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Effective Weather Messaging: Applying the Bad News Response Model to Hurricane Warnings

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EFFECTIVE WEATHER MESSAGING: APPLYING THE BAD NEWS RESPONSE MODEL TO HURRICANE WARNINGS

by

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(Under the Direction of Lawrence Locker)

ABSTRACT

Sweeny and Shepperd (2007, 2009) proposed the Bad News Response Model (BNRM), outlining three effective responses (i.e., Watchful Waiting, Active Change, Acceptance) as a function of the perceived controllability, likelihood, and severity of bad news. In the current study, we have adapted the BNRM, previously used in health-related scenarios, to explore the relationship between message content and responses in the context of hurricane warnings. Participants viewed hurricane warnings manipulated by severity (Category 1 vs. Category 5) and the inclusion of call-to-action statements (CTAs). The present study attempted to evaluate the effects of severity and controllability on participants' engagement in desirable response types. We found that individuals chose Active Change more frequently when the severity was high. However, the situational factors did not significantly affect preferences for Watchful Waiting and Acceptance. The lack of significant severity and controllability effects were likely due, in part, to our small sample size, which severely underpowered the study. Also, individuals may have misinterpreted the intended manipulations. Thus, further research is necessary to provide more insight into the communication of weather, encourage appropriate preparations for approaching storms, and inform potential policy changes for weather reporting.

INDEX WORDS: Hurricane, Weather, Warning, Severe, Natural disaster, Communication, Bad News Response Model, Watchful waiting, Active change, Acceptance

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CHAPTER 1

INTRODUCTION

Purpose of the Study

Natural disasters such as hurricanes, floods, tornadoes, earthquakes, and wildfires can be detrimental to society. On average, 60,000 people die each year from natural disasters; however, in some years, this number has reached over one million deaths, including 3.71 million deaths in 1931 (*EM-DAT | The International Disasters Database*, 2020; *GBD Results Tool | GHDx*, 2017; Ritchie & Roser, 2014). Hurricanes are often a significant contributor to the consequences of natural disasters. For example, Hurricane Katrina is considered one of the most destructive, deadliest, and costliest U.S. hurricanes (*The Federal Response to Hurricane Katrina: Lessons Learned*, 2006). According to the National Hurricane Center (NHC) and National Oceanic and Atmospheric Administration (NOAA; U.S. Department of Commerce, n.d.), Hurricane Katrina was responsible for an estimated $75 billion in damage and over 1200 deaths. Victims of natural disasters such as Hurricane Katrina continue to wade in the aftermath for years, sometimes never fully recovering. Thus, the present study has attempted to further the understanding of weather communication for the future mitigation of such consequences by applying the Bad News Response Model (BNRM) to hurricane warnings.

How This Study Is Original

The available literature involving the BNRM, designed to apply to most bad news contexts, is scarce (e.g., Sweeny, 2008; Sweeny & Shepperd, 2009, 2007). Additionally, the BNRM has primarily been applied to health-related scenarios. However, among the possible contexts in which bad news can occur is severe weather. Although there have been a number of recent studies assessing communication of and responding to weather warnings (e.g., Joslyn et al., 2011; Losee et al., 2017; Schumann et al., 2018; Wu et al., 2014), there has been no research examining responding to severe weather warnings using the BNRM.

CHAPTER 2

LITERATURE REVIEW

Psychological Impact of Natural Disasters

Natural disasters are not only destructive physically and economically, but they also affect survivors' health (Evans & Kantrowitz, 2002), emotional well-being (Knez et al., 2018; Martin, 2015), cognition and memory (Brown et al., 2009; Freedy et al., 1992; Helton et al., 2011), and sense of control and safety (Weisath, 1993). Indeed, research has found evidence of surges in suicide, stroke, heart attack, and death rates (Norris et al., 2002) as well as increased substance abuse (Gibbs, 1989) following disasters. Additionally, natural disasters are associated with psychopathologies such as significant increases in stress (Adams & Adams, 1984), depression (Gallup, 2014; Stimpson, 2006), posttraumatic stress disorder (PTSD; Green et al., 1992), and anxiety as well as increased feelings of hopelessness (Graham, 2012), loss, and grief (Ruiz & Hernández, 2014). For example, individuals assessed five to seven months following Hurricane Katrina and again after 18 to 24 months had a significant prevalence of PTSD (Galea et al., 2007, 2008). Moreover, disasters may decrease individuals' motivation to seek help, potentially leading to additional increases in depression levels and vulnerability to stress (Nakar et al., 1996).

Of importance to the present study, increased anxiety levels are a common consequence of natural disasters and can significantly impact how individuals respond to risky or threatening events such as hurricanes. Many studies have found a link between hurricane experience and anxiety symptoms (e.g., Adeola, 2009; Amstadter et al., 2013; Kopala-Sibley et al., 2016; Norris & Uhl, 1993; Ruggiero et al., 2009; Schwartz et al., 2017). For example, survivors interviewed following Hurricanes Charley, Francis, Ivan, and Jeanne showed signs of generalized anxiety disorder (Amstadter et al., 2010). Graham (2012) also found increased anxiety levels following Hurricane Sandy. An increased sense of control in threatening situations may decrease levels of worry and anxiety (Benight & Bandura, 2004). However, anxiety symptoms such as worry can negatively impact individuals' active coping behaviors and safety preparations. Indeed, Davey et al. (1996) suggested that worry inhibits individuals' ability to effectively evaluate and respond to threats.

Furthermore, individuals with high levels of state and trait anxiety have shown greater perceived risk (Butler & Mathews, 1987; Dewberry et al., 1990; Notebaert et al., 2016) such that individuals with high trait anxiety have increased perceptions of severity and likelihood of potentially threatening situations (Maner & Schmidt, 2006). Although our bodies use anxiety to prepare for danger cognitively for information processing and physiologically to respond to threats (Barlow, 2002; Beck et al., 2005), high levels of trait anxiety often lead to inappropriate engagement in danger mitigation and safety preparations. According to Lorian and Grisham (2010), highly anxious individuals often have a pervasive behavioral safety bias avoiding any perceived risks through actively engaging in behaviors to reduce the risk or avoiding the risk and risk-reducing behaviors. For example, highly anxious individuals were less likely to take risks in assessments of the Iowa gambling task (Miu et al., 2008) and the balloon analogue risk task (BART; Lorian & Grisham, 2010). When threatened by a natural disaster such as hurricanes, individuals need to engage in risk mitigation behaviors and safety preparations appropriately. As anxiety levels and other person-specific variables have differing effects on individuals, many researchers have focused on perceptions of and responses to severe weather communication and messages.

Weather Perceptions and Responses

The devastating consequences of natural disasters such as hurricanes have motivated many researchers to assess the factors affecting individuals' perceptions of and responses to storm warnings such as gender, age, and race/ethnicity. In general, women are more likely than men to avoid risks, seek information, show concern, perceive risks and fear, and engage in protective actions in response to natural hazards or storm warnings (Gutteling & Wiegman, 1993; Kunreuther et al., 1988; Perreault et al., 2014; Schumann et al., 2018). However, men are less likely to evacuate after seeing a hurricane forecast and evacuation order (Lazo et al., 2015). In terms of age, research has shown that while older adults are more likely to perceive lower risk compared to younger individuals (Botzen et al., 2009; Miceli et al., 2008;

Peacock et al., 2005), higher age is associated with greater attention to weather conditions, information seeking, and engagement in protective actions (Knocke & Kolivras, 2007; Miceli et al., 2008).

According to Fothergill et al.'s (1999) review of race, ethnicity, and disasters, individuals who identify as racial and ethnic minorities perceive greater risk but engage in preparatory and safety behaviors less than the white majority. The lack of protective actions among racial and ethnic minorities may be due to the disproportionate representation of these individuals in low-income brackets. For example, the working-class black citizens of New Orleans made up the majority of those who did not evacuate before Hurricane Katrina compared to the primarily middle-class white evacuees (Dyson, 2006). Despite outside observer, relief worker, and evacuee perceptions of stayers as “lazy,” “stupid,” or “passive” (Stephens et al., 2009), those who did not evacuate had significantly fewer resources available to them to enable evacuation. Compared to those who did leave, non-evacuees had significantly fewer opportunities for education, income, and access to reliable news and transportation (Lieberman, 2006).

Furthermore, Burnside et al. (2007) suggested that New Orleans’s long-term citizens may have underestimated the impact of Hurricane Katrina due to unnecessary evacuations and overestimations of past hurricanes’ predicted effects. Researchers have found that individuals’ behaviors and responses to severe weather are greatly affected by their prior experiences (e.g., Comstock & Mallonee, 2005; Ho et al., 2008; Lazo et al., 2015; Lindell et al., 2016; Rickard et al., 2017; Schumann et al., 2018). However, risk perceptions and responses to severe weather may vary depending on the type of experience. For example, participants who previously experienced a hurricane or evacuation, developed an evacuation plan, or knew someone affected by a hurricane had higher perceptions of risk and greater intentions to evacuate than those with no prior experience (Lazo et al., 2015; Rickard et al., 2017). Also, those who experienced a personal loss such as property damage or injury were more likely to engage in preparatory and safety behaviors (Helweg-Larsen, 1999; Perreault et al., 2014; C. Trumbo et al., 2011). In contrast, participants perceived less fear and were less likely to take shelter or evacuate the longer they had lived in an area vulnerable to hurricanes (Lazo et al., 2015) or tornadoes (Schumann et al., 2018). The relationship of experience, socio-demographics, and individuals’ perceptions of and responses to weather warnings further highlights the need for a better understanding of effective weather communication and messaging as individuals must first understand the information they receive before effectively responding (Rickard et al., 2017).

Communication and Messages

While the factors affecting how individuals perceive and respond to severe weather are essential to weather research, Rickard et al. (2017) emphasized the gravity of emergency preparedness message content and comprehension. Furthermore, Baker (1979) found that people do not always appropriately notice and respond to weather warnings. Indeed, people may misinterpret a weather warning and choose to evacuate when sheltering in place is more appropriate, risking travel expenses and unpaid employment leave, or they may not evacuate in response to a deadly storm surge risking injury or death (Lazo et al., 2015). The lack of understanding and inappropriate responses to storm warnings has led many researchers to investigate weather communication and messages (e.g., Demuth et al., 2012; Joslyn et al., 2011; Lindell et al., 2016; Lindell & Perry, 2012; Losee et al., 2017).

To better understand weather communication and message content, Lindell and Perry (2012) developed the Protective Action Decision Model (PADM) to evaluate how people process the information they receive in weather reports. The PADM involves three psychological stages of preparing for a threat. In general, people must first experience pre-decisional processes, including exposure, attention, and accurate comprehension of the environmental cues or social warnings to initiate an appropriate response. The second psychological stage involves the perception of environmental threats, hazard adjustments, and social stakeholders. The third stage of the PADM involves protective-action-decision making, including risk identification and assessment, information-seeking, and the assessment and implementation of protective actions (Lindell & Perry, 2012). Similar to Rickard et al.'s (2017) notion that individuals must first understand the message, the PADM highlights the necessity of comprehension before risk assessment and decision-making.

Further investigating how message content affects comprehension, Joslyn et al. (2011) assessed worst-case scenario forecasting, meaning, for example, that the forecast would only include the highest possible wind speed or the coldest possible temperature rather than the predicted interval (i.e., possible lower and upper values of the forecast). In their study, participants received one of the following scenarios: the most likely forecast of wind speed or temperature, the most likely forecast with the worst-case prediction, or the most likely forecast with the predicted interval of lowest and highest predictions. Participants in the worst-case scenario were often more likely to take action in response to the forecast compared to participants in other conditions, even when unwarranted. While engaging in protective actions is a positive behavior in general, taking actions that are later found to be unnecessary can lead to the “cry wolf” effect (LeClerc & Joslyn, 2015). Indeed, Joslyn et al.'s (2011) results also revealed that participants who only received the most likely wind speed estimated a much lower wind speed, indicating that people may distrust the forecast and believe forecasters may exaggerate.

The “cry wolf” effect is an underestimation of or hesitation to respond to warnings due to prior false alarms (Breznitz, 1984), often leading to noncompliance with weather warnings and distrust in forecasting agencies. As discussed earlier, this may have been a factor in New Orleans citizens’ decisions not to evacuate during Hurricane Katrina due to unnecessary evacuations and overestimations of past hurricanes’ predicted effects (Burnside et al., 2007). LeClerc and Joslyn (2015) also investigated the lack of responding to severe weather forecasts due to the “cry wolf” effect. In their study, participants were asked to decide whether to disseminate salt onto a town’s roads to prevent ice build-up after listening to a low temperature forecast and advice on how to respond. When the advice led to more false alarms, participants were less likely to trust and engage in the advised behavior, indicating a “cry wolf” effect due to notable miscommunication (LeClerc & Joslyn, 2015).

Further examining poor communication of severe weather, Lindell et al. (2016) evaluated the National Weather Service’s (NWS) decision to utilize smaller warning polygons in tornado forecasts, including misinterpretations of the polygons due to the lack of a standardized definition. The NWS issues warnings of potential tornadoes using polygons that are expected to identify the areas at risk. The goals of utilizing the warning polygons include reducing the number of people affected by false alarms as well as decreasing social disruption, economic losses, and source unreliability (Simmons & Sutter, 2011). Lindell et al.'s (2016) participants did engage in appropriate information-seeking and preparation behaviors based on their interpretations of risk. However, while the participants understood that the levels of risk vary throughout the polygon, they erroneously interpreted the locations of greatest risk using the warning polygons. Their findings suggested that participants assumed the area of greatest risk was at the center of the polygon and decreased towards the edges which was incorrect (Lindell et al., 2016). If the participants correctly interpreted the warning, they would have inferred that the line of storms was located near the southwest edge of the polygon, which would have been the area of greatest risk (Lindell et al., 2016). Individuals' misinterpretations of warning polygons due to the lack of explicit statements of the storm location and areas of greatest risk indicate the need for clearer communication within weather messaging.

Additional research regarding weather message communication and comprehension has involved the effects of forecast uncertainty and anchoring effects on information processing and perceptions (e.g., Joslyn et al., 2011; Losee et al., 2017; Wu et al., 2014). People seem to anchor to more severe reports of the same storm and fail to adjust away from the severe prediction if the severity decreases. For example, when a Category 5 hurricane downgrades to a Category 1 hurricane, people are likely to view the storm as more severe than if the storm had been a Category 1 from the beginning. In fact, Losee et al. (2017) found anchoring-to-severity effects when participants were presented with sequences of three and four hurricane predictions involving Categories 1 and 5. Compared to sequences of only Category 1 predictions, participants estimated more lives lost, higher severity, and greater evacuation intentions when the presented sequence involved a Category 5 prediction regardless of the order or when the predictions were downgraded.

Wu et al. (2014) also found anchoring-to-severity effects while investigating hurricane tracks (e.g., cone of uncertainty), severity (Category 1 or 4), and the resulting judgments of landfall likelihood. Participants were shown varying hurricane tracks (e.g., cone with a track, only cone, or only track) and track directions. The order of track and category information as well as whether participants received hurricane information training were also manipulated. The participants were able to correctly process the most likely location of the hurricane landfall regardless of the type of track. Unexpectedly, however, Wu et al.'s (2014) results revealed that people seem to anchor to the storm's severity, causing them to make errors in their likelihood judgments. In fact, the participants judged the hurricane as more likely to make landfall everywhere when the hurricane was a Category 4 compared to the narrower landfall estimates of the Category 1 hurricane. Misinterpretations of storm information have led researchers such as Lindell et al. (2016), Losee et al. (2017), and Wu et al. (2014) to suggest that weather forecasters and other storm reporting agencies focus on improved communication and message content.

Improving weather and risk communication, message content, and comprehension must begin where it originated. Therefore, Demuth et al. (2012) evaluated the roles of the NWS forecasters, local emergency managers, and local television and radio personnel in disseminating information to the public. NWS forecasters characterize and convey weather threats to the local emergency managers who recommend and coordinate risk reduction such as evacuations, shelters, closures, gathering emergency supplies, and other preparatory actions (Demuth et al., 2012). People most commonly retrieve synthesized versions of forecasts and preparatory actions from television and radio personnel (e.g., Morss & Hayden, 2010; Zhang et al., 2007) who typically rely on communication from NWS forecasters and emergency managers (Demuth et al., 2012).

Each sector of the hurricane warning system plays an essential role in communicating weather forecasts, reducing harm, and saving lives (Demuth et al., 2012). However, the various parts of the weather warning system do experience obstacles in their communication with each other. For example, media personnel and emergency managers have expressed difficulty in deciphering NWS forecast products and finding the necessary information for their reports. This difficulty in communication is due to the large amounts of jumbled information, time constraints during emergencies, and the use of scientific, NWS-specific content that can be hard to understand (Demuth et al., 2012). NWS forecasters also noted the need for updated forecast products. Demuth et al. (2012) interviewed forecasters who desired to better communicate with emergency managers and media personnel. The forecasters agreed that their products were outdated, redundant, complex, convoluted, challenging, and slow to interpret. If creators of weather messages struggle to communicate and interpret information, it is unsurprising that the general public may misinterpret the weather reports or make inappropriate decisions in response to the news of approaching storms.

The Bad News Response Model

Sweeny and Shepperd (2007) also noticed a lack of appropriate communication regarding giving and receiving information, specifically bad news. Thus, they proposed the Bad News Response Model (BNRM) due to the notion that news-giving should guide the news-recipients toward the desired response. That is, bad news should be expressed such that the recipients are able to accurately distinguish when their situation can be altered (e.g., take appropriate action in response to the news) or if they should accept what will happen (e.g., there is no viable response that would alter the situation; Sweeny & Shepperd, 2007).

Much of the research guiding Sweeny and Shepperd (2007) in developing their model pertained to health professionals delivering bad news. While the medical literature has offered little consensus on the goals, if any, of communicating bad news, some literature emphasizes reducing discomfort and difficulty for the news-giver (Baile et al., 1999; Clark & LaBeff, 1982; Eggly et al., 1997; McClenahen & Lofland, 1976; Parathian & Taylor, 1993; Radziewicz & Baile, 2001; Ungar et al., 2002), communicating clear and sufficient information (Fallowfield et al., 2002; Girgis et al., 1999; Goldie, 1982; Ward, 1992), promoting patient satisfaction (Ptacek & Eberhardt, 1996), improving patient memory and understanding (Back, 2002; Baile et al., 2000; Dias et al., 2003), decreasing patient distress (Baile & Aaron, 2005; Lerman et al., 1993; Shields, 1998), and encouraging hope (Bor et al., 1993; Groopman, 2004; Taylor et al., 1984). Each of these suggestions is an essential aspect of bad news communication, but they involve flaws such as portraying the news too lightly, omitting negative information, or giving inaccurate information (Sweeny, 2008; Sweeny & Shepperd, 2007). Consequently, the actual needs of patients, or news-recipients, may not be sufficiently emphasized, or news-givers may lead them to make uninformed decisions. For example, if a patient has terminal cancer, but the doctor is uncomfortable supplying the patient with their life expectancy and promotes a hopeful outcome, the patient may make an ineffective decision to continue treatment and not prepare a will. Furthermore, the goals found in the medical literature are inadequate for endorsing the most effective responses and may be quite difficult to implement in other areas of bad news.

In order to create a model for bad news communication that is beneficial to the bad news-recipient as well as the news-giver, Sweeny and Shepperd (2007) proposed four response types (i.e., Watchful Waiting, Active Change, Acceptance, and Non-Responding). Watchful Waiting is a passive, "wait-and-see" type of response (Sweeny, 2008; Sweeny & Shepperd, 2007, 2009). A person engaged in Watchful Waiting is aware of their bad news and continues to watch for changes but does not immediately take action. Watchful Waiters focus on regulating their emotions and distracting themselves from the negativity of their situation (e.g., anxiety, stress) by engaging in activities to take their mind off the situation. This response may be beneficial if actions toward the adverse event have greater costs than benefits or if the actions will not make a difference in the outcome at that time (Sweeny, 2008; Sweeny & Shepperd, 2007, 2009).

The Active Change response type focuses on addressing the bad news by utilizing productive coping strategies. Active Change involves seeking information for appropriate decision-making and connecting with those in a similar situation for support. Sweeny and Shepperd (2007) explained that Active Change responders engage in preventing further decline and the treatment or improvement of the unwanted situation.

Sweeny and Shepperd (2007) defined Acceptance as a combination of Watchful Waiting and Active Change most appropriate for unchangeable outcomes. Acceptance is active rather than passive. However, instead of attempting to prevent and improve the bad news to change the negative situation, those engaged in Acceptance focus on actions toward accommodating the consequences and reducing feelings of hopelessness in an attempt to change their lives. For example, Acceptance responders may share information about their bad news allowing them to make the event more of a reality and retain social support.

Sweeny and Shepperd (2007) suggested a fourth response type, Non-responding, in which the news-recipient may display denial, disbelief, deferral, or dismissal (Lubinsky, 1994; Sweeny, 2008).

Denial is often a defense mechanism including repression or disagreement with the news but is generally a rare response to bad news. Those who display disbelief in response to bad news may experience confusion about the news or maintain unwarranted hope for a better outcome. Bad news-recipients may engage in deferral, therefore, accepting the news but avoiding or rejecting the information regarding how to respond, which is often due to insufficient coping resources. Lastly, bad news-recipients may respond with anger toward the news giver or believe that the news-giver is incompetent or illegitimate. Non-responding is most likely to occur in place of Acceptance and is often an ineffective or unproductive response to bad news. Consequently, Sweeny (2008 Study 1, 2, & 4) and Sweeny and Shepperd (2009) chose not to include Non-responding in their analyses due to the BNRM's goal of effective messaging guiding news-recipients toward beneficial and efficacious responses.

Additionally, Sweeny and Shepperd (2007) proposed three situational factors that affect the types of responses that the recipient of the bad news may make: controllability, likelihood, and severity. They defined the variable, controllability, as the ability to direct or manage the outcomes of the event or news. Likelihood represented the chance or probability that something would happen, and severity was portrayed by the seriousness or unpleasantness of the situation or outcome. For example, Sweeny (2008, Study 1 & 2) and Sweeny and Shepperd (2009) assessed the BNRM in terms of participant responses to various scenarios with possible adverse outcomes. Study 1 (Sweeny, 2008) consisted of a within-subjects design in which participants read eight scenarios involving a poor grade on an exam. The scenarios differed in the likelihood of failing the course (i.e., likelihood), the importance of the course (i.e., severity), and the ability to improve the course grade (i.e., controllability). Sweeny (2008, Study 2) and Sweeny and Shepperd (2009) utilized a between-subjects design in which the participants received only one scenario involving a suspicious mole. Both studies varied in the controllability of removing the mole through surgery, the likelihood of the mole being cancerous, and the severity of the possible skin cancer. In these studies, participants rated Watchful Waiting, Active Change, and Acceptance on Likert-type scales in response to the scenarios and made a forced-choice response among the three options (Sweeny, 2008, Study 1 & 2; Sweeny & Shepperd, 2009).

Watchful Waiting

Sweeny (2008, Study 1 & 2) and Sweeny and Shepperd (2009) predicted that participants would prefer Watchful Waiting when likelihood, severity, and controllability of the negative outcome were low rather than high. This hypothesis was supported by the Likert-type ratings in the mole scenario (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009) and partially supported in the course grade scenario (Sweeny, 2008, Study 1). Indeed, the participants were more likely to prefer Watchful Waiting when the likelihood, severity, and controllability of the scenarios were low rather than high. Contrary to their predictions, however, Sweeny's (2008, Study 1) participants preferred Watchful Waiting when the controllability of improving their course grade was high as opposed to low. Consequently, Sweeny (2008, Study 1) suggested that participants may have misinterpreted the controllability manipulation or believed the increased ability to improve their course grade, such as opportunities for extra credit, indicated that they had time to wait before acting. In addition, Study 1 (Sweeny, 2008) revealed an interaction between likelihood, severity, and controllability as well as a controllability by likelihood interaction for Watchful Waiting. Participants with a high likelihood of failing the course were more likely to prefer Watchful Waiting when the controllability of improving their course grade was high, whereas for low likelihood the preference for Watchful Waiting was similar for low and high controllability (Sweeny, 2008, Study 1).

Regarding the forced-choice responses, participants opted for Watchful Waiting more so when likelihood was low rather than high (Sweeny, 2008, Study 1 & 2; Sweeny & Shepperd, 2009). Participants also chose this response more often when the controllability (Sweeny, 2008, Study 2) and severity (Sweeny, 2008, Study 1) were low. Contrary to their hypothesis, however, Sweeny (2008, Study 1) found that participants tended to choose Watchful Waiting more when the controllability of improving the course grade was high rather than low. Additionally, controllability (Sweeny & Shepperd, 2009) and severity (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009) of the potential cancer did not have significant effects on the participants' forced-choice responses, suggesting the participants may have interpreted their scenarios as highly severe in both severity conditions.

Active Change

Participants were expected to prefer Active Change when the likelihood, severity, and controllability of the negative outcome were high rather than low (Sweeny, 2008, Study 1 & 2; Sweeny & Shepperd, 2009). The hypothesis regarding Active Change was supported in the Likert-type ratings by Study 2 (Sweeny, 2008) and partially supported by Study 1 (Sweeny, 2008) and Sweeny and Shepperd (2009). Indeed, participants preferred Active Change more when the likelihood, severity, and controllability of the scenarios were high rather than low. Unexpectedly, however, the participants did not differ significantly in their preference for Active change when the controllability of their course grade was low or high (Sweeny, 2008, Study 1) or when the cancer was severe or non-severe (Sweeny & Shepperd, 2009). The results did reveal a likelihood by severity by controllability interaction (Sweeny, 2008, Study 1) as well as a severity by controllability interaction with conflicting results between Studies 1 and 2 (Sweeny, 2008). Although seemingly counterintuitive, Study 1 participants in the high course importance condition were more likely to prefer Active Change when the ability to improve the course grade was low, which may have been a consequence of scenario misinterpretations. In Study 2, however, participants in the severe cancer condition were more likely to prefer Active Change when the ability to remove the mole was high.

The Active Change hypothesis was also partially confirmed in the forced-choice responses of both scenarios. Indeed, participants opted for Active Change more when the likelihood of the scenarios was high rather than low (Sweeny, 2008, Study 1 & 2; Sweeny & Shepperd, 2009). Participants also chose this response more often when severity (Sweeny, 2008, Study 1) and controllability (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009) were high. Unexpectedly, preferences for Active Change did not differ when improving the course grade was more or less controllable (Sweeny, 2008, Study 1) or when the potential cancer was severe or non-severe (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009). Consequently, Sweeny (2008, Study 2) and Sweeny and Shepperd (2009) suggested that the participants may have interpreted their scenarios as highly severe in the high and low conditions.

Acceptance

Sweeny (2008) and Sweeny and Shepperd (2009) expected preferences for Acceptance when controllability was low, which was confirmed by the Likert-type ratings and forced-choice responses of both scenarios. Indeed, participants preferred Acceptance when the controllability of the scenario was low rather than high. The forced-choice responses did not reveal any other significant effects. However, despite only hypothesizing how controllability may influence Acceptance, Sweeny's (2008, Study 1) Likert-type ratings did reveal additional significant effects. Sweeny's (2008, Study 1) participants preferred Acceptance more when the likelihood of failing the course was high rather than low.

Furthermore, Sweeny (2008, Study 1) found severity by controllability and likelihood by severity interactions. That is, participants in the high course importance condition were more likely to favor Acceptance when the ability to improve the course grade was low. Participants in the high course importance condition were also more likely to choose Acceptance when the likelihood of failing the course was high. However, participants in the low course importance condition did not differ in their preferences for Acceptance when the likelihood of failing or the controllability of improvement were low or high (Sweeny, 2008, Study 1).

Additional BNRM Research

In addition to Sweeny (2008) and Sweeny and Shepperd's (2007, 2009) original assessments of the BNRM, Weston and Jackson (2016) attempted a conceptual replication in order to examine the possible range of behavioral responses to health news and the situations in which responses are influenced. They used Sweeny and Shepperd's (2009) suspicious mole and potential skin cancer scenarios as well as similar scenarios with a lump and potential tumor. Similar to the BNRM, Weston and Jackson (2016) manipulated the severity, controllability, and likelihood of the mole and tumor scenarios. Instead of presenting the types of responses with their definitions and asking participants to rate their likelihood of engaging in each response, participants rated a list of 23 behavioral responses.

Using an exploratory factor analysis on the behavioral responses, Weston and Jackson (2016) found five ways people tend to respond to health news: avoiding the problem, gathering information, taking action, adjusting future expectations, and seeking social support. The response labeled as “Avoid Problem” involved items that indicated a lack of action or deliberately ignoring the problem (Weston & Jackson, 2016), which is similar to the BNRM’s definition of Non-responding (Sweeny, 2008; Sweeny & Shepperd, 2007, 2009). The “Gather Information” and “Take Action” categories involved seeking more knowledge and taking initiative, closely mirroring the BNRM’s Active Change definition. Similar to the BNRM’s definition of Acceptance, the “Adjust Future Expectations” and “Seek Social Support” categories involved future plans and being close to others. Weston and Jackson (2016) expected participants to engage in the “Gather Information,” “Take Action,” “Adjust Future Expectations,” and “Seek Social Support” responses more when the scenarios were more severe, likely, or controllable. The authors found that “Gather Information” and “Take Action” responses were more likely when the negative outcome was higher in likelihood. “Adjust Future Expectations” and “Seek Social Support” were more likely when the negative outcome had higher severity and higher likelihood. They also found that “Avoid Problem” was more likely when the scenario was unlikely, non-severe, and uncontrollable.

In terms of Watchful Waiting, Weston and Jackson (2016) did not find significant effects for the “check mole periodically for changes” item, but the participants were more likely to “put off surgery until a later time” when the severity, controllability, and likelihood were low. Similar to Active Change predictions, participants were more likely to “book a procedure” when controllability and likelihood were higher and “read up on skin cancer” when likelihood was higher. However, “get a second opinion” was less likely when controllability was high but more likely when likelihood was high. While Weston and Jackson (2016) did not find a similar effect for the Acceptance item “seek social support,” “update your will” was more likely when controllability was low.

Overall, the results of the BNRM studies mentioned above (Sweeny, 2008 Studies 1 & 2; Sweeny & Shepperd, 2009; Weston & Jackson, 2016) supported the Watchful Waiting, Active Change, and Acceptance hypotheses. Each study reported successful manipulations of likelihood, severity, and controllability such that participants perceived lower levels of each when in the low conditions and higher levels when in high conditions. The participants tended to prefer Watchful Waiting when likelihood, severity, and controllability were low. Active Change was preferred when likelihood, severity, and controllability were high, and Acceptance was preferred when controllability was low. However, there were also mixed outcomes for response type preferences, especially concerning the controllability of the scenarios. For example, Study 1 (Sweeny, 2008) revealed that participants were more likely to prefer Watchful Waiting when controllability was high, which was the opposite of what the author predicted.

The Present Study

Sweeny and Shepperd (2007) suggested that the Bad News Response Model (BNRM) could apply to most bad news contexts and news-givers such as teachers, police officers, and business managers, among others. As noted above, among the various contexts in which bad news can occur is severe weather. Although there have been a number of recent studies assessing responding to and perceptions of weather warnings (e.g., Joslyn et al., 2011; Losee et al., 2017; Schumann et al., 2018; Wu et al., 2014), no available research has yet examined responding to severe weather warnings using the BNRM. Similar to the BNRM's goals, the purpose of weather warnings and corresponding call-to-action statements (CTAs) is to prompt engagement in safety/preparation behaviors (i.e., similar to the notion of Active Change; Troutman et al., 2001) or attendance to changes in the weather continuously monitoring the situation such as in a weather watch (i.e., similar to the notion of Watchful Waiting). As the BNRM is an immediate response model but can be applied to long-term events if reevaluated periodically (Sweeny, 2008; Sweeny & Shepperd, 2007, 2009), it may be especially appropriate for weather warnings as there is time involved, and the warnings can change over time (e.g., a hurricane upgrade or downgrade). The BNRM is also relevant as the research of weather warnings concerns responding to warnings, and the model may provide a valuable framework to guide further developments of effective messaging.

Furthermore, the effects of BNRM variables are evident within risk perception and responses outside of the primarily health-focused original research (i.e., Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009). Indeed, severity, likelihood, and controllability have significant effects on bad news responses as well as other factors such as the affective response. For example, while addressing anxiety's effect on risk perception and danger mitigation (i.e., actions toward reducing adverse effects), Notebaert et al. (2016) utilized a loud noise burst in an experimental setting in which participants could invest coins to avoid the perceived danger. They determined that higher likelihood and severity of the potential danger increased danger mitigation behaviors regardless of the participants' level of anxiety. Indeed, Notebaert et al.'s (2016) participants were more likely to invest their coins, despite the consequences of losing coins or future opportunities to mitigate danger, in order to avoid the loud noise burst when the severity and/or likelihood of the burst were higher.

Additionally, Matthes et al. (2019) found evidence of the news or news-giver influencing recipient perceptions and responses while examining how the news and other media outlets affect emotional responses to terrorist attacks. They found that a high number of potential terrorists (i.e., high severity) increased feelings of fear in both controllable and uncontrollable scenarios. Additionally, fear increased when the number of potential terrorists was low if the threat was also portrayed as uncontrollable. Matthes et al. (2019) suggested that the invoked fear due to perceived controllability and severity increased actions toward policy changes, illustrating the news-giver's influence over the news-recipients' responses.

In the context of severe weather, Trumbo et al. (2016) found a correlation between perceived risk and locus of control (i.e., perceived controllability) while assessing a cognitive-affective scale for hurricane risk perception. Indeed, higher perceived risk and controllability were associated with a higher likelihood to evacuate (Trumbo et al., 2016). Similarly, Evans et al. (2015) investigated the effect of damage and preparation images in tornado warnings on comprehension as well as perceptions of susceptibility (i.e., risk) and efficacy (i.e., feelings of ability to prepare). Evans et al. (2015) found that more severe tornado warnings increased perceptions of risk. While their pilot study did not have an effect of images on perceptions of efficacy, the subsequent study included CTAs and found an effect of damage and preparation pictures on efficacy. Evans et al.'s (2015) results suggested that responding was highly influenced by how the information was presented in the warning (e.g., the use of imagery and verbal information).

The current study aimed to examine the BNRM in the context of a severe weather warning (i.e., bad news messaging in the context of hurricane warnings). By applying this model to weather warnings, we attempted to facilitate a better understanding of how messaging in this context would influence perceptions and, by extension, possible responses. Moreover, this study sought to provide further insight into how weather forecasters and media personnel can better encourage the community involved in a threat of severe weather toward the desired precautionary and preparatory behaviors or refine their communication regarding severe weather depending upon the intended message (e.g., immediate action vs. monitoring of the situation).

In the current study, the BNRM was examined by presenting participants with hypothetical hurricane warnings to investigate the extent to which the storm’s level of controllability and severity affected the type of responses the news-recipients would have in terms of Watchful Waiting, Active Change, and Acceptance. The likelihood of our scenarios was held constant as the focus of this study was responding to conditions in which severe weather was highly likely (i.e., hurricane warning). Additionally, in the case of lower likelihood (i.e., hurricane watch), Watchful Waiting would be the expected response despite varying severity and controllability levels.

Severity. The Saffir-Simpson Scale determines the severity, or Category, of the hurricane by its wind speed (Schott et al., 2019). To maintain the greatest difference in our severity manipulations, we utilized a Category 5 hurricane, the most severe with wind speeds of 157 mph or higher, and a Category 1 hurricane, the least severe with wind speeds of up to 95 mph (Schott et al., 2019). Research has suggested that individuals' actions and preparatory behaviors increase when severity is perceived as high (e.g., Joslyn et al., 2011; Lindell et al., 2016; Losee et al., 2017; Matthes et al., 2019; Notebaert et al., 2016; Sweeny, 2008; Sweeny & Shepperd, 2009; Wu et al., 2014). Thus, we expected participants’ preferences for Active Change and Acceptance to increase and preferences for Watchful Waiting to decrease when the hurricane was a Category 5 (Hypothesis 1). Additionally, a Category 1 hurricane was expected to be associated with increased preferences for Watchful Waiting and decreased preferences for Active Change and Acceptance (Hypothesis 2).

Controllability. As described by Troutman et al. (2001) and the National Weather Service Directives System (U.S. Department of Commerce, n.d.), CTAs provide individuals with safety precautions, announcements, and recommendations. Additionally, research has suggested that the inclusion of information about preparations such as CTAs increases individual's perceptions of their ability to take action and prepare (e.g., Evans et al., 2015). Therefore, controllability was manipulated by the inclusion (i.e., high control) or exclusion (i.e., low control) of CTAs in the hypothetical warnings as higher perceptions of control have been associated with increased active preparatory behaviors (e.g., Lindell et al., 2016; Matthes et al., 2019; Sweeny, 2008; Sweeny & Shepperd, 2009). Thus, the inclusion of CTAs was expected to increase preferences for Active Change and decrease preferences for Watchful Waiting and Acceptance (Hypothesis 3). In contrast, the absence of CTAs in a warning was expected to increase preferences for Watchful Waiting and Acceptance and decrease preferences for Active Change (Hypothesis 4).

Interactions. Furthermore, we expected an interaction between severity and controllability for preferences of Active Change, Watchful Waiting, and Acceptance (Hypothesis 5). Because Active Change and Acceptance are both active responses (Sweeny, 2008), preferences for these responses were expected to be higher when the hurricane was a Category 5. However, we expected preferences for Active Change to be highest when CTAs (i.e., higher controllability) were included with the Category 5 warning (Hypothesis 5a). In contrast, we expected preferences for Acceptance to be higher when CTAs were not included with the highly severe warning (Hypothesis 5b). Additionally, we expected Watchful Waiting preferences to be higher when the warning was less severe and perceived as uncontrollable (Hypothesis 5c). See Table 1 for expected response type preferences.

Anxiety. Although the BNRM outlines the most effective responses as a function of high and low levels of controllability, likelihood, and severity, many other factors may influence how individuals respond to weather warnings (see Weather Perceptions and Responses). As discussed previously, anxiety or fear can significantly impact how individuals respond to potential threats (e.g., Lorian & Grisham, 2010). Thus, we explored the potential correlation between trait anxiety, using the State-Trait Inventory of Cognitive and Somatic Anxiety – Trait version (STICSA-T; Ree et al., 2000, 2008), and response type preferences. Sweeny (2008) suggested that Watchful Waiting was associated with high anxiety levels, Active Change with low levels, and Acceptance with moderate levels. According to Notebaert et al. (2016), highly trait-anxious individuals were more likely to engage in preventative behaviors when the magnitude of the threat was high and less likely to engage in preventative behaviors when the magnitude was low. Additionally, low perceived controllability was associated with increased feelings of anxiety and worry and decreased motivation to act (Benight & Bandura, 2004). Therefore, we hypothesized that higher scores of trait anxiety (Hypothesis 6a), somatic trait anxiety (6b), and cognitive trait anxiety (6c) would be positively correlated with preferences for Active Change but negatively correlated with preferences for Watchful Waiting and Acceptance.

Table 1.

Expected impact of situational variables on desired responses.

		Controllability	
		CTAs Excluded	CTAs Included
Severity	Category 1	Watchful Waiting	Active change
	Category 5	Acceptance	Active change

Note. Table adapted from Sweeny (2008) and Sweeny and Shepperd (2009) expected impact table.

CHAPTER 3

METHOD

Participants

An a priori power analysis for an ANCOVA with fixed effects, main effects, and interactions was conducted using G*Power 3.1 to estimate a sufficient sample size for the four groups with one potential covariate. Using an alpha of 0.05, 80% power, a numerator *df* of 1, and a medium effect size ($f = 0.25$; Cohen, 1992), the desired sample size was 128.

We recruited a convenience sample of Georgia Southern University undergraduate students for participation via the university's research experiment participant sign-up portal, SONA system, which had a stop date of April 23, 2021, at 11:59 PM. The students received 0.5 credits toward their course for participating in the study. Respondents participated voluntarily, and no identifying information was collected in connection with their survey responses. A separate survey asked participants for their name and school identification number, which were only used to grant credit for participation.

In total, we collected 162 responses to the study. As exclusionary criteria, we included six comprehension check items in the survey (see Appendix E). Participants were expected to answer at least four of the six items correctly. Of the total responses, 115 (71%) participants correctly answered four or more of the six questions. Additionally, participants had to know the type of storm they viewed and the correct storm category. For the type of storm, 13 (8.0%) respondents did not answer and 20 (12.3%) chose "Partially cloudy" instead of "Hurricane" ($n = 129$, 79.6%). In response to the storm category item, 15 (9.3%) participants did not respond, 85 (52.5%) chose Category 4, and 3 (3.9%) chose Category 5 although they were in the Category 1 condition. Consequently, our valid sample size was 57 resulting in minimal power.

We conducted all analyses using the valid sample of 57 participants. The valid sample consisted of 40 (70.2%) individuals identifying as a woman, 16 (28.1%) identifying as a man, and 1 (1.8%) identifying as non-binary (see Table 2). Most participants were freshmen ($n = 42$, 73.7%) (see Table 2), which was consistent with participant ages ($M = 19.26$, $SD = 1.70$). Race/ethnicity consisted of 11

(19.3%) African American or black participants and 42 (73.7%) European American or white participants (see Table 2). The majority of participants had experienced one or more hurricanes in their lifetime with 14 (24.6%) having experienced none (see Table 4). Table 3 contains descriptive statistics of participant employment status and household income.

Manipulations

To evaluate the effect of controllability and severity of a hurricane on responding, participants were randomly assigned to view one of four hurricane warnings (see Appendix A). The scenarios were designed to simulate those of the National Weather Service alert (i.e., NWS Directives System; U.S. Department of Commerce, n.d.) using Scratch, a project of the Lifelong Kindergarten Group at the MIT Media Lab (*Scratch - Imagine, Program, Share*, n.d.).

To maintain the greatest difference in severity manipulations, we presented the hurricane warnings as a Category 5 hurricane with wind speeds of 157 mph or higher (i.e., high severity) or a Category 1 hurricane with wind speeds up to 95 mph (i.e., low severity; Schott et al., 2019). According to the NWSI 10-601 (U.S. Department of Commerce, n.d.), call-to-action statements (CTAs), or Precautionary/Preparedness Actions, are provided following a weather announcement and contain protective action statements, recommendations, announcements, or evacuation information for the public which can provide a sense of control during storms. Therefore, controllability was manipulated by the inclusion or exclusion of the CTAs. The inclusion of CTA statements was expected to increase the perception of controllability. The CTA statements (see Appendix A) were designed from publications of the NWS Directives System (U.S. Department of Commerce, n.d.) and NOAA (Troutman et al., 2001).

Measures

The measures were modeled after Sweeny (2008) and Sweeny and Shepperd's (2009) BNRM. Participants read Sweeny and Shepperd's (2009) definitions and examples of related behaviors for Watchful Waiting, Active Change, and Acceptance adapted to fit responses to a hurricane warning (see Appendix B). Participants rated how likely they were to engage in each type of response on a 9-point Likert-type scale (*1 = very unlikely*, *9 = very likely;* see Appendix C) and which response they would choose if forced to select one (see Appendix D). To ensure that respondents effectively understood the manipulations, we included six comprehension check items with multiple choice formatting (see Appendix E). Participants had to answer at least four of the six questions correctly as well as select the correct storm type and category to be included in analyses.

Consistent with prior BNRM procedures (Sweeny, 2008; Sweeny & Shepperd, 2009), participants completed supplementary questions (see Appendix F) using 9-point Likert-type scales to ascertain participant perceptions of how severe the outcome of the hurricane would be if it occurred (*1 = not at all bad, 9 = very bad*) and how much control their actions would have over the consequences of the hurricane (*1 = little or no control, 9 = full control*). Participants also answered how likely they or their area were to be affected by the hurricane (*1 = very unlikely, 9 = very likely*) to ensure that their perceptions of the scenarios were accurate (i.e., that the storm was likely to affect their area). Because individual's perceptions of and responses to weather can be related to their socio-demographics and experiences (e.g., Lazo et al., 2015; Rickard et al., 2017; Schumann et al., 2018; Stephens et al., 2009), participants' age, gender identity, race/ethnicity, academic class standing, household income, employment status, and hurricane experience were collected as well (see Appendices G, H). To assess participants' hurricane experiences, we asked how many hurricanes they had experienced prior to the survey, how severe they perceived those hurricanes, and how much knowledge they had about hurricanes (see Appendix H). We found these three experience items to be reliable with a Cronbach's alpha of .76.

Another factor relating to how individuals respond to weather warnings is anxiety (e.g., Davey et al., 1996; Notebaert et al., 2016). Therefore, participants completed the State Trait Inventory of Cognitive and Somatic Anxiety - Trait version (STICSA-T) in which the prompt asked individuals how much they felt "trembly and shaky," for example, in general (i.e., trait anxiety) rather than in that moment (i.e., state anxiety). The STICSA-T (Ree et al., 2000, 2008) consists of 21 statements, including 11 somatic (e.g., physical manifestations of anxiety) and ten cognitive (e.g., a mental component of anxiety) items rated on a 4-point scale (*1 = Not at all, 2 = A little, 3 = Moderately, 4 = Very much so*). This measure returned scores for trait anxiety (a sum of all 21 items), cognitive trait anxiety (a sum of the ten cognitive items), and somatic trait anxiety (a sum of the 11 somatic items). The STICSA-T has been a highly reliable assessment of trait anxiety, including somatic and cognitive subsets of trait anxiety. Ree et al. (2008) reported Cronbach's alphas for the 11 somatic items and ten cognitive items, which were .75 and .80, respectively. In an assessment of the STICSA's psychometric properties, the Cronbach's alphas for the 11 somatic items, ten cognitive items, and 21 total items were .87, .87, and .91, respectively (Grös et al., 2007). We found the STICSA-T to be highly reliable as the Cronbach's alphas in the present study for the 11 somatic items, ten cognitive items, and 21 total items were .91, .92, and .95, respectively.

Design and Procedure

The study utilized a two-tailed Pearson Product-Moment Correlation to evaluate potential correlations between the trait anxiety scores (somatic, cognitive, and total) and the Likert-type ratings (Watchful Waiting, Active Change, and Acceptance). If anxiety scores were significantly related to Likert-type ratings, we included anxiety as a covariate in the Likert-type ratings using separate 2 (high controllability vs. low controllability) x 2 (high severity vs. low severity) between-subjects analyses of covariance (ANCOVAs) for the three outcome measures. If anxiety scores and Likert-type ratings did not significantly relate, we analyzed the Likert-type ratings using separate 2 (high controllability vs. low controllability) x 2 (high severity vs. low severity) between-subjects analyses of variance (ANOVAs). Chi-square analyses were used to compare the proportion of participants who chose each response in the conditions of controllability and severity.

Participants accessed the study online, outside of the lab, on their personal electronic devices (e.g., laptops, smartphones). We utilized Qualtrics survey software to present all materials and measures. The participants viewed the informed consent on the first page of the survey listing their rights and privileges. Participants had the right and ability to withdraw from the study at any time, and they indicated consent by continuing to the second page of the survey.

Following the informed consent, participants viewed a screen on the second page informing them that they needed to be able to see and hear the video on the following page and stating, "While watching the video, imagine that you are viewing a real weather broadcast, and answer the following questions accordingly." This statement appeared again on the third page containing the video. Qualtrics randomly assigned each participant with equal distributions to view one of the four hurricane warnings (see Appendix A). Once the participant viewed the hurricane warning, they read the descriptions of the three response types (i.e., Watchful Waiting, Active Change, and Acceptance) presented on the fourth page in a randomized order (see Appendix B). On the fifth page, they completed the Likert-type ratings of each response type presented in a randomized order (see Appendix C). Participants responded to the forced-choice question selecting the response they would most likely engage in on page six (see Appendix D).

The comprehension check items were located on the following two pages (see Appendix E). Participants responded to the question, presented independently on the seventh page with randomized answer choices, regarding the type of weather reported in the video. The eighth page contained the remaining five comprehension check items presented in a randomized order. As supplementary evaluations, the participants answered questions pertaining to their perceptions of the likelihood, severity, and controllability of the storm's outcome on page nine (see Appendix F).

On the tenth page, participants provided the following socio-demographic information in a randomized order (see Appendix G): gender identity, age, employment status, household income, race/ethnicity, and academic class standing. On the 11th page, we requested information regarding hurricane experience presented in order of the number of hurricanes experienced, perceived severity of experienced hurricanes, and perceived knowledge about hurricanes (see Appendix H). Finally, participants completed the STICSA-T presented on the 12th page in the order specified by the authors (Ree et al., 2000, 2008) so that the somatic and cognitive items were interspersed. Once participants completed the survey, they were thanked for their participation and directed to a separate survey requesting their full names and school identification numbers.

Table 2.

Socio-demographic characteristics of participants

Variable		*n*	%
Gender[a]			
	Female	40	70.2
	Male	16	28.1
	Non-binary	1	1.8
Race/Ethnicity[b]			
	African American/Black	12	21.1
	American Indian/Alaskan Native	1	1.8
	Asian/Asian America	1	1.8
	European American/White	42	73.7
	Hispanic/Latinx	2	3.5
Class standing			
	Freshman	42	73.7
	Sophomore	12	21.1
	Junior	1	1.8
	Senior	2	3.5

Note. Participants (N = 57) had a mean age of 19.26 years (SD = 1.70).

[a] The following options were not selected and, therefore, not reported: transgender male, transgender female, another gender identity not listed, and prefer not to say.

[b] Participants had the option of choosing multiple items such that 1(1.8%) identified as both African American or Black and American Indian or Alaskan Native. Of the valid sample, no participants selected Native Hawaiian/Pacific Islander, another not listed, or prefer not to say.

Table 3.

Socio-demographic characteristics of participants (continued)

Variable			*n*	%
Employment[a]				
	Full-time		4	7.0
	Part-time		19	33.3
	Student		38	66.7
	Unemployed			
		Looking for work	3	5.3
		Not looking for work	8	14.0
	Retired		0	0.0
	Another		1	1.8
	Prefer not to say		0	0.0
Income[b]				
	< $9,999		4	7.0
	$10,000 - $19,000		2	3.5
	$20,000 - $49,999		8	14.0
	$50,000 - $99,999		16	28.1
	$100,000 - $149,999		12	21.1
	> $150,000		7	12.3
	Prefer not to say		8	14.0

Note. [a] Participants had the option of choosing multiple items such that 8 (14%) were students and worked part-time, 1 (1.8%) was a student who worked full-time, 1 (1.8%) selected full-time and unemployed/not looking for work, 1 (1.8%) selected student, unemployed/looking for work, and 5 (8.8%) selected student and unemployed/not looking for work. The participant who selected another option specified their answer as self-employed.

[b] Participants were directed to give their best estimate if unknown. Income could represent the participant or an individual who financially supports the participant.

Table 4.

Number of hurricanes experienced

Variable	*n*	%
Number of hurricanes		
0	14	24.6
1	7	12.3
2	14	24.6
3	9	15.8
4	1	1.8
5	7	12.3
6	2	3.5
7	1	1.8
Other	2	3.5

Note. Other represents responses such as “A lot.”

CHAPTER 4

RESULTS

Of the valid sample size (N = 57), 24 (42.1%) participants received the low severity condition (i.e., Category 1) and 33 (57.9%) received the high severity condition (i.e., Category 5). Additionally, 29 (50.9%) participants received the low controllability condition (i.e., CTAs excluded) and 28 (49.1%) received the high controllability condition (i.e., CTAs included). More specifically, 10 (17.5%) participants watched the Category 1 hurricane warning with no CTAs, 14 (24.6%) watched the Category 1 with CTAs, 19 (33.3%) watched the Category 5 hurricane with no CTAs, and 14 (24.6%) watched the Category 5 with CTAs.

Bivariate Correlations

We conducted a two-tailed Pearson Product-Moment Correlation to test whether the participants' STICSA-T scores were potential covariates of their Likert-type responses (see Table 5). The bivariate correlations revealed one moderately significant, weak, positive correlation between the Likert-type ratings of Acceptance and the somatic trait anxiety scores, r (56) = .262, p = .049, such that individuals were more likely to engage in Acceptance when they had higher somatic anxiety. However, there were no other significant correlations between the STICSA-T scores (i.e., trait anxiety, somatic trait anxiety, and cognitive trait anxiety) and the Likert-type ratings of the three response types (i.e., Watchful Waiting, Active Change, and Acceptance).

Likert-Type Ratings

Due to the lack of significant associations with the anxiety scores as well as the limited and unequal sample sizes across cells, we used separate 2 (Controllability: high vs. low) by 2 (Severity: high vs. low) between-subjects ANOVAs to analyze participants' likelihood of engaging in Watchful Waiting and Active Change. However, we did have one significant correlation between somatic trait anxiety and Acceptance. Therefore, we utilized a 2 (Controllability: high vs. low) by 2 (Severity: high vs. low) analysis of covariance (ANCOVA) using somatic trait anxiety as the covariate to analyze the Likert-type ratings of Acceptance.

Watchful Waiting

We hypothesized significant main effects of controllability and severity for Watchful Waiting. We expected that participants would prefer Watchful Waiting when the controllability and/or severity of the negative outcome were low rather than high. We also expected a severity by controllability interaction in which preferences for Watchful Waiting would be higher when severity and controllability were both low. That is, participants were expected to prefer Watchful Waiting more when the hurricane was a Category 1, and the CTAs were excluded from the warning. Results of the ANOVA did not confirm our hypotheses. There was no main effect of severity, F (1, 53) = 1.37, p = .247, *partial* η^2 = .025 such that participants did not differ in how likely they were to engage in Watchful Waiting for a Category 1 hurricane warning (M = 6.25, SEM = .529) versus a Category 5 hurricane warning (M = 5.48, SEM = .522). There was no main effect of controllability, F (1, 53) = 1.32, p = .255, *partial* η^2 = .024 such that participants did not differ in how likely they were to engage in Watchful Waiting when CTAs were excluded (M = 6.17, SEM = .523) or included (M = 5.43, SEM = .540). There was also no significant severity by controllability interaction, F (1, 53) = 0.004, p = .948, *partial* η^2 = .000.

Active Change

We hypothesized significant main effects of controllability and severity for Active Change. We expected that participants would rate Active Change higher when the controllability and/or severity of the negative outcome were high rather than low. We also expected a severity by controllability interaction in which preferences for Active Change were expected to be higher when severity and controllability were both high. That is, participants were expected to prefer Active Change more when the warning reported a Category 5 hurricane with CTAs included. The results of the ANOVA did not support our hypotheses. There was no main effect of severity, F (1, 53) = 0.83, p = .368, *partial* η^2 = .015 such that participants did not differ in how likely they were to engage in Active Change for a Category 1 hurricane warning (M = 5.75, SEM = .494) versus a Category 5 hurricane warning (M = 6.42, SEM = .485). There was no main effect of controllability, F (1, 53) = 0.007, p = .932, *partial* η^2 = .000 such that participants did not differ in how likely they were to engage in Active Change when CTAs were excluded (M = 6.21, SEM = .512) or included (M = 6.07, SEM = .482). There was also no significant severity by controllability interaction, F (1, 53) = 0.07, p = .791, *partial* η^2 = .001.

Acceptance

We hypothesized significant main effects of controllability and severity for Acceptance. We expected that participants would rate Acceptance higher when the controllability of the negative outcome was low rather than high and/or the severity of the negative outcome was high rather than low. We also expected a severity by controllability interaction in which preferences for Acceptance were expected to be higher when severity was high, but controllability was low. Indeed, we expected participants to prefer Acceptance more when the hurricane was a Category 5 reported without CTAs. The results of the ANCOVA did not confirm our hypotheses for the main effects. There was a significant relationship between the covariate and the dependent variable, F (1, 52) = 5.46, p = .023, *partial* η^2 = .095. However, there was no main effect of severity, F (1, 52) = 0.97, p = .329, *partial* η^2 = .018 such that participants did not differ in how likely they were to engage in Acceptance for a Category 1 hurricane warning (M = 5.88, SEM = .581) versus a Category 5 hurricane warning (M = 5.36, SEM = .403). There was also no main effect of controllability, F (1, 52) = 1.60, p = .211, *partial* η^2 = .030 such that participants did not differ in how likely they were to engage in Acceptance when CTAs were excluded (M = 5.83, SEM = .516) or included (M = 5.32, SEM = .434).

There was a significant severity by controllability interaction, F (1, 52) = 6.15, p = .016, *partial* η^2 = .106 (see Figure 1). To examine the effect of controllability within each level of severity, we conducted separate one-way ANCOVAs in the low severity condition and the high severity condition. Within low severity, there was a significant effect of controllability, F (1, 21) = 4.36, p = .049, *partial* η^2 = .172 such that those who viewed a Category 1 warning with CTAs excluded (M = 7.20, SEM = .879) were more likely to engage in Acceptance than those who viewed a warning with CTAs included (M = 4.93, SEM = .691). There was no relationship between somatic trait anxiety and Acceptance, F (1, 21) = 0.40, p = .537, *partial* η^2 = .018. Within high severity, there was a relationship between somatic trait anxiety and Acceptance, F (1, 30) = 7.14, p = .012, *partial* η^2 = .192, but no effect of controllability, F (1,

30) = 1.26, p = .270, *partial* η^2 = .040 such that those who viewed a Category 5 warning with CTAs excluded (M = 5.11, SEM = .587) and those who viewed a warning with CTAs included (M = 5.71, SEM = .529) did not differ in their preferences for Acceptance.

Forced-Choice Responses

In addition to the Likert-type ratings for each response type, participants indicated which response type they would most likely engage in if forced to pick one response to the hurricane warning. We conducted a Pearson chi-square examining the effects of controllability and severity on participants' forced responses. Our predictions for the participants' forced-choice responses aligned with our main effect predictions for the Likert-type ratings

To examine our hypotheses, we conducted a Pearson chi-square to compare the proportion of participants who chose each type of response (i.e., Watchful Waiting, Active Change, or Acceptance) in the Category 1 versus Category 5 conditions as well as the CTAs included versus excluded conditions. Following Sweeny (2008) and Sweeny and Shepperd (2009), the analyses examined the observed frequencies in comparison to the expected frequencies (i.e., 50% of the responses would be in the low condition and 50% would be in the high condition for severity, and likewise, 50% in the CTAs included condition and 50% in the CTAs excluded condition). See Table 6 for the number and percentage of participants who chose each response based on the manipulations of controllability and severity.

Watchful Waiting

We expected a higher frequency of Watchful Waiting responses when the controllability and/or severity of the negative outcome were low rather than high. Severity had no significant effect on participants' response choices for Watchful Waiting, although there was a trend toward a difference in expected frequencies, $\chi 2$ (1, N = 27) = 3.81, p = .051 such that more participants preferred Watchful Waiting when severity was low (N = 15, 55.6%) rather than high (N = 12, 44.4%). The effect size for this finding, Cramer's V, was weak, .258 (Cohen, 1988). Additionally, controllability had no effect on participants' response choices for Watchful Waiting, $\chi 2$ (1, N = 27) = 0.45, p = .503. The effect size for this finding, Cramer's V, was weak, .089 (Cohen, 1988).

Active Change

We expected a higher frequency of Active Change responses when the controllability and/or severity of the negative outcome were high rather than low. Partially supporting the hypotheses for Active Change, participants opted for Active Change more often when severity was high rather than low, $\chi 2$ (1, N = 19) = 8.10, p = .004. The effect size for this finding, Cramer's V, was moderate, .377 (Cohen, 1988). However, controllability had no effect on participants' response choices, $\chi 2$ (1, N = 19) = 0.04, p = .851. The effect size for this finding, Cramer's V, was weak, .025 (Cohen, 1988).

Acceptance

We expected a higher frequency of Acceptance responses when the controllability of the negative outcome was low rather than high and/or the severity of the negative outcome was high rather than low. Contrary to our hypotheses, severity had no effect on participants' response choices for Acceptance, $\chi 2$ (1, N = 11) = 0.87, p = .352. The effect size for this finding, Cramer's V, was weak, .123 (Cohen, 1988). Additionally, controllability had no effect on participants' response choices for Acceptance, $\chi 2$ (1, N = 11) = 1.15, p = .284. The effect size for this finding, Cramer's V, was weak, .142 (Cohen, 1988).

Supplemental Analyses

Perceived Factors

To assess participants' perceptions of the controllability, severity, and likelihood of the hurricane warnings and the effectiveness of our manipulations, we conducted separate 2 (Controllability: high vs. low) by 2 (Severity: high vs. low) between-subjects analyses of variance (ANOVAs) on the supplemental items. Analysis of the perceived severity item was expected to yield a main effect of severity in which participants in the Category 5 condition (i.e., high severity) would rate the storm as highly severe while participants in the Category 1 condition (i.e., low severity) would rate the storm as less severe. Analysis of the perceived severity manipulation yielded a main effect of severity, F (1, 53) = 39.73, p < .001, *partial* η^2 = .428 such that participants who received the Category 5 hurricane warning (M = 7.94, SEM = .282) rated the severity of the hurricane significantly higher than those who received a Category 1 hurricane warning (M = 5.00, SEM = .351). There was no main effect of controllability, F (1, 53) = 1.22, *p* = .275, *partial* η^2 = .022 such that participants did not rate the severity of the hurricane significantly different in the low controllability condition (*M* = 7.14, *SEM* = .360) than in the high controllability condition (*M* = 6.25, *SEM* = .453). There was also no severity by controllability interaction, *F* (1, 53) = 0.62, *p* = .434, *partial* η^2 = .012.

The analysis of the perceived controllability item was expected to yield a main effect of controllability in which participants who received the CTAs (i.e., high control) would rate the storm as more controllable while those who did not receive the CTAs (i.e., low control) would rate the storm as less controllable. There was no main effect of controllability, *F* (1, 53) = 0.13, *p* = .721, *partial* η^2 = .022 such that participants did not rate their ability to control the hurricane significantly different in the low controllability condition (*M* = 5.03, *SEM* = .405) than in the high controllability condition (*M* = 5.50, *SEM* = .441). However, the analysis revealed a difference in terms of severity, *F* (1, 53) = 5.47, *p* = .024, *partial* η^2 = .093 such that participants who received the Category 5 hurricane warning (*M* = 4.67, *SEM* = .434) rated their ability to control the outcome of the hurricane significantly lower than those who received a Category 1 hurricane warning (*M* = 6.08, *SEM* = .318). There was no severity by controllability interaction, *F* (1, 53) = 0.17, *p* = .686, *partial* η^2 = .003.

Analysis of participants' perceived likelihood item yielded no main effect of severity on likelihood ratings, *F* (1, 53) = 3.70, *p* = .060, *partial* η^2 = .065 such that participants did not rate the likelihood of the hurricane hitting their area significantly different in the low severity condition (*M* = 6.17, *SEM* = .488) than in the high severity condition (*M* = 7.30, *SEM* = .327). There was no main effect of the controllability manipulation on perceived likelihood ratings, *F* (1, 53) = 0.02, *p* = .876, *partial* η^2 = .000 such that participants did not rate the likelihood of the hurricane hitting their area significantly different in the low controllability condition (*M* = 6.93, *SEM* = .384) than in the high controllability condition (*M* = 6.71, *SEM* = .433). Additionally, there was no severity by controllability interaction, *F* (1, 53) = 0.28, *p* = .598, *partial* η^2 = .005.

Hurricane Experience

We conducted Pearson correlations to evaluate whether the participants' experiences with hurricanes were associated with their Likert-type responses or their perceived severity, controllability, and likelihood of the warning (see Table 7). The bivariate correlations revealed a significant positive correlation between the number of hurricanes participants experienced and the perceived severity of experienced hurricanes, r (56) = .533, p < .001, such that individuals who experienced more hurricanes were more likely to perceive the previous hurricanes as more severe. The bivariate correlations revealed a significant positive correlation between the number of hurricanes participants experienced and participants' perceived ability of controlling the outcome of the hurricane, r (56) = .348, p = .008, such that individuals who experienced more hurricanes had an increased perceived ability of controlling the outcome of the hurricane. However, there were no other significant correlations for the number of hurricanes participants experienced.

The bivariate correlations revealed a significant positive correlation between the perceived severity of experienced hurricanes and participants' perceived ability of controlling the outcome of the hurricane, r (56) = .649, p < .001, such that individuals who perceived the severity of experienced hurricanes as higher had an increased perceived ability of controlling the outcome of the present study's hurricane. However, there were no other significant correlations for the perceived severity of experienced hurricanes.

The bivariate correlations revealed a significant positive correlation between ratings of self-reported knowledge about hurricanes and participants' perceived ability to control the outcome of the hurricane, r (56) = .371, p = .004, such that individuals who believed they had more knowledge about hurricanes had increased perceived controllability in the study. However, there were no other significant correlations for the self-reported knowledge of hurricanes.

The bivariate correlations revealed a significant negative correlation between the Likert-type ratings of Active Change and Watchful Waiting, r (56) = -.414, p = .001, such that individuals were moderately less likely to engage in Active Change when they engaged in Watchful Waiting. This correlation speaks to the validity of the measures as Active Change and Watchful Waiting are response types expected at opposite levels of severity and controllability. Additionally, the bivariate correlations revealed a significant positive correlation between the Likert-type ratings of Acceptance and Watchful Waiting, r (56) = .318, p = .016, such that individuals were moderately likely to engage in Acceptance when they engaged in Watchful Waiting.

Table 5.

STICSA-T correlation matrix

			Likert-type ratings			STICSA-T scores		
Variable	*M*	*SD*	1	2	3	4	5	6
1. Watchful Waiting	5.81	2.84	--					
2. Active Change	6.14	2.64	-.414**	--				
3. Acceptance	5.58	2.54	.318*	.137	--			
4. Trait Anxiety	37.95	13.25	.158	-.035	.245	--		
5. Somatic	18.12	6.39	.153	-.010	.262*	.930**	--	
6. Cognitive	19.82	7.67	.281	-.053	.205	.952**	.773**	--

**p<.01 *p<.05

Table 6.

Chi-square Frequencies

	Watchful Waiting		Active Change		Acceptance	
Condition	*n*	%	*n*	%	*n*	%
Severity						
Low	15	55.56	3	15.79	6	54.55
High	12	44.44	16	84.21	5	45.45
Controllability						
Low	15	55.56	10	52.63	4	36.36
High	12	44.44	9	47.37	7	63.64

Figure 1.

Controllability by severity interaction of Acceptance.

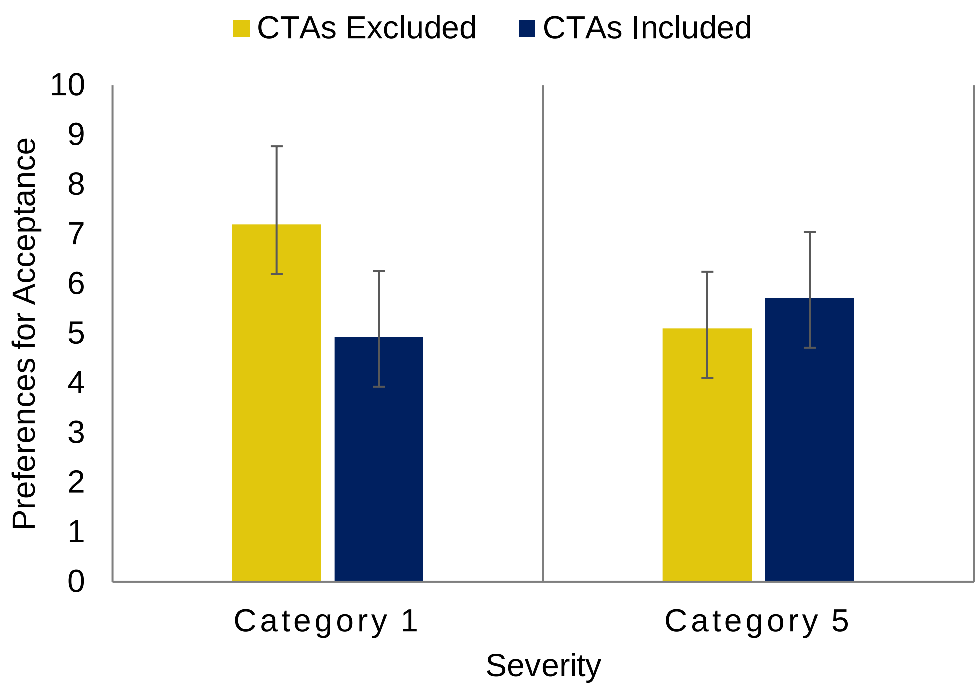

Table 7.

Hurricane experience correlation matrix

			Likert-type ratings			Perceived Factors			Experience		
Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Watchful Waiting	5.81	2.84	--								
2. Active Change	6.14	2.64	-.414**	--							
3. Acceptance	5.58	2.54	.318*	.137	--						
4. Likelihood	6.82	2.16	-.038	.192	.087	--					
5. Severity	6.70	2.20	-.041	.207	.079	.427**	--				
6. Controllability	5.26	2.25	.092	.105	.135	.021	-.186	--			
7. # of hurricanes	2.28	1.97	-.054	.020	-.083	.108	-.021	.140	--		
8. Exp. severity	4.00	2.45	-.103	.094	.029	.030	.076	.253	.533**	--	
9. Knowledge	5.05	2.17	.086	.118	.140	.242	.097	.371**	.348**	.649**	--

$^{**}p<.01$ $^{*}p<.05$

Note. Table represents the bivariate correlations of hurricane experience (7, 8, 9), perceived situational factors (4, 5, 6), and Likert-type ratings (1, 2, 3)

CHAPTER 5

DISCUSSION

The present study provided a test of the Bad News Response Model, designed to improve understanding and predictions of bad news responses in the context of weather perceptions and communication (Sweeny, 2008; Sweeny & Shepperd, 2009). We also aimed to expand upon this model by evaluating STICSA-T scores (i.e., trait anxiety, somatic trait anxiety, and cognitive trait anxiety) in relation to preferences for Watchful Waiting, Active Change, and Acceptance.

STICSA-T. Unexpectedly, our results revealed a significant correlation between preferences for Acceptance and somatic trait anxiety. However, this correlation was relatively weak. Additionally, the positive correlation, suggesting preferences for Acceptance increased with increased somatic trait anxiety, contradicts the notion that high levels of anxiety increased mitigation behaviors (Notebaert et al., 2016) as Acceptance does not involve actions to prevent potential threats. Rather, this response type incorporates the threat into the individual's life. However, this result may indicate that increased anxiety levels, to an extent, may be associated with coping behaviors overall rather than explicitly taking action, at least in the current context. Further research would be needed to better understand the relationship between the BNRM measures and affective traits such as anxiety.

Also unexpected, there were no other significant correlations between scores of trait anxiety, somatic trait anxiety, or cognitive trait anxiety and the preferences for Watchful Waiting, Active Change, and Acceptance. These results contradict those suggesting that Watchful Waiting and Acceptance preferences would be associated with low anxiety levels, and Active Change preferences would be associated with high anxiety levels (e.g., Benight & Bandura, 2004; Notebaert et al., 2016; Sweeny, 2008).

Severity. As expected, participants did choose Active Change more frequently in the Category 5 hurricane condition than in the Category 1 condition (Hypothesis 1) in terms of the forced-choice response, but contrary to our predictions, this relationship was not observed for the Active Change Likert-type ratings. Additionally, severity did not have a significant effect on Watchful Waiting or Acceptance preferences. The lack of a significant effect of severity was unexpected as the analysis of the participants' perceived severity revealed that individuals in the Category 5 condition perceived the hurricane as significantly more severe than those in the Category 1 condition.

Controllability. Contrary to our predictions, the inclusion or exclusion of call-to-action statements did not significantly affect Watchful Waiting, Active Change, or Acceptance preferences. The lack of a significant effect of controllability was not surprising as participants' perceptions of their ability to control the outcome of the hurricane did not significantly differ for those who received CTAs and those who did not. The lack of controllability effects suggests that the use of CTAs may be insufficient in terms of applying controllability in the context of the BNRM.

Finally, we did find a significant interaction regarding the measure of Acceptance. However, the pattern contradicts our hypothesis in that we expected a greater preference for Acceptance in the Category 5 condition without CTAs. Rather, the pattern trended toward greater Acceptance preferences in the Category 1 condition without CTAs. For a scenario in which both the severity and controllability are low, Watchful Waiting would be the most desirable response as Acceptance would be more desirable when the situation is severe but uncontrollable. However, Acceptance would be more desirable than Active Change in this scenario because Active Change may involve safety preparations such as evacuating, which would be costly and unnecessary.

Supplemental Results. Interestingly, the results revealed some significant effects of participants' perceptions of the manipulations as well as their experiences with hurricanes. Perceived severity did significantly affect participants' perceived controllability such that the participants in the Category 5 condition perceived their ability to control the outcome of the storm as significantly lower than those in the Category 1 condition. The perceived severity's effect on control perceptions may, in part, explain the lack of controllability effects as participants may have perceived the high control condition as less controllable in the high severity condition. Furthermore, it is possible that perceived controllability was lower as the majority of responses to the storm would have been less efficacious than to evacuate.

We also found that the number of hurricanes participants experienced, the severity of the prior hurricanes, and self-reported knowledge about hurricanes were associated with participants' perceived controllability in the current study. That is, participants believed they had more control over the outcome of the study's hurricane when they had more hurricane experience, perceived higher severity of prior hurricanes, and when they reported having more knowledge about hurricanes. As most of our participants had experienced at least one hurricane before completing the survey, their prior experience may have influenced their perceptions of controllability, affecting their response type preferences. Furthermore, a better understanding of the best measure of controllability in the context of the BNRM and weather warnings needs to be further investigated.

Limitations and Future Directions

The present study comprised several limitations, and the findings discussed above should be interpreted with caution in the context of these limitations. In particular, the present study was extremely underpowered as our analyses required 128 participants to attain 80% power, but we retained less than half of that for our valid sample ($N = 57$). We experienced a time constraint on data collection as the survey was active for less than four months affecting the initial number of participants recruited. Critically, the sample size significantly decreased due to inaccurate responses to the comprehension items that served to check participants' understanding of the manipulations. The high percentage of incorrect responses suggests a lack of attention or understanding of survey questions. The inaccurate responses were likely enhanced by the completely remote method of data collection. Participants completed the survey outside of the lab without any researcher supervision. Therefore, we cannot confirm if individuals were able to focus solely on the manipulations or even view the stimuli. Finally, of the valid sample, participants were primarily European American or white female psychology students around the age of 20. Thus, the study lacked external validity as well as the appropriate sample size for significant results indicating that the current findings must be interpreted with caution.

Due to necessary COVID-19 restrictions, the present study was conducted online rather than in-person presenting a potential limitation in the dissemination of the survey. According to Johnson (2005), online surveys create a physical distance between the researcher and respondents, reducing the participants' perceived accountability and potentially leading to increased carelessness in responses. There are also potential distractions that cannot be controlled for in virtual studies with the participants' uninhibited access to the Internet and technological activities. Notably, respondents of more recent generations, such as those of the present study, are more likely to multitask when using technology (Carrier et al., 2009), and performance is reduced when individuals do not provide their full attention to the task, potentially decreasing data quality (Spelke et al., 1976). For example, Zwarun and Hall (2014) had a significant number of college-aged participants report multitasking and increased feelings of distraction during an online survey.

Therefore, we suggest a conceptual replication of this study using an in-person method and a larger sample size. Despite several insignificant results, there are indications that a replication may be warranted. We did have a significant effect of severity on Active Change preferences and a significant severity by controllability interaction for Acceptance. There were also trends in the data implicating expected patterns with potential for significant findings. For example, the Watchful Waiting chi-square analysis results trended toward more preferences in the low severity condition than in the high severity condition. As a larger sample size increases power (Cohen, 1988), our results have the potential to be significant with more participants. Additionally, there was an evident lack of understanding or failure to effectively pay attention among the participants when completing the survey. Thus, we suggest an in-person replication in a laboratory setting to control for potential distractors and ensure that participants are able to successfully view and understand the hurricane warnings.

Integrating Prior BNRM Results

Overall, the results of the BNRM literature (Sweeny, 2008 Studies 1 & 2; Sweeny & Shepperd, 2009; Weston & Jackson, 2016) have supported the Watchful Waiting, Active Change, and Acceptance hypotheses. However, despite indications that each of their manipulations of likelihood, controllability, and severity were successful (e.g., participants in the low conditions of each rated the scenarios as less likely, severe, and controllable while participants in the high conditions of each rated them higher), there were unexpected results concerning response type preferences. Indeed, some results were the opposite of expected outcomes, or the situational factors simply did not affect the response preferences.

Likelihood. As expected, participants in the BNRM research preferred Watchful Waiting when likelihood was low and Active Change when likelihood was high (Sweeny, 2008 Studies 1 & 2; Sweeny & Shepperd, 2009; Weston & Jackson, 2016). Supporting our hypotheses, although not predicted by past literature, Sweeny (2008, Study 1) found that preferences for Acceptance were higher when likelihood was high. Unexpectedly, however, participants preferred the Acceptance-like factor "Avoid the Problem" more when the likelihood was low (Weston & Jackson, 2016). Likelihood did not affect forced-choice responses (Sweeny, 2008, Studies 1 & 2; Sweeny & Shepperd, 2009) or Likert-type ratings (Sweeny, 2008 Study 2; Sweeny & Shepperd, 2009) of Acceptance preferences. Additionally, there was no effect of likelihood on preferences for the Watchful Waiting-like behavior of periodically checking the mole or the Acceptance-like behaviors of updating a will or seeking social support (Weston & Jackson, 2016).

Severity. Furthermore, the results of the four studies supported predictions regarding severity such that participants preferred Watchful Waiting when severity was low (Sweeny, 2008, Studies 1 & 2; Sweeny & Shepperd, 2009; Weston & Jackson, 2016) and Active Change when severity was high (Sweeny, 2008 Studies 1 & 2). Although not predicted in prior literature, Acceptance-like behaviors were preferred when severity was high (Weston & Jackson, 2016). Unexpectedly, the Acceptance-like behavior "Avoid the Problem" was preferred when severity was low (Weston & Jackson, 2016). Severity did not affect forced-choice preferences for Watchful Waiting (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009), Active Change forced-choice responses (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009) and Likert-type ratings (Sweeny & Shepperd, 2009), or Acceptance Likert-type ratings and forced-choice responses (Sweeny, 2008, Studies 1 & 2; Sweeny & Shepperd, 2009). Additionally, there was no effect of severity for the Watchful Waiting-like behavior of checking the mole periodically, Active Change-like behaviors of taking action and gathering information, or the Acceptance-like behaviors of updating a will and seeking social support (Weston & Jackson, 2016).

Controllability. The results of prior studies supported the expected controllability effects such that participants preferred Watchful Waiting and Acceptance when the controllability was low, and they preferred Active Change when the controllability was high. However, Likert-type ratings and forced-choice responses of Watchful Waiting in Study 1 (Sweeny, 2008) indicated the opposite. Participants preferred Watchful Waiting when controllability was high rather than low. Additionally, participants were more likely to prefer the Active Change-like behavior “Get a second opinion” when controllability was low rather than high (Weston & Jackson, 2016). There was no effect of controllability on preferences for Watchful Waiting forced-choice responses (Sweeny & Shepperd, 2009) or Active Change Likert-type ratings and forced-choice responses (Sweeny, 2008 Study 1). Controllability also did not affect the Watchful Waiting-like behavior of periodically checking the mole, Active Change-like behaviors of gathering information and taking action, or Acceptance-like behaviors of adjusting future expectations and seeking social support (Weston & Jackson, 2016).

Interactions. Although not predicted in the BNRM literature, the research did reveal a number of interaction effects. Supporting our hypotheses, Sweeny’s (2008) Study 2 indicated that individuals in the high severity condition were more likely to choose Active Change when the controllability was also high. In Study 1 (Sweeny, 2008), participants in the high severity condition were more likely to engage in Acceptance when the controllability was low as well as when the likelihood was high. Contrary to the present study’s expectations, Study 1 (Sweeny, 2008) revealed that participants in the high severity condition were more likely to choose Active Change when there was low control. Additionally, participants in the high likelihood condition preferred Watchful Waiting more when controllability was high (Sweeny, 2008, Study 1).

Evaluating their mixed results, the authors of the BNRM literature suggested that participants may have misinterpreted the manipulations. In Study 1, Sweeny's (2008) exam grade scenario may have been too familiar for participants to objectively perceive the likelihood, severity, and controllability of the outcome. The participants likely added their own interpretations to the scenarios from personal experiences. For example, their use of a D as the exam grade may have been devastating to some students but normal for others. Additionally, in the case of a course grade, Sweeny (2008, Study 1) suggested that participants may have interpreted high controllability (e.g., extra credit opportunities) as having time to wait until later in the semester leading to higher Watchful Waiting preferences. In an attempt to avoid the familiarity limitation of Study 1 (Sweeny, 2008), the subsequent studies involved scenarios concerning a mole and potential skin cancer (Sweeny, 2008, Study 2; Sweeny & Shepperd, 2009). However, forced-choice results of Watchful Waiting and Active Change revealed no effect of severity. Sweeny (2008, Study 2) and Sweeny and Shepperd (2009) suggested that the participants in the high and low severity conditions interpreted the scenarios as highly severe. The aforementioned results and potential misinterpretations indicate the need for a more precise definition of the BNRM variables and further clarification of the intent of bad news communication and messages.

Further research may be necessary in terms of effectively defining and conveying the BNRM variables in the context of weather as well as future applications of the BNRM as controllability seems to have been viewed differently by participants than previous authors or we intended. Identifying a more precise definition of the variables, particularly controllability, would aid in refining the BNRM in terms of what these components mean to news-recipients. As there is limited literature pertaining to the BNRM, potential methods for clarifying the key components are cognitive interviews and open-ended questionnaires with a sample of the target population (Boateng et al., 2018).

Considering the lack of controllability effects in the present study and potential misinterpretations of previous studies, another application of the BNRM is necessary to assess the extent to which individuals understand the goal of the message, particularly in terms of controllability. In each of the scenarios, the intent was to convey low or high levels of controllability. However, this was misunderstood in prior studies and not effectively apprehended in the current study. Our inclusion or exclusion of CTAs was not sufficient in manipulating controllability, suggesting the need to identify any mismatches between understanding and component goals of the message. Troutman et al. (2001) suggested that the goal of CTAs is to increase perceptions of control, and Evans et al.'s (2015) study indicated that the inclusion of CTAs with images in tornado warnings increased efficacy. Notably, however, call-to-action statements lack specific requirements for differing storms and levels of severity; there are merely recommendations left to the interpretations of local officials and broadcasters (Troutman et al., 2001; U.S. Department of Commerce, n.d.). Additionally, CTAs are not required in weather reports and are often left out when warnings are delivered via text message and other modes shortened for convenience.

Communication and messages are essential to the safety of those affected by impending weather. Thus, the content of and ability to comprehend the news must be sufficiently evaluated. Individuals' sense of controllability influences how they perceive and respond to adverse situations. However, there is limited research involving perceptions of controllability in severe weather and the use of call-to-action statements. Therefore, further evaluating controllability in the context of weather communication and messaging is vital. To our knowledge, the inclusion of CTAs in weather warnings is the only method of increasing perceptions of controllability; however, there are limitations to this. As discussed previously, available resources have significant impacts on how individuals respond to severe weather. For example, although the call-to-action for Hurricane Katrina in New Orleans was to evacuate, many individuals did not leave due to a lack of resources such as reliable transportation (Lieberman, 2006). Additionally, many individuals lack the resources to comprehend the content of weather warnings effectively.

Furthermore, the current study and prior literature suggest that participants' responses are influenced by their experiences with severe weather such as hurricanes. In the present study, participants believed that they had more control over the outcome of the hurricane when they had more perceived experience. Similarly, research suggests that experience with severe weather such as hurricanes increases preparatory behaviors (e.g., Rickard et al., 2017), which we would expect with increased perceptions of controllability. However, further research suggests that the longer individuals live in an area vulnerable to hurricanes, the less likely they are to engage in safety/preparatory behaviors (e.g., Lazo et al., 2015). Perhaps, experience has the potential to induce the "cry wolf" effect. For example, LeClerc and Joslyn (2015) found that the more false alarms the participants received, the less likely they were to trust or engage in the advised behavior. As such, living in an area that is vulnerable to hurricanes may increase an individual’s perception of controllability but decrease their likelihood of engaging in preparatory behaviors when they experience false alarms.

Considering the above discussion, we suggest further evaluations of controllability in the context of weather communication as well as the application of the Bad News Response Model. In terms of weather communication, we suggest an in-depth assessment of call-to-action statements and increasing perceptions of controllability through message content. Although research suggests that CTAs should increase perceptions of controllability, further evaluations of specific statements for effective responses are necessary. Additionally, the inclusion of imagery in CTAs should be considered as images of preparations with CTAs increased efficacy in Evans et al.'s (2015) study of tornado perceptions. The cone of uncertainty (Wu et al., 2014) and tornado warning polygons (Lindell et al., 2016) also influenced preparatory intentions. However, individuals must be able to accurately comprehend the imagery for it to be effective. Due to the lack of CTA requirements and evident effects of experience, we suggest the production of CTA requirements based on the storm type, severity, location, and potential consequences. Importantly, call-to-action statements should be tailored to the specific storm and required in all weather communication.

Conclusion

The present study adds to the limited literature available on the Bad News Response Model (Sweeny, 2008; Sweeny & Shepperd, 2007, 2009; Weston & Jackson, 2016). Because the current study involved hurricane warnings and messaging, we have also provided a new scenario in which the model is examined due to the health focus of previous assessments. The BNRM’s purpose is to estimate the most desirable responses to bad news based on the severity, likelihood, and controllability of the situation as well as provide better communication for bad news-givers and recipients. Although the results did not support our hypotheses, we do not negate the BNRM as a valuable tool for furthering the knowledge of bad news communication, including weather messaging, comprehension, and responding.

As illustrated in previous sections, weather communication has mixed implications, and the current study supports the need for further assessments of how individuals perceive and respond to weather warnings. As the warnings presented in this study align with current NWS and NOAA recommendations and requirements, the lack of significant results may suggest the need for improved weather forecasting, broadcasts, and messages. Additionally, we suggest an in-person replication of the current study to improve participant attention and response quality as the application of the BNRM to weather contexts has the potential to advance weather forecaster and media personnel communication of and guidance during severe weather.

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APPENDIX A

HURRICANE WARNING STIMULUS WITH CTAS

Hurricane Warning URL (low severity, high control)

https://youtu.be/aDTDRqW7ICc

Weather Warning Text (Call-to-action statements included)

Rotating Text

The National Weather Service has issued a ***Hurricane Warning*** for the following counties: Bryan - GA, Bulloch - GA, Camden - GA, Chatham - GA, Effingham - GA, Glynn - GA, Liberty - GA, McIntosh - GA.

Voice Recording

3 medium length beeps, 1 long & high-pitched beep

A hurricane warning remains in effect for Southeast Georgia. A warning means that hurricane-force conditions are expected to occur. Hurricane Alex, a Category (1 / 5) hurricane with winds (up to 95mph / of 157mph or higher), is expected to make landfall in your area soon. This storm is expected to cause (catastrophic destruction and serious injury or death / some dangerous winds and damage to older or poorly constructed buildings).

Call-to-Action Voice Recording

All residents of Southeast Georgia are advised to remain in their homes, avoid traveling, and stay off telephones and cell phones in case of emergencies. Cover windows and doors. Take refuge in a designated storm shelter or an interior room. Do not walk, swim, or drive through flood waters. Stay tuned in to your local weather station for further updates and evacuate if told to do so.

3 short beeps

APPENDIX B

BAD NEWS RESPONSE MODEL DESCRIPTIONS

Adapted from Sweeny (2008); Sweeny & Shepperd (2009)

The following descriptions represent three possible types of responses to bad news. Please read each description carefully.

Active Change: This response involves specific actions directed toward addressing the bad news. It includes behaviors like seeking information, prevention, and treatment. For example, if a person in your area heard the previous hurricane report engaged in Active Change, his/her immediate response might be to research information about safety precautions and evacuation guidelines for the storm, board windows and doors, buy water and food, and/or evacuate if told to do so.

Watchful Waiting: This response involves a "wait and see" mentality. People engaged in this response are aware that they are facing a possible threat. However, they go about life as usual rather than take action. For example, if a person in your area heard the previous hurricane report engaged in Watchful Waiting, his/her immediate response would likely not be to take precautionary measures such as buying supplies and boarding windows. However, he/she might occasionally check the weather channel and/or the local radio for updates instead of taking immediate action.

Acceptance: This response involves coming to terms with bad news rather than taking action to change the situation. Acceptance involves making changes, not to affect the outcome, but rather to incorporate the negative event into one's life. For example, if a person in your area heard the previous hurricane warning engaged in Acceptance, his/her immediate response might be to let family and friends know in order to receive social support and buy flood and/or home insurance as well as health and/or life insurance for the future.

APPENDIX C

LIKERT-TYPE RATING ITEMS

Using the descriptions of the three possible responses, rate how likely you would be to engage in each type in response to the weather report you viewed earlier on a scale of 1 (Very Unlikely) to 9 (Very Likely).

How likely would you respond to the weather report with Active Change?

1	2	3	4	5	6	7	8	9
Very Unlikely								Very Likely

How likely would you respond to the weather report with Watchful Waiting?

1	2	3	4	5	6	7	8	9
Very Unlikely								Very Likely

How likely would you respond to the weather report with Acceptance?

1	2	3	4	5	6	7	8	9
Very Unlikely								Very Likely

APPENDIX D

FORCED-CHOICE ITEM

Of the three responses, how would you most likely respond to the weather report that you viewed earlier?

(Check One)

- Watchful Waiting
- Active Change
- Acceptance

APPENDIX E

COMPREHENSION CHECK ITEMS

Page 7

What kind of weather was reported in the video at the beginning of this survey?

- Hurricane
- Tornado
- Thunderstorm
- Partially cloudy

Page 8

According to the weather report, what category was the storm?

- Category 1
- Category 2
- Category 3
- Category 4
- Category 5

What was the maximum expected wind speed associated with the weather report?

- Less than 74 mph
- Up to 95 mph
- Up to 110 mph
- Greater than 157 mph

Was the storm expected to hit your current location?

- Yes
- No

Which preparatory recommendation was NOT included in the weather report?

- Evacuate immediately
- Stay tuned in to your local weather station for updates
- Evacuate if told to do so
- No preparatory recommendations were given

The weather report said that Southeast Georgia was under a Hurricane Warning. This means that:

- Hurricane-force conditions are expected to occur
- Conditions indicate that a hurricane is possible

APPENDIX F

PERCEPTIONS OF SITUATIONAL FACTORS

How likely is your area to be hit by the hurricane from the weather report?

1	2	3	4	5	6	7	8	9
Very Unlikely								Very Likely

How severe, or bad, would it be if the hurricane did hit your area?

1	2	3	4	5	6	7	8	9
Not at All severe/ bad								Very severe/bad

How much control over your safety/preparation for the storm do you think you would have if the hurricane did hit your area?

1	2	3	4	5	6	7	8	9
Little Or no Control								Full Control

APPENDIX G

DEMOGRAPHICS

What is your gender identity?

- Woman
- Man
- Transgender woman
- Transgender man
- Non-binary
- Another gender identity not listed here, please specify: _____
- Prefer not to say

What is your age? ______

Which of the following best describes your employment status? (Check all that apply)

- Full-time
- Part-time
- Retired
- Student
- Unemployed/Looking for work
- Unemployed/Not looking for work
- Another not listed here, please specify: _____
- Prefer not to say

What is your household income? If you don’t know, please estimate.

- Less than $9,999
- $10,000 - $19,999
- $20,000 - $49,999
- $50,000 - $99,999
- $100,000 - $149,999
- More than $150,000
- Prefer not to say

What is your race/ethnicity? (Check all that apply)

- African American or Black
- American Indian or Alaskan Native
- Asian or Asian American
- European American or White
- Hispanic or Latinx
- Native Hawaiian/Pacific Islander
- Another race/ethnicity not listed here, please specify:_____
- Prefer not to say

What is your current academic class standing?

- Freshman
- Sophomore
- Junior
- Senior

APPENDIX H

HURRICANE EXPERIENCE ITEMS

How many hurricanes have you experienced in your lifetime? _____

On a scale from 1 to 9, where 1 means not at all severe or bad, and 9 means extremely severe or bad, how severe or bad were the hurricane(s) you have experienced?

1	2	3	4	5	6	7	8	9
Not at all severe/bad								Extremely severe/bad

On a scale from 1 to 9, where 1 means not at all knowledgeable, and 9 means extremely knowledgeable, how knowledgeable are you about hurricanes?

1	2	3	4	5	6	7	8	9
Not At all knowledgeable								Extremely knowledgeable