether perceived efficacy mediates the relationship between the high threat-efficacy warning and motivation to seek information. The unstandardized indirect effect was −.0038, and the bootstrapped confidence interval did include zero (−.0402, .0336). Thus, the high threat-efficacy warning does not indirectly affect motivation to seek information via perceived efficacy.

Hypothesis 7 predicted that anxiety will mediate the relationship between the high threat-efficacy warning and motivation to seek information. The unstandardized indirect effect was .0229, and the bootstrapped confidence interval did include zero (−.0216, .0758). Thus, the indirect effect is not significant, and Hypothesis 7 is rejected.

Hypothesis 8 predicted that perceived threat and anxiety will sequentially mediate the relationship between the high threat-efficacy warning and motivation to seek information. The unstandardized indirect effect was .0340, and the bootstrapped confidence interval did not include zero (.0049, .0740). Thus, the indirect effect is significant, and Hypothesis 8 is supported.

Hypothesis 9 predicted that perceived efficacy and anxiety will sequentially mediate the relationship between the high threat-efficacy warning and motivation to seek information. The unstandardized indirect effect was −.0001, and the bootstrapped confidence interval did include zero (−0.0033, .0035). Thus, the indirect effect is not significant, and Hypothesis 9 is rejected.

5.4 Summary

This chapter presented the results of testing nine hypotheses. These results are summarized in Table 5.7. Furthermore, this chapter also answered two research questions. These results, as well as their theoretical and applied implications, are further discussed in the subsequent chapter.

Table 5.5 Summary of Hypothesis Testing Results

Hypothesis	Prediction	Supported?
Hypothesis 1a	Compared to the low threat-efficacy warning, the high threat-efficacy warning will be positively associated with increases in perceived threat	Supported
Hypothesis 1b	Compared to the low threat-efficacy warning, the high threat-efficacy warning will be positively associated with increases in perceived efficacy	Rejected
Hypothesis 1c	Compared to the low threat-efficacy warning, the high threat-efficacy warning will be positively associated with increases in fear	Rejected
Hypothesis 2	Perceived threat will mediate the relationship between the high threat-efficacy warning and protective action intentions	Supported
Hypothesis 3	Perceived efficacy will mediate the relationship between the high threat-efficacy warning and protective action intentions	Rejected
Hypothesis 4	Fear will mediate the relationship between the high threat-efficacy warning and protective action intentions	Rejected
Hypothesis 5	Perceived threat and fear will sequentially mediate the relationship between the high threat-efficacy warning and protective action intentions	Supported
Hypothesis 6	Perceived threat will mediate the relationship between the high	Rejected

	threat-efficacy warning and motivation to seek information	
Hypothesis 7	Anxiety will mediate the relationship between the high threat-efficacy warning and motivation to seek information	Rejected
Hypothesis 8	Perceived threat and anxiety will sequentially mediate the relationship between the high threat-efficacy warning and motivation to seek information	Supported
Hypothesis 9	Perceived efficacy and anxiety will sequentially mediate the relationship between the high threat-efficacy warning and motivation to seek information	Rejected

CHAPTER 6. DISCUSSION

This study has three primary aims: (a) to examine warning message language manipulations on extended parallel process model (EPPM) perceptions—or perceived threat, perceived efficacy, and fear; (b) to examine how these perceptions simultaneously influence one's intention to protect themselves and further explore the role of fear in motivating danger control (i.e., positive) responses to a message; (c) to investigate behaviors beyond danger control and fear control by examining information seeking intentions. The following sections explore the results related to these study objectives and include a discussion of the theoretical implications for the EPPM, practical findings for warning message designers, and limitations and future directions.

6.1 The EPPM and Warning Message Design

The first objective of this study was to examine the effect of warning message language manipulations on perceived threat, perceived efficacy, and emotion. These language manipulations and their effect on message relevant perceptions are important to examine in order to advance our understanding of message design and persuasion holistically (O'Keefe, 2003), as well as to provide empirically informed guidance to warning message writers.

Two types of warning messages were created that manipulated the type of threat and efficacy information. The high threat-efficacy warning contained the following characteristics: (a) severity information included the impacts or consequences of the hazard (e.g., life threatening, destroy buildings); (b) susceptibility information included specific location information (e.g., landmarks) and the direction, speed, and/or location of the hazard; (c) response efficacy information included the effectiveness of the

recommended response in protecting oneself; and (d) self-efficacy information included one's ability to perform the recommended action(s). Furthermore, this study also used a multi-message approach in order to create more generalizable claims about message effects, whereby warning messages were created for both tornado and flash flood events.

First, the high threat-efficacy warning significantly increased perceived threat. Perceived threat is important theoretically, as it is the first thing people assess in response to a risk message. Furthermore, if perceived threat is low, message recipients will stop processing the message; thus, perceived threat is the catalyst toward action (Witte, 1992).

These results are in line with prior research, which has found that warning messages that include information related to (a) the impacts to one's environment and/or one's safety, (b) one's likelihood of experiencing a hazard, and (c) protective action statements have been found to increase cognitive risk perceptions, such as perceptions of overall threat (Potter et al., 2018) and risk (Ripberger et al., 2015), as well as severity and susceptibility more specifically (Morss et al., 2018). Thus, to motivate people towards action via increasing perceived threat, these pieces of information should be included in a warning message (Mileti & Peek, 2000).

However, there was not a significant association between the high threat-efficacy warning and perceived efficacy. This finding may be explained, in part, by a lack of noticeable difference between the overall efficacy (i.e., protective action) content in the two message conditions. Recent research suggests that when compared to a control message without protective action guidance, warning messages with protective action information significantly raise both response and self-efficacy perceptions (Sutton et al., 2021). Both conditions in this study included protective action statements that

communicated how one ought to protect themselves, thus potentially explaining the lack of significant differences in perceived efficacy between the two message conditions.

This finding could suggest that message writers do not need to provide efficacy information as traditionally conceptualized in EPPM research, meaning warnings may not need to explicitly provide justification for why the recommended behaviors are effective or that one possesses the ability to perform these behaviors. However, it should be noted that prior experience was controlled for in this testing. Logically, those with lower experience may desire more detailed information about the recommended protective action(s). Providing this information may, in turn, increase perceived efficacy. Indeed, as prior experience can affect efficacy perceptions (Demuth et al., 2016), future work may consider incorporating prior experience as a predictor of perceived efficacy to determine whether more tailored protective action guidance is needed for those with or without prior experience.

Finally, the high threat-efficacy warning did not directly lead to higher feelings of fear when considering perceived threat and efficacy. Such results are not surprising given the close relationship between perceived threat (i.e., cognitive risk perceptions) and fear (i.e., emotion). For example, when examining the type(s) of information associated with fear, prior research has found that severity information/perceived severity is a more significant predictor of fear than perceived susceptibility (So et al., 2016). Indeed, warnings that include severity information via highlighting the impacts to one's environment have been found to increase concern (Potter et al., 2018; Weyrich et al., 2018). However, it is important to note that although concern is conceptually similar to

fear, concern is argued to be more of a holistic measure of negative affect rather than a discrete emotion (Wilson et al., 2019).

Furthermore, prior research suggests that the type of severity information included in a warning message can elicit different levels of fear. For example, Morss et al. (2018) found that for a hypothetical hurricane event, highlighting the impacts to one's environment (e.g., "many homes will be destroyed or uninhabitable, and some neighborhoods will be completely destroyed") significantly increased fear; however, messages focusing the impacts to one's safety (e.g., "people who do not have safe shelter to suffer devastating injuries or be killed. If you stay, you may die") did not significantly increase fear. The current study included impacts both to one's environment and one's safety as a form of severity information; thus, future work may consider performing qualitative formative research to determine which type of impact information is perceived as scarier and why. Furthermore, examining these message components using a full orthogonal design to determine precisely which message components could elicit fear in message recipients is also a viable next step (see Roberto et al., 2019).

It is important to note that message pretesting was conducted, which has long been recognized as a valuable exercise for message designers as a part of the formative research process (O'Keefe, 2018), and thus was a key focus of this study. Specifically, message pretesting involved having the target audience evaluate initial versions or drafts of messages to help increase the effectiveness of the final experimental message interventions (Atkin & Freimuth, 2013). In the context of threat or fear appeals, effectiveness is defined as ensuring that the initial messages increase perceptions of threat, efficacy, and fear, respectively (Basil & Witte, 2012).

Although message pretesting helped identify the message content that could elicit key EPPM perceptions, this study demonstrates that despite message manipulations and threatening language, pre-existing hazard perceptions, often based on one's prior experience, were hard to change. Specifically, on the basis of message pre-testing results, those who read a flash flood warning message had lower levels of perceived threat, perceived efficacy, fear, and anxiety than those who read a tornado warning, despite similar language being used across hazard topics.

Even though it is not theoretically relevant to analyze hazards separately at this time, as this study is interested in perceptions as overall theoretical constructs, in practical or applied terms, additional analysis is warranted. Importantly, these findings regarding hazard perceptions share similar findings to recent research about the communication of TORFF events, which occur when tornado and flash flood warnings occur simultaneously. For example, Henderson et al. (2020) observed and interviewed National Weather Service Weather Forecast Office meteorologists in the Southeastern United States who experienced overlapping and simultaneous tornado and flash flood events, and thus had to issue warnings for each type of hazard. These researchers found that when flash floods and tornadoes overlap, forecasters expressed that they themselves and their community would typically be more concerned with tornadoes versus flooding for several reasons. First, forecasters note that flash flooding is relatively common and their warnings, especially their associated wireless emergency alert messages, can become a "nuisance." Furthermore, forecasters in the study pointed out an important fact—that water is a part of our everyday experience. As Henderson et al. (2020) note, "the ubiquitous experience people have with water—in their homes, in rivers and oceans,

in rainfall and its behavior during storms—may create circumstances in which a flash flood is not visible as a threat but as a familiar part of people's world" (p. 1469). In contrast, tornadoes are more uncommon and unusual; thus, the forecasters in this study believed that their community would not only view tornadoes as more dangerous but also be less likely to ignore their warning messages. The findings of this study support these beliefs, whereby participants viewed tornado warnings as more threatening and scarier than flash flood warnings.

Overall, these findings suggest that in certain instances, one's risk perceptions may be influenced less by the language in a message and more by perceptions of the hazard itself. As this study did not measure hazard specific risk perceptions, future work should investigate this possibility, as well as incorporate one's prior experience with a hazard as a key predictor of response intentions. Furthermore, formative research about hazard specific topics, which can be used to construct tailored warnings for various types of hazards, should be explored.

Next, this study focused on how the perceptions triggered by message manipulations influence danger control responses. Specifically, this study was designed to provide claims regarding the effectiveness of the experimental messages in inducing perceptions and how these perceptions, in turn, influence one's intention to protect themselves, with a special emphasis on the role of fear in predicting these intentions.

6.2 Protective Action Intentions

The second objective of this study was to examine how EPPM perceptions simultaneously influence protective action intentions. The EPPM predicts that risk messages that include threat and efficacy information will lead to adaptive behavioral

changes via increases in perceived threat and perceived efficacy. If perceived threat is low, message recipients will stop attending to the message. However, if perceived threat is high, message recipients will assess their ability to cope and determine their perceived level of efficacy. If perceived efficacy is high, message recipients will change their attitudes, intentions, and behavior in line with message recommendations (i.e., danger control responses; see Appendix A for the full list of EPPM propositions). Fear is hypothesized to play a minor role in predicting these danger control responses (Witte, 1992). Specifically, perceived threat is thought to mediate the relationship between fear and danger control; however, this only occurs when perceived efficacy is high (proposition 7). Then, fear is cognitively addressed and leads individuals to further increase their degree of perceived threat (proposition 8).

However, many of these EPPM propositions lack empirical testing and evidence, especially those regarding fear (Popova, 2012). And although the EPPM ultimately classifies fear as something that hinders positive decision making (see proposition 6), research examining the fear-based propositions of the EPPM has found evidence contrary to their conclusions (Bigsby et al., 2021; Dillard et al., 2017a; Ooms et al., 2015; Serpas & Ignacio, 2021; So et al., 2016; Totzkay et al., 2022). Thus, this study builds on this work by examining the role of fear in predicting danger control responses in an imminent threat context and uses mediation analysis to examine how perceived threat, perceived efficacy, and fear relate to one another to simultaneously influence the effect of warning message language on protective action intentions.

Results indicate that perceived threat significantly mediates the relationship between message condition and protective action intentions, whereby those who read a

high threat-efficacy warning had higher levels of perceived threat, which led to higher intentions to engage in protective action. However, fear also significantly influences this relationship as well, whereby the high threat-efficacy warning led to higher perceived threat, which increased fear and ultimately protective action intentions. These findings suggest that emotion plays a closer role in positive decision making via danger control responses than originally theorized in the EPPM and demonstrates that although perceived threat can motivate protective action intentions, perceived threat can also increase feelings of fear, which in turn increase protective action intentions.

These results are similar to those of Totzkay et al. (2022), who found that in the context of dense breast notification letters, perceived threat led to negative affective responses independent of perceived efficacy, which positively influenced women's intention to talk to their healthcare provider; thus, the authors conclude that emotion is the "motivating force behind planning to act to reduce one's risk" (p. 110). Furthermore, recent work on COVID-19 perceptions found that higher COVID-19 risk perceptions were associated with higher levels of fear, which increased the likelihood of individuals performing COVID-19 preventative behaviors (Serpas & Ignacio, 2021). Indeed, fear can also positively affect other danger control responses, such as positive thoughts and attitudes towards a message (Bigsby et al., 2021). Thus, fear may not necessarily interfere with positive decision making and danger control responses overall. Instead, perceived threat and fear can ultimately motivate protective action intentions and other positive changes in the message recipient.

However, as previously mentioned, this study failed to produce enough variance in perceived efficacy in a way that was significantly influenced by message

manipulations. Thus, hypotheses regarding the mediating role of perceived efficacy between message condition and protective action intentions were not supported. However, perceived efficacy is still important, as it was found to positively predict protective action intentions. Furthermore, previous research suggests that efficacy does not significantly moderate the relationship between threat and danger control responses as originally predicted in the EPPM (Ooms et al., 2015; Totzkay et al., 2022; Witte & Allen, 2000). Therefore, although perceived threat and fear may be enough to independently motivate action, perceived efficacy is also an important and independent determinant of behavioral intention; thus, messages that increase perceived threat should attempt to increase perceived efficacy. Specifically, warning messages should provide protective action guidance to increase efficacy perceptions (Sutton et al., 2021), which in turn should positively impact protective action intentions.

Of additional theoretical interest is the result that perceived efficacy did not significantly influence or reduce fear. The EPPM predicts that those with low efficacy "will be most frightened when they feel helpless in the face of a grave threat" (Witte, 1994, p. 117) and hypothesizes that efficacy information, and in turn high perceived efficacy, should reduce fear arousal (Witte, 1992). Results provide evidence contrary to this proposed relationship.

Importantly, the nonsignificant relationship between fear and perceived efficacy is in line with the results of Dillard and Li's (2020) meta-analysis, which found that efficacy is not a significant moderator in fear arousal. In particular, the degree of fear elicited by a threat appeal did not significantly vary between studies that included an efficacy statement ($k = 28$) and those without an efficacy statement ($k = 41$). Dillard and

Li argue that this effect is the result of prior knowledge of the recommended action(s). Specifically, EPPM studies typically assume that message recipients lack prior knowledge about how to effectively protect themselves; thus, risk messaging attempts to fill this gap by outlining precisely what one needs to accomplish. However, as Dillard and Li note, "contemporary adults do not need to be told how to brush their teeth nor that doing so will reduce the risk of gum disease," (p. 17), as this type of information is typically learned through the media, interpersonal channels, and overall life experiences.

Indeed, many individuals have received education and understand tornado (Walters et al., 2020) and flash flood safety behaviors (Coles & Hirschboeck, 2020). Thus, message recipients may have possessed a pre-existing degree of contextual knowledge, and thus efficacy, about how to protect themselves. This contextual knowledge may buffer the relationship between perceived efficacy and fear. Furthermore, message pre-testing indicated that in response to the hypothetical scenario, participants felt they could effectively protect themselves, which is also demonstrated by the high reported means in efficacy across message conditions. Future research may consider including more unfamiliar hazards or situations to further explore the relationship between fear and perceived efficacy.

Finally, these results have implications not only for the EPPM but also for explanatory models within the disaster and warning literature. Specifically, Mileti and Sorensen's (1990) warning response model and the protective action decision model (PADM; Lindell & Perry, 2012) both dominate the majority of work related to warning outcomes. Mileti and Sorensen's model summarizes a series of steps that warning recipients generally perform prior to acting, whereupon receiving a warning, message

recipients must (a) understand the message, (b) believe that the information contained in the message is true, and (c) feel personally at risk (Mileti & Peek, 2000). The PADM further elaborates upon Mileti and Sorensen's work and focuses on how information cues initiate a series of pre-decisional factors (e.g., attention, comprehension) that inform one's perception of the situation and ultimately action (Lindell & Perry, 2012).

Thus, both scholars conclude that warning response is not an isolated action but a series of pre-decisional cognitive steps that ultimately lead to response. Yet, the role of affect in predicting, mediating, or influencing these perceptions is not included, as neither model accounts for the role of emotion in warning decision making (Sutton et al., 2018). Results of this study suggest that affect, in particular fear, should be incorporated as a predictor of warning response intentions.

6.3 Motivation to Seek Information

The third objective of this study is to explore behaviors outside of fear and danger control responses by examining information seeking. Indeed, individuals often try to manage their imminent threat risk in many ways, including paying attention to weather information and forecasts (Demuth et al., 2022), defining and making sense of a situation with others (i.e., milling; Wood et al., 2018), and confirming the contents of a warning message by seeking additional information from various sources (Mileti & O'Brien, 1992). Thus, information seeking was also investigated as a possible response to a warning message in this study.

Before turning to the results, it is important to note information seeking is typically classified as a positive outcome in the information seeking literature, especially for health information, where it is often viewed as an antecedent to behavior change (So

et al., 2016; Zhuang & Guan, 2021). However, if the goal of a message is to get people to quickly act, information seeking may impede this outcome by delaying protective action. Specifically, there is often a limited amount of time to perform protective actions for high impact, sudden onset imminent threats and avoid negative outcomes, such as injury and death (Kuligowski et al., 2014). As Dootson et al. (2022) succinctly summarize, during imminent environmental threats "the time between taking protective action (e.g., evacuating) and the outcome (e.g., not dying during a flood event) is shorter than health actions (e.g., quitting smoking) and the outcome (e.g., not getting lung cancer)" (p. 2). Thus, warning message writers may seek to design messages in a way that lessens the likelihood of individual's seeking additional information and/or confirming the information already included in a message (Wood et al., 2018).

Results of this study indicate that although perceived threat and emotion are important predictors of protective action intentions, they also increase the likelihood that one will seek additional information. Thus, perceived threat and emotion produce a situation that has both positive and negative aspects, whereby these perceptions increase the likelihood of protective action but also increase behavior that may delay said response.

Specifically, this study uses anxiety as the affective predictor of motivation to seek information. Anxiety, rather than fear, was included for two primary reasons. First, although there are many reasons that people seek additional information, most explanations center upon the notion of uncertainty reduction (e.g., Kuang & Gettings, 2021; Zhang & Fan, 2022). Because uncertainty occurs when there is a gap in one's knowledge and the knowledge one feels is necessary to act (Brashers, 2001), information

seeking is an important way for message recipients to reduce and manage their uncertainty (Afifi & Weiner, 2004). As argued by the functional theory of emotion, uncertainty elicits anxiety (Lazarus, 1991a). Therefore, in response to uncertainty, individuals will experience anxiety, which is theorized to increase their likelihood of seeking information to reduce this feeling (Afifi et al., 2006; Lee & Hawkins, 2016; Turner et al., 2006).

Results of this study demonstrate that the high threat-efficacy warning led to high perceived threat and anxiety and an increased motivation to seek information. Specifically, anxiety mediated the relationship between perceived threat and motivation to seek information, whereby the high threat-efficacy warning led to higher levels of perceived threat, which in turn increased anxiety and resulted in higher motivation to seek information. Unlike the previous findings, perceived threat was not a significant mediator between message condition and motivation to seek information independent of emotion. Instead, perceived threat exerts an effect on information seeking through increasing anxiety.

These findings support prior work and information seeking theories, such as the risk information seeking and processing model (RISP; Griffin et al., 2004), planned risk information seeking model (PRISM; Kahlor, 2010), and extended-extended parallel process model (E-EPPM; So, 2013). Specifically, these theories predict that high risk perceptions produce negative affective responses (e.g., worry), which increases the likelihood of seeking information (e.g., Kahlor, 2010). For example, using RISP as a theoretical lens, Yang and Zhuang (2020) examined predictors of Hurricane Harvey information seeking and sharing behaviors post event for both those affected (i.e.,

Houston residents) and not affected by the hurricane. Results indicate that participants who had higher risk perceptions about hurricane risks in general (e.g., think that hurricanes cause catastrophic destruction and death) were more likely to experience negative emotions (i.e., fear, worry, sadness, depression, anger). Negative emotions, in turn, led to a higher desire for information about Hurricane Harvey (i.e., higher information insufficiency), which ultimately led to higher information seeking. Although this particular study, and RISP more generally, uses an overall negative affect measure, similar results have been found for anxiety as a discrete emotion. Specifically, perceived threat has been found to increase anxiety, which increases the likelihood of seeking additional information (So et al., 2016). Thus, both theory and the results of this study provide evidence that cognitive and affective risk perceptions are important predictors of information seeking (Yang & Kahlor, 2013), and explanations about what motivates information seeking must include an affective component.

However, if message writers want to decrease the likelihood of information seeking behavior, perceived efficacy is important to consider. Although perceived efficacy did not mediate the effect of message condition on motivation to seek information, it was found to be negatively related to motivation to seek information, meaning those with lower levels of efficacy were more likely to seek information in response to a threat. Similar findings regarding the relationship between perceived efficacy and information seeking have emerged in the risk perception attitude framework literature (RPA; Rimal, 2001), which classifies individuals into four groups based on their risk perceptions (i.e., perceived susceptibility) and efficacy perceptions (i.e., self-efficacy): (a) *responsive* (high perceived susceptibility, high perceived self-efficacy),

proactive (low perceived susceptibility, high perceived self-efficacy), *avoidance* (high perceived susceptibility, low perceived self-efficacy), and *indifference* (low perceived susceptibility, low perceived self-efficacy). Although the RPA predicts that the high susceptibility/low self-efficacy (i.e., avoidance) group would be the least likely to seek information and may even avoid information on purpose—meaning information seeking is a danger control response and information avoidance is a fear control response—prior work in this area has found that those with high perceived susceptibility and low self-efficacy were as likely to seek information as the other three groups (Rimal & Real, 2003; Turner et al., 2006). These results also support research by So et al. (2019), who found that self-efficacy was a negative predictor of information seeking, whereby lower self-efficacy beliefs lead to higher information seeking behaviors, such as time spent on a website. Altogether, these results along with study findings suggest that to decrease the likelihood of additional information seeking upon receipt of a warning message, message recipients must possess a high degree of perceived efficacy in performing the recommended response(s).

Yet, the question remains as to the types of information message recipient's desire. Specifically, do message recipients seek information to increase their efficacy or do they want information to confirm the threat? Logically, those with low self-efficacy may seek information to increase their coping (Turner et al., 2006), but future work in this area should determine whether participants want information about the threat (e.g., potential impacts, location, confidence in forecast), about how to protect themselves (Potter et al., 2018), or about what others are doing (i.e., milling; Wood et al. 2018).

Further refining the types of information people want also has implications for warning message design overall.

Finally, results indicate that perceived efficacy and anxiety are unrelated, whereby perceived efficacy does not appear to reduce anxiety as originally predicted. These results mirror those regarding fear and perceived efficacy, whereby there was an insignificant relationship between perceived efficacy and fear as well; thus, in both domains, efficacy does not appear to impact or reduce emotional responses.

Overall, these findings suggest that both perceived threat and emotion are important in motivating action, but these variables also increase information seeking behaviors. Accordingly, warning messages should include protective action information indicating exactly what people should do to protect themselves in order to increase perceived efficacy (Sutton et al., 2021); furthermore, there should be little uncertainty or ambiguity in the actions people should perform, as this increases information seeking (Goodall & Reed, 2013). Thus, clear and certain protective action statements should be included to increase one's response efficacy and self-efficacy, which increases the likelihood of performing protective actions and decreases information seeking in this context.

6.4 Limitations and Future Directions

This study uses hypothetical scenarios to immerse participants in an imminent threat context to test experimentally manipulated fear appeal messages. Given the experimental nature of this study, behavioral intentions are measured, rather than actual behavior(s). Some argue that behavioral responses during real-time events, such as tornadoes, may differ from self-reported behavioral intention measures. In particular,

participants may underestimate their intentions to perform protective actions given the lack of actual consequences (Kox & Thieken, 2017). And although the scenario used in this study is intended to prompt participants to envision themselves and their responses within an imminent threat context, those who do not have direct experience with tornadoes or flash floods may have difficulty picturing themselves in these situations. Indeed, no narrative or hypothetical scenario can truly induce the sense of urgency and stress experienced during an actual event. However, collecting responses during real-time events poses challenges, such as gaining access to the site of the event; predicting these low probability, high consequence events far enough in advance; randomization to condition; and subsequent data analysis (Spence & Lachlan, 2010). Although behavioral intentions may provide a valid proxy for behavior in imminent threat contexts (see Weyrich et al., 2020), one must be cautious when interpreting these study results, as they cannot imply how participants will behave in response to real-life warning messages. Further work in this area is warranted.

Another limitation is the demographic composition of the sample, whereby the average age of participants was ~20 years and the majority identified as a woman. Although there is concern regarding the representativeness and generalizability of undergraduate university student samples (Henrich et al., 2010), college-aged students represent a particularly important population to examine for several reasons. First, college-aged students are a relatively understudied population in disaster and warning response research (Jauernic & Van Den Broeke, 2017). Second, college-aged students, in particular out-of-state and international students, are especially vulnerable to disasters and high impact weather events due to a lack of familiarity with their immediate

surroundings (He et al., 2007), lack of financial resources (FEMA, 2003), and lack of social networks in their area (He et al., 2007). Thus, it is important to include this population in disaster research studies.

However, how these demographic characteristics influence risk perceptions and protective action intentions is unclear (Sherman-Morris, 2013); therefore, it is unknown how these factors may influence this study's conclusions. Specifically, some studies have found age and gender may affect how someone perceives a hazard (e.g., Abrahamson et al., 2009; Kellens et al., 2011). For example, younger individuals have been found to take hazards, such as flash floods, less seriously than older adults (e.g., Drobot et al., 2007; Knocke & Kolivras, 2007). Likewise, women have been found to report higher risk perceptions than males for technological hazards, such as hazardous material incidents (Siegrist et al., 2005). Yet, other studies have found no significant relationship between age and gender on risk perceptions (e.g., Burningham et al., 2008; Siegrist & Gutscher, 2006). Similarly, how age and gender differences translate into protective action is also unclear. For example, identifying as female has been found to positively predict sheltering in place during a tornado (e.g., Jauernic & Van Den Broeke, 2017; Sherman-Morris, 2010); yet, other studies have found no effect between gender and protective actions during tornado events (e.g., Schmidlin et al., 2009). Therefore, overall "there's no consistent understanding of the importance of these [age and gender] factors" (Wachinger et al., 2013, p. 1051) for both risk perceptions and protective actions (Sherman-Morris, 2013). Instead, Wachinger et al. (2013) suggest that other factors, such as education, access to resources, trust, agency, social connections, and information sources, may better explain studies that found a positive effect of age and gender differences. Likewise,

Sherman-Morris (2013) notes that the relationship between demographics, risk perception, and protective action may be dependent on the specific hazard.

Furthermore, this study assessed perceived threat, perceived efficacy, affect and protective action and information seeking intentions at one point in time; therefore, it could not assess potential changes in these variables as an event unfolds. Previous research suggests that when fear is measured at multiple points in time (i.e., using within-persons, repeated measures), the relationship between fear and persuasion may be curvilinear (i.e., an inverted U-shape), rather than linear (Dillard et al., 2017b; Meczkowski et al., 2016; Shen & Dillard, 2014). Therefore, future research may consider measuring fear, perceived threat, and perceived efficacy across the entire timeline of an event and assessing whether there are differences in fear and response across different points in time. In addition, as an event unfolds, warning messages may start to convey more confidence and use less uncertainty language (e.g., may vs. will). Because uncertainty information can influence protective action intentions (Joslyn & LeClerc, 2012; Miran et al., 2017), future research may also consider examining fear appeal language coupled with uncertainty information.

In addition, to provide more comprehensive research guided recommendations for practitioners, a 2 (high threat vs. low threat) × 2 (high efficacy vs. low efficacy) factorial design should be used. This research design would allow researchers to determine precisely which message components lead to threat and efficacy perceptions. Thus, future research may consider taking the messages identified in this study and testing them in a fully crossed (i.e., orthogonal) manner.

Finally, the EPPM proposes that perceived threat and perceived efficacy are higher-order constructs, whereby perceived threat is composed of perceived severity and perceived susceptibility, and perceived efficacy is composed of perceived response efficacy and perceived self-efficacy (Witte, 1996). Given this theoretical guidance, this study uses overall threat and efficacy indices. Yet, it may be advantageous for future research to examine these variables separately, as prior research has found that each sub-construct may exert a different effect on persuasive outcomes (Brewer et al., 2007; Dillard et al, 2017a; So et al., 2016). Furthermore, examining EPPM sub-constructs separately would allow researchers to determine which cognitive perceptions exert a greater influence on key outcome variables and specify precisely which components of threat and efficacy help encourage response, thereby contributing to a more refined understanding of how specific perceptions lead to emotional responses and protection motivation (Totzkay et al., 2022). In addition, separating sub-constructs would allow message designers to determine precisely which types of information to emphasize for a particular threat.

6.5 Conclusion

This study examines the EPPM in an imminent threat context and focuses on how warning message content influence EPPM perceptions and how these perceptions, in turn, influence both protective action and information seeking intentions. By analyzing the linkages between message, perception, and outcome, this study is equipped to provide both theoretical and applied contributions to the EPPM and warning message design literatures, respectively.

Overall, results suggest that one should not "fear the fear appeal" in the context of imminent threat warnings. Specifically, results indicate that warning messages should include specific location information, impact statements, and clear protective action guidance. These types of information can increase perceived threat and fear, which motivate protective action intentions. Thus, contrary to the EPPM, fear can play a positive role in increasing one's danger control responses. However, warning messages that increase perceived threat can also increase anxiety, which elicits information seeking behaviors. If message writers want to lessen the likelihood of information seeking while increasing the probability of protective action, there must be a focus on increasing efficacy perceptions by including clear protective action guidance.

APPENDIX A: The 12 Propositions of the EPPM

From Popova (2012)

1. When perceived threat is low, regardless of perceived efficacy level, there will be no further processing of the message.

2. As perceived threat increases when perceived efficacy is high, so will message acceptance.

3. Cognitions about the threat and efficacy cause attitude, intention, or behavior changes (i.e., danger control responses).

4. As perceived threat increases when perceived efficacy is low, people will do the opposite of what is advocated.

5. As perceived threat increases when perceived efficacy is moderate, message acceptance will first increase, and then decrease, resulting in an inverted U-shaped function.

6. Fear causes fear control responses.

7. When perceived efficacy is high, fear indirectly influences danger control outcomes, as mediated by perceived threat.

8. When perceived efficacy is high, there is a reciprocal relationship between perceived threat and fear.

9. Cognitions about efficacy are unrelated to fear control responses.

10. Cognitions about threat are indirectly related to fear control responses.

11. Perceived threat determines the intensity of a response (how strong the response) and perceived efficacy determines the nature of the response (either fear or danger control).

12. Individual differences influence outcomes indirectly, as mediated by perceived threat and efficacy.

APPENDIX B: Message Pretesting Protocol

[RANDOMIZATION: TORNADO OR FLASH FLOOD WARNING SCENARIO]

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[Tornado Warning Scenario]

"Imagine it is 6 PM on a Tuesday and you are at the William T. Young Library on the University of Kentucky Campus. You receive the following alert on your cell phone:"

After you clink the link in the message, you receive the following warning:"

[INSTRUCTION] Please click the "Next" button to continue with the survey

[RANDOMIZATION: LOW OR HIGH TORNADO THREAT & EFFICACY WARNING]

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[INSTRUCTION] Please read the following message carefully because you will be asked several questions about this message.

Condition 1: Tornado Low Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a tornado warning for central Fayette County in east central Kentucky, until 6:30 PM EDT.
At 5:30 PM EDT, a confirmed tornado was observed 10 miles south of Lexington, moving north at 30 MPH.

A tornado is on the ground. Flying debris may be dangerous to those caught without

shelter. Damage to homes, businesses, and vehicles is possible.

Precautionary/Preparedness Actions:

Take cover now. Move to an interior room on the lowest floor of a sturdy building. Avoid windows. If in a mobile home, vehicle, or outdoors, move to the closest substantial shelter.

Condition 2: Tornado High Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a tornado warning for central Fayette County in east central Kentucky until 6:30 PM EDT.

At 5:30 PM EDT, a confirmed tornado was observed 10 miles south of Lexington, near Fayette Mall, and moving north towards the University of Kentucky at 30 MPH.

You are in a life-threatening situation. An extremely dangerous and potentially deadly tornado is on the ground. Flying debris may be dangerous to those caught without shelter. Considerable damage to homes, businesses, and vehicles is likely and complete destruction is possible.

Precautionary/Preparedness Actions:

Take cover now. The best way to protect yourself is to move to an interior room on the lowest floor of a sturdy building and avoid windows. If in a mobile home, a vehicle, or outdoors, move to the closest substantial shelter. Your ability to protect yourself increases by following these directions.

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[Flash Flood Scenario]

"Imagine it is 6 PM on a Tuesday and you are at the William T. Young Library on the University of Kentucky Campus. You receive the following alert on your cell phone:"

After you click the link in the message, you receive the following warning:"

[INSTRUCTION] Please click the "Next" button to continue with the survey

[RANDOMIZATION: LOW OR HIGH FLASH FLOOD THREAT AND EFFCICACY WARNING]

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[INSTRUCTION] Please read the following message carefully because you will be asked several questions about this message.

Condition 3: Flash Flood Low Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a flash flood warning for central Fayette County in east central Kentucky until 6:30 PM EDT.

At 5:30 PM EDT, Doppler radar indicated heavy rainfall from thunderstorms over the warning area, where up to 3 inches of rain have already fallen. Additional rainfall amounts of 1 to 3 inches are likely, with rainfall rates up to 1 inch an hour.

Basements and low-lying areas, including those around rivers, creeks, and streams could flood. Numerous roads may be closed in the area. Several water rescues have occurred.

Precautionary/Preparedness Actions:

Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order from a public safety official. Do not drive or walk near flooded areas.

Condition 4: Flash Flood High Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a flash flood warning

for central Fayette County in east central Kentucky until 6:30 PM EDT.

At 5:30 PM EDT, Doppler radar indicated thunderstorms producing torrential rainfall over the Lexington area. Up to 3 inches of rain have already fallen, causing severe and widespread flooding. Additional rainfall amounts of 1 to 3 inches are likely, with rainfall rates up to 1 inch an hour. Basements and low-lying areas, including those around rivers, creeks, and streams could flood.

You are in a life-threatening situation. Extremely dangerous flooding has caused many roads to be impassable, resulting in several water rescues around Kroger Field on the University of Kentucky campus.

Precautionary/Preparedness Actions:

The best way to protect yourself is by not driving or walking near flooded areas unless you are under an evacuation order from a public safety official. Your ability to protect yourself increases by following these directions.

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Threat

X) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Severity 1] I believe that the danger posed from [the tornado/the flash flood] is serious	( )	( )	( )	( )	( )
[Severity 2] I believe that the danger posed from [the tornado/the flash flood] is significant	( )	( )	( )	( )	( )
[Severity 3] I believe that the danger posed from [the tornado/the flash flood] is severe	( )	( )	( )	( )	( )
[Susceptibility 1] I am at risk for being by [the affected tornado/the flash flood]	( )	( )	( )	( )	( )

[Susceptibility 2] It is likely I will be affected by [the tornado/the flash flood]	( )	( )	( )	( )	( )
[Susceptibility 3] It is possible I will be affected by [the tornado/the flash flood]	( )	( )	( )	( )	( )

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Efficacy

x) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Response Efficacy 1] The recommendations in the message are an effective way to protect myself	( )	( )	( )	( )	( )
[Response Efficacy 2] If I follow the recommendations in the message, I am less likely to get hurt	( )	( )	( )	( )	( )
[Response Efficacy 3] The message presents strategies for protecting myself that actually work	( )	( )	( )	( )	( )
[Self-Efficacy 1] I am able to follow the recommendations in the message	( )	( )	( )	( )	( )
[Self-Efficacy 2] I am confident I can follow the recommendations in the message	( )	( )	( )	( )	( )
[Self-Efficacy 3] I know I can follow the	( )	( )	( )	( )	( )

steps in the message and protect myself					

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Emotion

x) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements:

This message made me feel:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Fear 1] Afraid	( )	( )	( )	( )	( )
[Fear 2] Frightened	( )	( )	( )	( )	( )
[Fear 3] Scared	( )	( )	( )	( )	( )
[Anxiety 1] Anxious	( )	( )	( )	( )	( )
[Anxiety 2] Worried	( )	( )	( )	( )	( )
[Anxiety 3] Nervous	( )	( )	( )	( )	( )

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Behavioral Intention

x) [INSTRUCTION] Please indicate your agreement or disagreement with the following statements:

After reading the message,

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Intention 1] I would follow the directions in the message	( )	( )	( )	( )	( )
[Intention 2] I would do what the message recommends	( )	( )	( )	( )	( )
[Intention 3] I intend to follow the recommendations in the message	( )	( )	( )	( )	( )

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Motivation to Seek Information

x) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements**:**

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Info Seeking 1] I know less than I'd like to know about the [tornado/flash flood]	( )	( )	( )	( )	( )
[Info Seeking 2] I want to know more than I currently know about the [tornado/flash flood]	( )	( )	( )	( )	( )
[Info Seeking 3] I wish I knew more about [the tornado/the flash flood]	( )	( )	( )	( )	( )
[Info Seeking 4] I know less than I'd like to know about how to protect myself	( )	( )	( )	( )	( )
[Info Seeking 5] I want to know more than I currently know about how to protect myself	( )	( )	( )	( )	( )
[Info Seeking 6] I wish I knew more about how to protect myself	( )	( )	( )	( )	( )

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Open Ended Questions

[INSTRUCTION] Please re-read the scenario below and answer the following questions.

[Show assigned scenario again]

X) Do you feel this scenario is realistic? Why or why not?

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[INSTRUCTION] Please re-read the message below and answer the following questions

[Show assigned message again]

X) Do you feel that this situation will be severe? Why or why not?

X) Do you feel that this risk applies to you? Why or why not?

X) Did this message make your feel frightened or worried? Why or why not?

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[INSTRUCTION] Please re-read the message below and answer the following questions

[Show assigned message again]

X) Do you feel that the behaviors recommended in the message are an effective way for you to protect yourself? Why or why not?

X) Do you feel that the behaviors recommended in the message are feasible for you to perform? Why or why not?

X) How could this message be improved to make you feel confident you could perform the behaviors recommended in the message?

X) What barriers exist that would influence or prevent you from performing the recommended actions?

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[INSTRUCTION] Please re-read the message below and answer the following questions

[Show assigned message again]

X) Do you feel this message is easy to understand? Why or why not?

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Demographics

[INSTRUCTION] Finally, please answer a few questions about yourself.

X) What is your current age (in years)?

_____

X) What is your gender?

( ) Woman

( ) Man

( ) Genderqueer

( ) Non-Binary

( ) Not Listed: _____

( ) Prefer not to reply

X) Are you transgender or cisgender (i.e. not transgender)?

( ) Cisgender

( ) Transgender

( ) Prefer not to reply

X) Which of the following best describes you? (Check all that apply)

[ ] American Indian/Alaska Native

[ ] Asian/Asian American

[ ] Black/African American

[ ] Native Hawaiian or Pacific Islander

[ ] Latino/Hispanic

[ ] White/Caucasian

[ ] Other (please specify): _____

APPENDIX C: Experimental Protocol

[RANDOMIZATION: TORNADO OR FLASH FLOOD WARNING SCENARIO]

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[Tornado Warning Scenario]

"Imagine it is 6 PM on a Tuesday and you are at the William T. Young Library on the University of Kentucky Campus. You receive the following alert on your cell phone:"

After you clink the link in the message, you receive the following warning:"

[INSTRUCTION] Please click the "Next" button to continue with the survey

[RANDOMIZATION: LOW OR HIGH TORNADO THREAT & EFFICACY WARNING]

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[INSTRUCTION] Please spend 30 seconds reading the message below because you will be asked several questions about this message.

Condition 1: Tornado Low Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a tornado warning for central Fayette County in east central Kentucky, until 6:30 PM EDT.

At 5:30 PM EDT, a confirmed tornado was observed 10 miles south of Lexington, moving north at 30 MPH.

A tornado is on the ground. Flying debris may be dangerous to those caught without

shelter. Damage to homes, businesses, and vehicles is possible.

Precautionary/Preparedness Actions:

Take cover now. Move to an interior room on the lowest floor of a sturdy building. Avoid windows. If in a mobile home, vehicle, or outdoors, move to the closest substantial shelter.

Condition 2: Tornado High Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a tornado warning for central Fayette County in east central Kentucky until 6:30 PM EDT.

At 5:30 PM EDT, a confirmed tornado was observed 10 miles south of Lexington, near Fayette Mall, and moving north towards the University of Kentucky at 30 MPH.

You are in a life-threatening situation. An extremely dangerous and potentially deadly tornado is on the ground. Flying debris may be dangerous to those caught without shelter. Considerable damage to homes, businesses, and vehicles is likely and complete destruction is possible.

Precautionary/Preparedness Actions:

Take cover now. The best way to protect yourself is to move to an interior room on the lowest floor of a sturdy building and avoid windows. If in a mobile home, a vehicle, or outdoors, move to the closest substantial shelter. Your ability to protect yourself increases by following these directions.

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[Flash Flood Scenario]

"Imagine it is 6 PM on a Tuesday. It has been raining throughout the day and the ground appears saturated with water. While you are at the William T. Young Library on the University of Kentucky Campus, you receive the following alert on your cell phone:"

After you clink the link in the message, you receive the following warning:"

[INSTRUCTION] Please click the "Next" button to continue with the survey

[RANDOMIZATION: LOW OR HIGH FLASH FLOOD THREAT AND EFFICACY WARNING]

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[INSTRUCTION] Please spend 30 seconds reading the message below because you will be asked several questions about this message.

Condition 1: Flash Flood Low Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a flash flood warning for central Fayette County in east central Kentucky until 8:30 PM EDT.

At 5:30 PM EDT, Doppler radar indicated heavy rainfall from thunderstorms over the warning area, where up to 5 inches of rain have already fallen. Additional rainfall amounts of 2 to 4 inches are likely. Basements and low-lying areas, including those around rivers, creeks, and streams could flood.

Numerous roads may be closed in the area. Several water rescues have occurred.

Precautionary/Preparedness Actions:

Remain in a safe location. Do not attempt to travel unless you are fleeing an area subject to flooding or under an evacuation order from a public safety official. Do not drive or walk near flooded areas.

Condition 2: Flash Flood High Threat and Efficacy Warning

The National Weather Service in Louisville, Kentucky has issued a flash flood warning

for central Fayette County in east central Kentucky until 8:30 PM EDT.

At 5:30 PM EDT, Doppler radar indicated thunderstorms producing torrential rainfall over the Lexington area. Up to 5 inches of rain have already fallen, causing severe and widespread flooding. Additional rainfall amounts of 2 to 4 inches are likely. Basements and low-lying areas, including those around rivers, creeks, and streams could experience extreme flooding.

You are in a life-threatening situation. Extremely dangerous and devastating flooding has caused many roads to be impassable, resulting in several water rescues around Kroger Field on the University of Kentucky campus.

Precautionary/Preparedness Actions:

The best way to protect yourself is to remain in a safe location and not drive or walk near flooded areas unless you are under an evacuation order from a public safety official. Your ability to protect yourself and stay safe increases by following these directions.

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Threat

X) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Severity 1] I believe that the danger posed from [the tornado/the flash flood] is serious	( )	( )	( )	( )	( )
[Severity 2] I believe that the danger posed from [the tornado/the flash flood] is significant	( )	( )	( )	( )	( )
[Severity 3] I believe that the danger posed from [the tornado/the flash flood] is severe	( )	( )	( )	( )	( )
[Susceptibility 1] I am at risk for being affected by [the tornado/the flash flood]	( )	( )	( )	( )	( )

[Susceptibility 2] It is likely I will be affected by [the tornado/the flash flood]	( )	( )	( )	( )	( )
[Susceptibility 3] It is possible I will be affected by [the tornado/the flash flood]	( )	( )	( )	( )	( )

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Efficacy

x) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Response Efficacy 1] The recommendations in the message are an effective way to protect myself	( )	( )	( )	( )	( )
[Response Efficacy 2] If I follow the recommendations in the message, I am less likely to get hurt	( )	( )	( )	( )	( )
[Response Efficacy 3] The message presents strategies for protecting myself that actually work	( )	( )	( )	( )	( )
[Self-Efficacy 1] I am able to follow the recommendations in the message	( )	( )	( )	( )	( )
[Self-Efficacy 2] I am confident I can follow the recommendations in the message	( )	( )	( )	( )	( )
[Self-Efficacy 3] I know I can follow the steps in the message and protect myself	( )	( )	( )	( )	( )

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Emotion

x) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements:

This message made me feel:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Fear 1] Afraid	( )	( )	( )	( )	( )
[Fear 2] Frightened	( )	( )	( )	( )	( )
[Fear 3] Scared	( )	( )	( )	( )	( )
[Anxiety 1] Anxious	( )	( )	( )	( )	( )
[Anxiety 2] Worried	( )	( )	( )	( )	( )
[Anxiety 3] Nervous	( )	( )	( )	( )	( )

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Behavioral Intention

x) [INSTRUCTION] Please indicate your agreement or disagreement with the following statements:

After reading the message,

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Intention 1] I would follow the directions in the message	( )	( )	( )	( )	( )
[Intention 2] I would do what the message recommends	( )	( )	( )	( )	( )

[Intention 3] I intend to follow the recommendations in the message	( )	( )	( )	( )	( )

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Motivation to Seek Information

x) [INSTRUCTION] Based on the message you just saw, please indicate your agreement or disagreement with the following statements**:**

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Info Seeking 1] I know less than I'd like to know about the [tornado/flash flood]	( )	( )	( )	( )	( )
[Info Seeking 2] I want to know more than I currently know about the [tornado/flash flood]	( )	( )	( )	( )	( )
[Info Seeking 3] I wish I knew more about [the tornado/the flash flood]	( )	( )	( )	( )	( )
[Info Seeking 4] I know less than I'd like to know about how to protect myself	( )	( )	( )	( )	( )
[Info Seeking 5] I want to know more than I currently know about how to protect myself	( )	( )	( )	( )	( )
[Info Seeking 6] I wish I knew more about how to protect myself	( )	( )	( )	( )	( )

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Experience

x) **[INSTRUCTION]** Finally, people can have multiple experiences with [tornadoes/flash flooding] over the course of their lifetime. Please think about all of your experiences with [tornadoes/flash flooding] and indicate how much experience you have with each of the statements listed below.

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
[Experience 1] I have been under a [tornado/flash flood] warning	( )	( )	( )	( )	( )
[Experience 2] I have heard or watched news coverage on radio, TV, or online of a [tornado/flash flood] as it was happening	( )	( )	( )	( )	( )
[Experience 3] I have seen news coverage about the aftermath of a [tornado/flash flood]	( )	( )	( )	( )	( )
[Experience 4] I have feared for my life due to a [tornado/flash flood]	( )	( )	( )	( )	( )
[Experience 5] I have feared for my loved ones due to a [tornado/flash flood]	( )	( )	( )	( )	( )
[Experience 6] I have worried about my home due to a [tornado/flash flood]	( )	( )	( )	( )	( )

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Demographics

[INSTRUCTION] Finally, please answer a few questions about yourself.

X) What is your current age (in years)? _____

X) What is your gender?

( ) Woman

( ) Man

( ) Genderqueer

( ) Non-Binary

( ) Not Listed: _____

( ) Prefer not to reply

X) Are you transgender or cisgender (i.e. not transgender)?

( ) Cisgender

( ) Transgender

( ) Prefer not to reply

X) Which of the following best describes you? (Check all that apply)

[ ] American Indian/Alaska Native

[ ] Asian/Asian American

[ ] Black/African American

[ ] Native Hawaiian or Pacific Islander

[ ] Latino/Hispanic

[ ] White/Caucasian

[ ] Other (please specify): _____

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Zhao, M., Rosoff, H., & John, R. S. (2019). Media disaster reporting effects on public risk perception and response to escalating tornado warnings: A natural experiment. *Risk Analysis, 39,* 535-552.

Zhuang, J., & Guan, M. (2021). Modeling the mediating and moderating roles of risk perceptions, efficacy, desired uncertainty, and worry in information seeking-cancer screening relationship using HINTS 2017 data. *Health Communication,* 897-908.

VITA

MICHELE K. OLSON

EDUCATION

Graduate Certificate – Applied Statistics (Completed December 2018)
University of Kentucky
Emphasis: Multivariate Methods

Graduate Certificate – Risk and Crisis Communication (Completed May 2017)
University of Kentucky
Certificate Director: Dr. Shari Veil

M.A. University of Wisconsin-Milwaukee (Completed May 2015)
Communication
Emphasis: Health Communication
Thesis: Motivational interviewing in primary care and general health care settings: A meta-analysis
Advisor: Dr. Mike Allen

B.A. University of Wisconsin-Milwaukee (Completed May 2012)
Communication
Emphasis: Health Communication

B.A. University of Wisconsin-Milwaukee (Completed May 2012)
Psychology
Emphasis: Experimental Psychology

Certificate – University of Wisconsin-Milwaukee (Completed May 2012)
Childhood and Adolescent Studies
Emphasis: Sociology

RELEVANT EXPERIENCE

Research Associate **Nov. 2021 – Present**

Emergency and Risk Communication Message Testing Laboratory
College of Emergency Preparedness, Homeland Security and Cybersecurity
University at Albany

Social, Behavioral, and Economic Analyst **Sept. 2018 – Nov. 2021**

Cherokee Nation Federal Supporting the National Oceanic and Atmospheric Administration's (NOAA) Weather Program Office

Research Fellow and Researcher **Sept. 2014 – Sept. 2018**

Sept. 2016 - Aug. 2018 **Graduate Research Assistant**
"Collaborative Research: Message Retransmission and Amplification in the Context of Meteorological Hazards." Funded by the National Oceanic and Atmospheric Administration. Jeannette Sutton (PI), Department of Communication, University of Kentucky.

Jan. 2016 - Aug. 2018 **Graduate Research Assistant**
"Online Hazard Communication in the Terse Regime: Measurement, Modeling, and Dynamics." Funded by the National Science Foundation (CMMI 1536347). Jeannette Sutton (PI), Department of Communication, University of Kentucky

Aug. 2017- Dec. 2017 **Graduate Research Assistant**
"Socially Responsible Communication to Increase Awareness of Lung Cancer Screening." Owensboro Community Health. PI: Jamie Studts.

Sept. 2015 – Aug. 2017 **Doctoral Candidate and Volunteer Research Assistant**
Department of Communication, University of Kentucky

Sept. 2014 - May 2015 **Graduate Research Assistant**
Scientific & Medical Communication Laboratory, University of Wisconsin-Milwaukee

RESEARCH PUBLICATIONS

Refereed Journal Articles

9. Prestley, R., **Olson, M. K**., Vos, S. C., & Sutton, J. (2020). Machines, monsters, and coffin corners: Broadcast meteorologists' use of figurative and intense language during Hurricane Harvey. *Bulletin of the American Meteorological Society*, *101,* E1329-E1339.

8. **Olson, M. K.,** Vos, S. C., & Sutton, J. (2020). Threat and efficacy in television news: Reporting on an emerging infectious disease. *Western Journal of Communication*, *84,* 623-640.

7. Sutton, J., Renshaw, S. L., Vos, S. C., **Olson, M. K.,** Prestley, R., Gibson, B. C., &

Butts, C. T. (2019). Getting the word out, rain or shine: The impact of message features and hazard context on message passing online. *Weather, Climate, and Society, 11,* 763-776. doi: 10.1175/WCAS-D-19-0021.1

6. **Olson, M. K.,** Sutton, J., Vos, S. C., Prestley, R., Renshaw, S. L., & Butts, C. T. (2019). Build community before the storm: The National Weather Service's social media engagement. *Journal of Contingencies and Crisis Management, 27,* 359-373**.** doi: 10.1111/1468-5973.12267

5. Vos, S. C., Sutton, J., Yu, Y., Renshaw, S., **Olson, M. K.**, Gibson, C. B., & Butts, C. T. (2018). Retweeting risk communication: The role of threat and efficacy. *Risk Analysis,* 38, 2580-2598. doi: 10.1111/risa.13140

4. Tatum, N. T., **Olson, M. K**., & Frey, T. K. (2018). Psychological reactance to classroom cell phone policies: Noncompliance and instructional dissent as consequences of policy threat. *Communication Education, 67,* 226-244. doi: 10.1080/03634523.2017.1417615

3. Sutton, J., Vos, S. C., **Olson, M. K**., Woods, C., Cohen, E., Gibson, B., … Eberth, J. (2018) Lung cancer messages on Twitter: Content analysis and evaluation. *American College of Radiology, 15,* 210-217. doi: 10.1016/j.jacr.2017.09.043

2. Kim, S., Graham, S. S., Ahn, S., **Olson, M. K**., Card, D. J., Kessler, M. M., DeVasto, D. M., Roberts, L. R., & Bubacy, F. A. (2016). Correcting biased Cohen's Kappa in NVivo. *Communication Methods and Measures, 10,* 217-232. doi:10.1080/19312458.2016.1227772

1. Graham, S.S., Card, D.J., Ahn, S., Kim, S., Kessler, M. M., **Olson, M. K**. (2016). Conflicts of interest among patient and consumer representatives to U.S. Food and Drug Administration drug advisory committees. *Annals of Internal Medicine, 165,* 606-607. doi: 10.7326/L16-0031

Edited Book Chapters

Olson, M.K. (2017). Databases. In M. Allen (Ed.), *The SAGE Encyclopedia of Research Methods.* Thousand Oaks, CA: SAGE.

Olson, M.K. (2017). Foundation and government collections. In M. Allen (Ed.), *The SAGE Encyclopedia of Research Methods.* Thousand Oaks, CA: SAGE.

SELECT PROFESSIONAL CONFERENCE PRESENTATIONS

2020

5. Eosco, G. M., & **Olson, M. K.** (August, 2020). Putting NOAA's social science

research to work: Current state and future directions. NOAA Environment Data Management 2020 Workshop, Ashville, NC.

4. **Olson, M. K** & Sutton, J. (September, 2020) "Can I get a Retweet?" – How to engage and amplifying messages on social media. National Weather Association 2020 Annual Meeting, Tulsa, OK.

3. Eosco, G. M., **Olson, M. K.,** & Sprague-Hilderbrand, J. (January, 2020). Back to the future: Transitioning social and behavioral science into the next 100 years. Presented at the American Meteorological Society's 100th Annual Meeting, Boston, MA.

2. **Olson, M. K,** Eosco, G. M., & Rowley, K. (January, 2020). Uncertainty and probability communication in weather forecasting: Past, present, and future. Presented at the American Meteorological Society's 100th Annual Meeting, Boston, MA.

1. Sprague-Hilderbrand, J., Eosco, G. M., & **Olson, M. K.** (January, 2020). The transition puzzle: How operational meteorologists can champion Social Science R2O. Presented at the American Meteorological Society's 100th Annual Meeting, Boston, MA.

2019

4. Sutton, J., Renshaw, S., Vos, S.C., **Olson, M.K.,** Prestley, R., & Butts, C.T. (July, 2019). Longitudinal engagement and audience attention: Message contents and features that get passed on. Presented at the American Meteorological Society's 5th Conference of Weather Warnings and Communication, San Diego, CA.

3. Eosco, G.M., **Olson, M. K.,** Sprauge, J., Cortinas, J., & Geppi, D. (January, 2019). Demystifying social and behavioral science research to application transitions. Presented at the 14th Symposium on Societal Applications: Policy, Research and Practice sponsored by the American Meteorological Society, Phoenix, AZ.

2. Sprauge, J., Eosco, G.M., **Olson, M. K.,** & Geppi, D. (January, 2019). Ready or not, choose a readiness level! How NOAA's readiness levels work with social, behavioral and economic sciences. Presented at the 14th Symposium on Societal Applications: Policy, Research and Practice sponsored by the American Meteorological Society, Phoenix, AZ.

1. Prestly, R., **Olson, M. K.,** & Sutton, J. (January, 2019). Strategic tactics and language features used by broadcast meteorologists during Hurricane Harvey to describe threat and build resilience. Presented at the 14th Symposium on Societal Applications: Policy, Research and Practice sponsored by the American Meteorological Society. Phoenix, AZ.

2018

2. Sutton, J., **Olson. M.K.,** Prestley, R., Renshaw, S., Vos, S. C., & Butts, C. (November, 2018). Build community before the storm: How the National Weather Service uses digital engagement and dialogic strategies on social media. Paper accepted to National Communication Association 104th Conference, Salt Lake City, UT.

1. Sutton J., **Olson, M. K**., Renshaw, S., Vos, S. C., & Butts, C. T. (January, 2018). Social media communication across the weather continuum: Introducing the social media engagement model for the National Weather Service. Poster presented at the 13th Symposium on Societal Applications: Policy, Research, and Practice at the American Meteorological Society Annual Meeting, Austin, TX.

2017

9. Sutton J., **Olson, M. K**., Vos, S. C., Yu, Y., Renshaw, S., Gibson, B., & Butts, C. T. (December, 2017). Modeling social media engagement across the disaster continuum. Poster presented at the Society for Risk Analysis, Arlington, VA.

8. Tatum, N. T., **Olson, M. K**., & Frey, T. K. (November, 2017). Student compliance with classroom cell phone policies: Antecedents and consequences of psychological reactance. Paper presented at National Communication Association 103rd Conference, Dallas, TX.

7. **Olson, M. K**. (July, 2017). Social media engagement: Fostering relationships during non-threat periods. Paper presented at Natural Hazards Center 2017 Workshop, Broomfield, CO.

6. Butts, C. T., Sutton, J., Gibson, B., Li, K., **Olson, M. K**., Phillips, N. E., Renshaw, S., Vos, S. C., Yu, Y. (July, 2017). Predictors of message passing, social media adoption, and social media use in meteorological and health hazard settings. Poster presented at Natural Hazards Center 2017 Workshop, Broomfield, CO.

5. **Olson, M. K.,** Sheff, S. E., Helme, D. W., & Scarduzio, J. A. (May, 2017) College student perception and defensive avoidance strategies as a reaction to sexual harassment on Tinder. Paper presented at International Communication Association 2017 Conference, San Diego, CA.

4. **Olson, M. K.,** Sutton, J., & Vos, S. C. (April, 2017). Threat and efficacy messages in television news following local transmission of the Zika virus in the United States. Poster presented at DC Health Communication 2017 Conference, Washington, DC.

3. Vos, S. C., Sutton, J, & **Olson, M. K.** (April, 2017). Public conversations about

cancer on social networking sites: Analyzing response to Ben Stiller's prostate cancer moment. Poster presented at DC Health Communication 2017 Conference, Washington, DC.

2. Tatum, N. T., Frey, T. K., & **Olson, M. K.** (March, 2017). Development and validation of the classroom cell phone policy attitudes and policy compliance instruments. Paper presented at Central States Communication Association 2017 Conference, Minneapolis, MN. **Top Paper Panel, Communication Education Interest Group**

1. Madig, J., **Olson, M. K.,** Woods, C., & Sheff, S. E. (March, 2017). A proposed model of college students' mental health help-seeking attitudes and intentions. Paper presented at Southern States Communication Association's 2017 Conference, Greenville, SC. **Top Student Paper**

2016

7. Vos, S. C., Sutton, J, & **Olson, M. K**. (December, 2016). Communicating visual risk: Threat, efficacy, and emotion in SNS messages about Zika. Poster presented at Society for Risk Analysis 2016 Conference, San Diego, CA

6. **Olson, M. K.,** Sutton, J. N., & Vos, S. C. (December, 2016). Communicating threat and efficacy through the media: An analysis of news broadcasts about the Zika virus. Poster presented at Society for Risk Analysis 2016 Conference, San Diego, CA. **Top Poster**

5. **Olson, M. K.,** & Lane, D. R. (November, 2016). Predicting behavioral and attitudinal change from anti-marijuana public service announcements using need for sensation and need for cognition. Paper accepted to Health Communication Division of the National Communication Association 102nd Conference, Philadelphia, PA.

4. Adams, E., Frisby, B. N, Hardin, F., & **Olson, M. K.** (September, 2016). The role of trust and self-disclosure during and individualized dietary intervention. Paper presented at Kentucky Communication Association 2016 Conference, Bowling Green, KY.

3. Kim, S., Graham, S. S., Ahn, S., **Olson, M. K.,** Card, D. J., Kessler, M. M., DeVasto, D. D., Roberts, L. R., Bubacy, F. A. (May, 2016). Bias correction for overestimated Kappa in NVivo. Paper presented at the International Communication Association 66th Convention, Interpersonal Communication Division, Fukuoka, Japan.

2. Adams, E., & **Olson, M. K.** (April, 2016). Narratives of a rural food desert: A thematic analysis of motivational interviews with Appalachian residents enrolled in an individualized dietary intervention. Poster presented at the Center for

Clinical and Translational Science 2016 Conference, Lexington, KY.

1. Watterson, T. C., & **Olson, M. K.** (April, 2016). Applying the bystander model: Student characteristics and attitudes about "civilian interventions" for campus tobacco use violations. Presented to the 2016 Kentucky Conference on Health Communication, Lexington, KY. **Top Three Student Poster**

2015

5. Kohler, K.V., & **Olson, M. K.** (November, 2015). A hunger for meaning: Analysis of online eating disorder recovery stories through a relational dialectics perspective. Paper presented at the National Communication Association 101st Conference, Las Vegas, NV.

4. Card, D. J., Kessler, M. M., DeVasto, D., Roberts, L., **Olson, M. K.,** & Graham, S. S (November, 2015). The laboratories and lived experiences: Assessing patient inclusion in FDA pharmaceuticals regulation. Paper presented at the National Communication Association 101st Conference, Las Vegas, NV.

3. Graham, S.S., Kim, S-Y., Kessler, M.M., Card, D. J., DeVasto, D. M., Ahn, S., **Olson, M. K.,** Bubacy, F., Roberts, L. (October, 2015). The effects of differential inclusion on FDA pharmaceuticals policy deliberation. Paper presented at the Seventh International Conference on Science in Society, Chicago, IL.

2. Kim, S-Y., Allen, M., **Olson, M. K.,** Stoll, A. (May, 2015). Does reactance arise to a counter-attitudinal message: Reexamining social judgment theory adopting intertwined model of psychological reactance. Paper presented at the International Communication Association 2015 Conference, San Juan, Puerto Rico

1. **Olson, M. K.,** Kohler, K. V., & Stoll, A. (April, 2015). Sex guilt and homophobia experiences of young adults. Paper presented to Sexual Orientation and Gender Identity Division of the Central States Communication Association 2015 Conference, Madison, WI. **Top Three Paper Sexual Orientation and Gender Identity Division.**

RESEARCH HONORS AND AWARDS

Fall 2017	Risk and Crisis Communication Fellow, University of Kentucky
Spring 2017	Outstanding Scholarship in Risk and Crisis Communication, Communication Graduate Student Association, University of Kentucky
Spring 2017	Top Four Paper, Communication Education Interest Group, Central States Communication Association 2017 Conference, Minneapolis MN

Spring 2017	Top Student Paper, Southern States Communication Association 2017 Conference, Greenville, SC.
Fall 2016	Top Poster, Society for Risk Analysis 2016 Conference, San Diego, CA
Spring 2016	Top Three Student Poster, Kentucky Conference on Health Communication 2016 Conference, Lexington, KY.
Spring 2015	Melvin H. Miller Award for Outstanding Master's Research, Department of Communication, University of Wisconsin-Milwaukee
Spring 2015	Top Three Paper, Sexual Orientation and Gender Identity Division, Central States Communication Association 2015 Conference, Madison, WI.