Communication Factors Influencing Flood-Risk-Mitigation Motivation and Intention among College Students

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ABSTRACT: When attempting to communicate flood risk, trust in and perceptions toward risk information dissemination as well as individual efficacy factors can play a significant role in affecting risk-mitigation motivation and intention. This study seeks to examine how risk communication, risk perception, and efficacy factors affect evacuation motivation and behavioral intentions in response to a presumed flood risk, as based on a conceptual framework guided by protection motivation theory. An online survey was administered to college students ($N = 239$) from a region that is subject to sea level rise and storm surges. Path analysis results indicate that, while less information-source trust predicts greater risk perception, greater information-source trust predicts greater mitigation-information-seeking intention, lower self-efficacy, and stronger response efficacy. As lower mitigation-information-seeking intention similarly predicts greater risk perception, greater mitigation-information-seeking intention also predicts stronger response efficacy. Significant predictors of evacuation motivation include lower risk perception as well as greater information-source trust, severity perception, and response efficacy. Implications of these findings are discussed in terms of information dissemination channels, messaging strategies, and recent severe flooding events.

KEYWORDS: Social Science; Extreme events; Flood events; Storm surges; Societal impacts

1. Introduction

The National Climate Assessment and IPCC both suggest that global climate change is expected to increase the frequency of flooding due to rising sea levels and more frequent extreme rainfall events; the primary cause of climate change is human activity, based on near-unanimous consensus among climate scientists (Cook et al. 2016). Residents in coastal areas are especially susceptible to flooding-related risks, as a result of storm surge coming onto land or heavy rainfall saturating low-lying sea level areas (Jonkman and Vrijling 2008). Combined with the growth of population in coastal areas, flooding damage is expected to increase in coastal regions during the twenty-first century (Hinkel et al. 2014; Alfieri et al. 2017).

According to a survey conducted with coastal residents in Connecticut after Hurricane Sandy, less than 60% of these residents mentioned that they would evacuate—including those living in the lowest lying (and most adversely affected) flood zone—if an official advises them to evacuate before the landfall of a category-2 hurricane (Marlon et al. 2015). If one compounds an additional external force—such as being a college student and not owning the residence in which one lives—evacuation decision-making is even less understood. Although there has been an increase in promoting flood-risk mitigation and related risk communication (Kousky and Shabman 2015), much of the risk information communicated either did not effectively reach its intended audience or had little influence on its audience to help inform their harm avoidance or reduction decision-making (Donahue et al. 2013). In rare instances, such as during Hurricane Ike in 2008 or Hurricane Katrina in 2005, the National Weather Service issued messages that assured a “certain death,” if residents did not heed evacuation warnings (Drye 2008). Even with such a stern warning in place, hundreds of people did not evacuate in time and died in the flooded neighborhoods of New Orleans, Louisiana, during Hurricane Katrina (Jonkman and Vrijling 2008). This is a good example of how a severe warning message issued by a reliable government source can fail in motivating people to take protective actions.

Yet one population that is not well understood with respect to evacuation decisions is college students. College students are unique in their nature in that they have the ability to act and make decisions as adults yet they have not experienced many of the considerations older individuals make in times of risks and crises. For example, through their college years, students may heed the advice of their parents (or guardian decision-makers) when responding to risk and crisis events. They may also follow the instructions of the college or administration to make decisions for protecting their personal safety while in school. While many researchers use student samples for exploring these topics, it is not well understood as to how these individuals respond to risk communication that is essential for their protective decision-making.

Research addressing the effectiveness of risk communication campaigns on flooding—resulting from coastal storms and storm surges—is limited. The same is true with research examining the motivations and decision-making process associated with flood preparedness and mitigation. As a case in point, the Federal Emergency Management Agency (FEMA) conducted a mock exercise called “Hurricane Pam” in 2004, which produced 15 themes that emergency managers must address during and after a hypothetical catastrophic storm
has presumably struck New Orleans (McQuaid 2005). The issue of risk communication effectiveness, however, was a theme that was not examined in this mock exercise, and hence no guidelines were generated for this topic.

The objective of the current study is to explore how factors such as risk information, risk perception, and efficacy may influence a student’s mitigation and evacuation motivation and behavioral intentions. We proposed and tested a conceptual framework that integrates protection motivation theory with other risk-communication-related constructs. Specifically, the study examined the relations between information-trust perception and information-seeking behavior and how such relations may impact an individual’s threat appraisal, efficacy assessment, and protection motivation to formulate evacuation intentions—in the event of an impending storm that poses flooding risk.

2. Literature review

Protection motivation theory (PMT; see Fig. 1) is a framework that has been used to explain individuals’ decision-making process, leading to behaviors that could protect them from a threat (Rogers 1975, 1983). PMT describes how an individual incorporates both a threat and a coping appraisal process in responding to a threat. While the threat appraisal involves a cognitive process that evaluates perceived severity of and perceived vulnerability to a threat, the coping appraisal reflects perceived effectiveness of a coping response and perceived ability to perform that coping response. In the current study context, the threat for individual appraisal would be coastal flooding. The following discussion will review past research that applied PMT to study environmental hazards and risk communication factors—including risk-information seeking, message-source credibility, and message effectiveness.

a. Threat appraisal

Threat appraisal can be considered as an individual’s perception of a risk and subsequent evaluation of the personal danger that may be caused by the risk. Appraising a threat requires considerations of severity and vulnerability of the threat. Assessment of threat severity is an individual’s perception of how strong the negative consequences of a risk may be if preventative behavior is not taken. For example, if an individual lives along the coast during a coastal storm, they may perceive the impacts of the storm more negatively than an individual who lives inland. Evaluation of vulnerability to threat is an individual’s perception of how susceptible they could be subject to the threatening object or phenomenon in question. For instance, people who live in a land-locked state may feel low vulnerability to storm-related coastal flooding, even though they are not immune from flooding caused by storms, heavy rainfalls, or melting snow and the like.

PMT has been applied to environmental, health, and natural disaster research (see Floyd et al. 2000; Milne et al. 2000; Rainear and Christensen 2017), including research that addresses flooding events (Bubeck et al. 2012; Grothmann and Patt 2005; Grothmann and Reusswig 2006). Bubeck et al. (2012) performed a review of risk perceptions and other factors that influence flood mitigation behavior. They found that the coping appraisal construct is consistently related to mitigation behavior, but not the threat appraisal variables. Depending on the threat in question, threat appraisal may be related to mitigation behavior when additional factors—such as effectiveness measures, cost measures, or perceived responsibilities—in conjunction with the coping appraisal process are in effect. This suggests that perceived threat or fear alone may not necessarily predict mitigation behaviors.

The literature reviewed above suggests that threat appraisal—a multidimensional construct—and an important component of risk evaluation, could influence an individual’s risk-mitigation decision-making and intention. To test the PMT assumption that threat appraisal will lead to risk-mitigation motivation in the current study context, the following hypotheses are posited:

H1: Perceived severity of a coastal flood risk will positively predict evacuation motivation.

H2: Perceived risk of a coastal flood will positively predict evacuation motivation.
The empirical findings discussed above, based on the limited available literature, suggest that there could be a potential direct effect from threat appraisal to evacuation intention, which is not proposed in the PMT model. The following research question (RQ) is posed to further explore this potential theoretical link:

RQ1a and b: Will (a) perceived risk or (b) perceived severity be positively related to evacuation intention?

b. Coping appraisal

The coping appraisal construct has been found to be consistently related to mitigation behavior in the research literature (Bubeck et al. 2013). In comparison with threat appraisal, individuals’ evaluation of their coping ability will likely influence their mitigation decision-making, even though perceived fear may not drive them into action. Nevertheless, the role coping appraisal plays in mitigation decision-making also seems clear, when it is contrasted with how individuals who have prior experience with a similar risk make their mitigation decision. For instance, Adeola (2008) found that whether treated as a sole predictor or in conjunction with an individual’s duration of residency in a flood zone, prior experience with flooding does not predict an individual’s odds of evacuation. Yet, more recent research has suggested the likelihood that this relationship is an indirect (rather than direct) effect on behavior, offering the opportunity for a combined effect with additional variables (Burn 1999; Kellens et al. 2013).

For individuals to effectively engage in coping appraisal, they must make judgement on two fronts: their response efficacy and self-efficacy (Grothmann and Reusswig 2006; Koerth et al. 2013). In terms of response efficacy, an individual must determine if the mitigation behavior or action, which is usually conveyed by media sources (e.g., reporters, meteorologists, weather websites) when the risk is approaching, can effectively reduce their personal risk. In doing so, an individual may also weigh the costs of carrying out the risk-mitigation action. With regard to self-efficacy, individuals must make a judgment on whether they are capable of psychologically or physically performing the risk-mitigation behavior given the resources they have or lack thereof (e.g., economic cost or means of transportation).

Two meta-analyses of health-risk research found that all the PMT constructs are consistently associated with behavioral intentions, but the coping appraisal variables were stronger predictors of intentions than the threat appraisal variables (Floyd et al. 2000; Milne et al. 2000). These findings further imply that communicating the threat to the public without allowing their fear to overtake the need to cope with the threat is essential if the objective is to enable individuals to develop risk-mitigation motivation. Grothmann and Reusswig (2006) found that adding the coping appraisal construct of PMT, in the instance of flood risk, could explain an additional 2%–21% of the variance in protective responses. By implication, the coping appraisal construct likely has a greater explanatory strength than the risk appraisal construct in measuring protective responses or mitigation behaviors.

Following the theoretical framework of PMT and the research assumptions already elaborated thus far, it is reasonable to assume that individuals with greater response efficacy and stronger self-efficacy—when confronted with the need to evaluate risk mitigation—will also be more motivated to engage in mitigation action. To test this PMT component in the current research, the following hypotheses are posited:

H3: Perceived self-efficacy will positively predict evacuation motivation.
H4: Perceived response efficacy will positively predict evacuation motivation.

As with our earlier query (RQ1a) about the potential direct effect from threat appraisal to evacuation intention, the PMT model also does not propose a direct effect from coping appraisal to protection intention. To verify the limited preliminary research findings that indicate such a conceptual link, the following research question is advanced:

RQ2a and b: Will (a) perceived self-efficacy or (b) perceived response efficacy be positively related to evacuation intention?

c. Information trust and seeking

While Katrina was approaching land, multiple media reports about the impact of a landfall were made available (see Times-Picayune special report in 2002 on landfalling hurricanes in New Orleans)—including accurate storm surge forecasts 48 h in advance—to provide coastal residents the information necessary for taking protective action. Nonetheless, even though the risks of a damaging high-category hurricane were made known, informing the public about these risks was unsuccessful during Katrina (Kapucu and Van Wart 2006). For example, weaknesses in the levees were known ahead of time but were not acknowledged from a mitigation standpoint. This negligence was subsequently enhanced by a poor governmental response in the aftermath of the disaster.

When attempting to communicate a message about an anticipated environmental risk or crisis, perceived trust in the message and perceived credibility of the communication source are important factors to consider. This is because individuals prefer to receive communication about weather risks from a source that is seen to care about and is honest with them—as well as having the expertise to provide them solutions for reducing or avoiding the risk (Cole and Fellows 2008). Therefore, to effectively communicate a public safety risk to the public, those who are in charge of disseminating the risk message on a large-scale need be knowledgeable about the subject and exhibit positive behavioral intentions (Palenchar and Heath 2002).

Source credibility has been shown to play an important role in whether an individual will choose to accept and even consider the risk information communicated to be relevant or useful (Hovland et al. 1954; Reynolds and Seeger 2005; Spence et al. 2013). For instance, past research indicated that minority groups are less likely to find a risk warning message originated from the government or an agency to be credible, unless that message is confirmed by additional sources such as religious groups or interpersonal sources (Lindell and Perry 2004). Adeola’s (2008) research on the aftermath of Katrina further
revealed the distrust between minority groups and government agencies. First, more than half of the New Orleans respondents believed that the federal government’s poor response to Katrina victims was related to the race of those victims. Second, 43% of the respondents also felt that differential treatment between predominantly white and black communities in New Orleans by the government’s emergency response contributed to the unequal impacts of the Katrina flood between these communities.

Source credibility research in the domain of new media platforms has increased in recent years, as social media is now seen as a useful source for the public to seek risk information (Pepitone 2010; Morris et al. 2010; Sin and Kim 2013). A study by Westerman et al. (2012) reported that cognitive elaboration may be tied to evaluations of tweets. They maintained that the more quickly (i.e., rate of updating) an organization disseminates credible risk information to inform the public, the more likely the information could have a positive influence on cognitive elaboration. Thus, if the argument is a good one, it may lead to a more positive evaluation of the tweet.

To examine how perceived credibility of risk-information sources may influence risk evaluation, the following research questions are proposed:

RQ3a and b: Will information-source trust be positively related to (a) mitigation-information seeking or (b) mitigation motivation?

RQ4a-d: Will information-source trust be positively related to (a) perceived risk, (b) perceived severity, (c) perceived self-efficacy, or (d) perceived response efficacy?

With today’s diverse choice of media sources available to them, individuals can utilize one or multiple sources for seeking information as well (Sorenson 2000). When facing a risk of crisis, individuals can engage in a variety of behaviors to seek additional information before making a protective or proactive decision (Mileti and Darlington 1997). While presentation of different warning styles can influence responses (Sorenson 2000), studies have shown the importance of local media, the Weather Channel (2016), or even the National Hurricane Center (NHC 2016) as a source for information (Dow and Cutter 1998; Zhang et al. 2007). Sherman-Morris et al. (2011) examined Google Trends and web traffic from Weather Underground (https://www.wunderground.com) to better understand public interest in hurricane information. Their findings showed a variety of trends. For instance, coastal areas exhibit higher search volume when their geographical region was placed in the cone of uncertainty by the NHC. Larger hurricanes would generate more national interest in information seeking and extensive postlandfall searching.

Specific to weather information seeking, during Hurricanes Frank and Bertha in 1996, having confirmatory information from media sources about the threat had more impact on evacuation than receiving an evacuation order (Dow and Cutter 1998). Trust in public officials was important during Hurricane Katrina when considering the risk communication received (Burnside 2006), so was anticipated personal exposure to information from interpersonal sources, family, and friends. Interestingly, Lazo and Waldman et al. (2010) found that perceived accuracy of a forecast only weakly predicted evacuation intentions, but increased trust in the accuracy of a forecast had no role in motivating evacuation intentions. Thus, the relationships between information seeking, trust, and credibility are complex in nature and should be further explored.

From the assumption that information-source credibility will influence an individual’s mitigation-information seeking and risk evaluation (RQ3 and RQ4), it is logical to propose that mitigation-information seeking may also impact an individual’s risk and severity perception. To verify this proposition, several research questions are presented below:

RQ5a-d: Will mitigation-information seeking be positively related to (a) perceived risk, (b) perceived severity, (c) perceived self-efficacy, or (d) perceived response efficacy?

Last, on the basis of the PMT model, there is a direct effect from protection motivation to protection intent. Hence, it is expected that risk-mitigation motivation will predict evacuation intention. To validate this expectation, the following hypothesis is posited:

H5: Mitigation motivation will positively predict evacuation intention.

On the basis of the aforementioned research questions and hypotheses, a conceptual model is proposed. This conceptual framework integrates variables from PMT with other risk communication-related constructs. Most important, relationships between information-trust perception and information-seeking behavior and how such relations may impact an individual’s threat appraisal, efficacy assessment and protection motivation—to formulate evacuation intentions in the event of an impending storm that poses flooding risk—were of major focus.

3. Research methods

A survey was conducted to collect data from a northeastern coastal state that has experienced weather-related events such as flooding and other storm-related hazards. The sample was recruited from the undergraduate student body of a large university located in the region. These undergraduate students, majoring in a wide variety of academic disciplines, were enrolled in a large general education course and offered course credit for survey participation. Participant recruitment and data collection began after receiving the institutional review board approval for the research protocol.

A total of 244 students participated in the anonymous survey online. Of these, 239 participants provided valid and usable responses. The average age of the sample was 19.28 [standard deviation (SD) = 1.16], and 55% were male. Other sample characteristics include the following: 68% “Caucasian,” 7.1% “African American,” 17.2% “Asian,” 6.6% “other,” and 1.2% “refused” (or chose not to report). Approximately 50% of the participants reported that their yearly household/family income was $100,000 or greater. Thus, the sample was largely in the middle-to-high-income groups; it was overrepresented by
the Asian ethnicity and underrepresented by the African American ethnic group.

4. Measures

This study developed eight risk perception measures. Table 1 gives the degree of correlation between the measures as determined by bivariate correlations.

a. Information-source trust

Measurement of trust in information sources was adapted from Lazo et al. (2015). Participants responded to a question that assesses their level of trust in weather information via eight different sources on a Likert-type scale (1 = extremely untrustworthy and 5 = extremely trustworthy). Examples of these information sources include “National Hurricane Center,” or “Local radio stations (e.g. WTIC-1080/CBS Radio).” A confirmatory factor analysis (CFA) was conducted for the responses to these eight items with an adequate model fit \( \chi^2 (11) = 26.92, p = 0.005 \); chi-square value (CMIN) = 2.45; comparative fit index (CFI) = 0.99; RMSE of approximation (RMSEA) = 0.08. These eight items were combined to form a composite variable (mean \( M = 3.88 \) and SD = 0.74; Cronbach’s alpha = 0.93)—this is a measure of internal consistency, i.e., the reliability.

b. Mitigation-information seeking

To measure information-seeking intention related to risk mitigation during an impending flood, participants responded to a four-item measure adopted from Kellens et al. (2012) on a Likert scale (1 = strongly disagree; 5 = strongly agree). Examples of these items include “possible consequences of storm surge along our coastline” and “safe locations in the neighborhood.” The CFA procedure generated a good model fit for the four items \( \chi^2 (1) = 1.87, \) with \( p = 0.172; \) CMIN = 1.87; CFI = 0.99; RMSEA = 0.06 that were subsequently collapsed into a composite variable \( (M = 3.71 \) and SD = 0.85; alpha = 0.90).

c. Perceived risk and perceived severity

Participant risk perception was measured with four items adapted from Champion’s (1999) “perceived susceptibility” scale for the flooding context, assessed on a seven-point Likert-type scale (1 = strongly disagree and 7 = strongly agree). Examples of these items include “Coastal flooding can negatively affect me whether I live on the coast or not” and “I will experience the negative effects of coastal flooding in my lifetime.” Perceived severity was also measured using four items adapted from Champion’s (1999) “perceived severity” scale. Examples of these items include “Coastal flooding is a serious issue for our environment” and “Coastal flooding can have negative consequences to the environment, including property, lives and land loss.” The four separate items measuring perceived risk and perceived severity variables were analyzed by a CFA via a two-factor solution, which provided an adequate model fit \( \chi^2 (18) = 46.41, p < 0.001; \) CMIN = 2.58; CFI = 0.97; RMSEA = 0.08. Each factor was then respectively merged into a composite variable of perceived risk \( (M = 2.58 \) and SD = 0.85; alpha = 0.88) and perceive severity \( (M = 2.87 \) and SD = 0.66; alpha = 0.86).

d. Evacuation (self) efficacy

To better understand an individual’s perception of their ability to evacuate, the five-item measure of evacuation efficacy was adapted from Lazo et al. (2015). Participants indicated their agreement to the statement “In the event of a coastal flood threat, I would shelter in place and would NOT evacuate because...” on a Likert scale (1 = strongly disagree; 5 = strongly agree). Examples of these items include “I do not know how to evacuate” and “My family makes it difficult to evacuate.” The CFA model produced a good model fit \( \chi^2 (6) = 11.21, p = 0.08; \) CMIN = 1.87; CFI = 0.99; RMSEA = 0.06, after removing one item with a low coefficient. The remaining four items were collapsed into a composite evacuation efficacy variable \( (M = 2.67 \) and SD = 0.68; alpha = 0.84).

e. Response efficacy

The three-item measure for this variable was adopted from Kellens et al. (2012), gauged on a Likert scale (1 = strongly disagree; 5 = strongly agree). Participants responded to the statement “To what extent do you think the following information is useful to you, if you live near the coast?” for three separate items, to measure response efficacy. An example of an item includes “instructions about evacuation procedures and escape routes.” After performing a CFA that produced a good model fit \( \chi^2 (3) = 0.76, \) with \( p = 0.39; \) CMIN = 0.76; CFI = 0.99; RMSEA = 0.01, the three measurements items were grouped into a composite response efficacy variable \( (M = 3.65 \) and SD = 0.77; alpha = 0.92).

f. Evacuation motivation

The four-item measure for this variable was adapted from an existing scale (Lazo et al. 2015). Participants indicated their
level of agreement to the statement “If coastal flood threatens, I would evacuate...” on a Likert scale (1 = strongly disagree; 5 = strongly agree). Examples of these items include “because I want to keep my own life safe” and “because I would not want to suffer a financial loss.” The CFA result generated a good model fit for the four items $\chi^2 (1) = 1.07$, with $p = 0.30$; CMIN = 1.07; CFI = 0.99; RMSEA = 0.02. These items were then combined into a composite variable ($M = 4.02$ and SD = 0.80; alpha = 0.87).

g. Evacuation intentions

Participants responded to a 10-item measure, adopted from Lazo et al. (2015) and measured on a Likert scale. These items assessed intentions to leave their residence, if they receive evacuation-related information about a hurricane, storm surge, or flood. Examples of these items include “you received an evacuation order” and “you received a hurricane warning.” The CFA result for these 10 items showed an adequate model fit $\chi^2 (6) = 13.07$, with $p = 0.042$; CMIN = 2.18; CFI = 0.99; RMSEA = 0.07], after removing two items with low coefficients. The remaining eight items were consolidated into a composite variable ($M = 3.27$ and SD = 0.81; alpha = 0.91).

5. Results

All of the hypotheses and research questions presented in the proposed model (see Fig. 2) were tested via a path model, with the use of SPSS AMOS 23.0 and the procedure of maximum likelihood estimates. The results are summarized in Table 2. The path analysis results indicated that the proposed model did not produce the best anticipated model fit $\chi^2 (8, N = 239) = 40.05$, with $p < 0.001$, and CMIN/DF = 5.01] with a CFI = 0.96, Tucker–Lewis index (TLI) = 0.83, and RMSEA = 0.13. Seven nonsignificant paths were removed, and the model was retested; these directional paths include, for example, the following: 1) information trust to perceived severity, 2) perceived severity to evacuation intentions, and 3) response efficacy to evacuation intentions. The modified model produced a good model fit (see Fig. 3), and the following fit statistics: $\chi^2 (12, N = 239) = 20.07$, with $p = 0.07$; CMIN/DF = 1.67, with a CFI = 0.99, TLI = 0.97, and RMSEA = 0.05. Hypothesis 1 predicts a positive association between perceived severity of coastal flood risk and evacuation motivation. The results indicate a significant relationship between these two variables ($\beta = 0.63$; $p < 0.001$); thus, H1 is supported. Hypothesis 2 asserts that perceived risk of a coastal flood would positively predict evacuation motivation. The path generated a significant statistical result ($\beta = -0.67$; $p < 0.001$) but was opposite to the hypothesized direction. Thus, H2 is not supported.

Hypothesis 3 presumes that self-efficacy will positively predict evacuation motivation. Findings show that this relationship was not significant ($\beta = -0.08$; $p = 0.11$); H3 was thus not supported. Hypothesis 4 examines the same relationship but with response efficacy as the predictor. The results indicate that response efficacy was a positive predictor of evacuation motivation ($\beta = 0.16$; $p < 0.01$), lending support for H4. Hypothesis 5 intends to validate a positive relationship...
between evacuation motivation and intentions of evacuation. Motivation for evacuating was found to positively predict intentions to evacuate ($\beta = 0.44; p < 0.001$), providing support for H5.

Research question 1 investigates whether perceived risk and perceived severity would both positively predict evacuation intentions. Perceived risk did not emerge as a predictor of evacuation intentions ($\beta = 0.25; p = 0.10$). By comparison, perceived severity did predict intentions to evacuate, although with a negative relationship ($\beta = -0.32; p < 0.05$). Research question 2 explores the relationship between the two coping appraisal constructs and intention to evacuate. Results indicated that self-efficacy was a positive predictor of intentions to evacuate ($\beta = 0.14; p < 0.01$), while the relationship between response efficacy and evacuation intentions was not statistically significant ($\beta = 0.11; p = 0.11$).

Research questions 3 and 4 explore the source trust variables with information seeking, motivation, and the four PMT constructs utilized in this study. Specifically, RQ3 queries whether information-source trust would be positively related to both mitigation-information seeking and evacuation motivation. Indeed, information-source trust was positively related to mitigation-information seeking ($\beta = 0.36; p < 0.001$) at a moderate and positive level. Similarly, information-source trust was also a positive and moderate predictor of evacuation motivation ($\beta = 0.40; p < 0.001$). Research question 4 inquires the relationship between information-source trust and four PMT constructs (perceived risk, perceived severity, self-efficacy, and response efficacy). Information-source trust was a negative predictor of both perceived risk ($\beta = -0.14; p < 0.05$), and self-efficacy ($\beta = -0.28; p < 0.001$). It was also a positive predictor of response efficacy ($\beta = 0.35; p < 0.001$) in addition to being a nonsignificant predictor of perceived severity ($\beta = -0.02; p = 0.74$).

Research question 5 assesses the relationship between mitigation-information seeking and the aforementioned PMT constructs. Only one of the relationships in question was found to be statistically significant. Specifically, mitigation-information seeking positively predicted response efficacy ($\beta = 0.37; p < 0.001$), and none of the remaining relationships between mitigation-information seeking and perceived risk ($\beta = -0.14; p = 0.29$), perceived severity ($\beta = 0.06; p = 0.26$), and self-efficacy ($\beta = 0.08; p = 0.13$) were statistically significant.

6. Discussion

This study integrates PMT with information-source credibility and information-seeking factors in a conceptual model to measure the cognitive process that helps formulate the risk-mitigation behavioral intentions. The weather-warning information sources examined here include a combination of the major national-, state-, and local-level weather forecast, emergency management, and news media (including the Weather Channel) outlets. Study results provided validation for the role of PMT and source credibility and information-seeking factors in influencing an individual’s evacuation motivation and intention, toward a potential impending coastal flood. The modified conceptual model explained 47% of the total variance in evacuation motivation.

On the basis of the modified conceptual model, perceived weather-warning source credibility stood out as an important factor in explaining other cognitive and behavior indicators. In particular, if students trust the sources of weather event coverage or announcement, they are also more vigilant in keeping up with updated information about the impending danger. Information trust and seeking, in turn, boosts their response efficacy in facing the danger. The new and more intriguing finding here has to do with how perceived information-source trust emerges as a moderately strong predictor of evacuation motivation. This suggests that those who are in the position to inform people about what natural disasters need to ascertain what is the degree of trust that different population...
segments have in them. Such trust is especially important among the vulnerable populations, which could include college students—who may be away from home and have limited available resources. More often than not, they may need to rely on friends/family (if nearby), neighbors, landlords, and/or community/local emergency management. In some extreme cases, they may need assistance from administrative officials overseeing the school and residence halls.

While information-source trust was a moderately strong and positive predictor of evacuation motivation during an impending coastal flood, greater trust in the information sources also influences a stronger level of individual perceptions about their vulnerability to flood risk. Likewise, greater trust in information sources also predicts an individual’s lower self-efficacy in dealing with the flood risk. These findings seem to imply a clear conundrum, one that risk communicators need to consider and resolve. On the one hand, it is important for the students to trust the public information sources that communicate the threat posed by the impending danger—and the viable preparedness and/or mitigation actions—for elevating their response efficacy. On the other hand, it is also necessary for that communication to avoid evoking too much fear and paralyze a student’s self-confidence in adopting any of the recommended protective actions.

The strong and negative relationship between perceived vulnerability to flood risk and protection motivation contradicts the assumption of PMT. This inverse relationship, however, is consistent with the risk communication challenge elaborated above, with regard to the potential peril of evoking too much fear. In particular, when perceived risk is high, a student could respond to the threat by engaging in maladaptive “fear” control instead of adaptive “danger” control; the uncontrolled fear could then evolve into a barrier for the individual to become motivated to take protective action (e.g., Aspinwall 1999; Lachlan and Spence 2007; Witte 1992). In other words, a high level of perceived risk does not necessarily draw out protection motivation if the student cools in a fear-defensive mode.

In contrast, neither perceived information-source credibility nor mitigation-information-seeking intention had any influence on perceived severity, which was measured by participant perceptions of coastal flooding as a serious, severe, negative, and scary event. This suggests that prior experience and/or general awareness of flooding consequences via media exposure (e.g., news coverage) could influence how students derive their severity perception of a coastal flooding event. If one considers the familiar devastating images of recent flooding events caused by Hurricane Katrina, Hurricane Sandy, and other coastal storms, it is likely that students studying in this coastal state could have a perception of coastal storm consequences—indeed of the availability of and access to weather-event communication—from different information sources.

Findings also show that stronger evacuation self-efficacy was a positive but weak predictor of evacuation intention but not evacuation motivation. The lack of significant predictive relationship from perceived self-efficacy to protection motivation is inconsistent with the assumptions of PMT. These results may indicate that self-efficacy could be more directly related to behavioral intentions or actual behavior more than motivation to perform protective behavior in this mock flood-risk context. Because of inertia, which is a common reaction to weather risks, most people may not be motivated to evacuate until the risk is immediate or
physically present. In other words, individuals could feel confident in their ability to carry out protective measures when necessary, while not feeling sufficiently motivated to enact those measures until that risk becomes pressing in a real-life scenario.

Taken together, it appears that a student’s trust in information sources that communicate weather risks—as well as their perception of the severity of an impending coastal storm and the usefulness of mitigation/evacuation measures—are positive facilitators of evacuation motivation. Alternatively, stronger perceived vulnerability to being impacted by a coastal storm event is a negative barrier that could lower evacuation motivation. These positive and negative constructs also have an indirect effect on evacuation intention (via evacuation motivation).

The modified path model—as tested—demonstrates that a greater level of trust in the weather-warning information sources and intention for mitigation-information seeking are positive predictors of a stronger level of perceived response efficacy. In relative terms, it may be the case that response efficacy is a better predictor of motivation than self-efficacy, as individuals may feel more motivated to respond when they believe that they have the proper knowledge or know-how to respond efficaciously to the presumed risk. It is not surprising to find protection motivation as a precursor of evacuation intention, as this finding confirms the findings from past research (Rogers 1975; Milne et al. 2000) and validates the assumption of PMT. Note that the predictive path from perceived evacuation self-efficacy to evacuation intention examined here is not an existing theoretical link hypothesized in the PMT model.

This study has several limitations. First, the survey sample comprised of college students from one university located in a coastal state, which limits the generalizability of the findings beyond a younger population. This sample also does not reflect the demographic diversity and geographic representation of the larger populations that face coastal flood threats. For example, more than 50% of respondents indicated a household income of $100,000, which suggests that the sample has a relatively affluent economic background. Because many of the decisions probed in this study are related closely to economic situations, future research may wish to compare the responses from a sample with diverse economic backgrounds. Second, the study collected self-reported survey data. This means that the path model does not reflect causal relationships between the model components. Third, a hypothetical coastal flooding scenario was adopted as the basis for measuring participant response to study measures. In practical terms, unless the study could be conducted immediately prior to an impending coastal storm, it would be challenging to capture the actual participant reactions to a coastal flood threat. Fourth, even though the study was able to demonstrate measurement validity via the CFA procedure, selected variables—including threat and coping appraisal measures adopted from the existing literature—could be improved to reflect greater content validity.

7. Conclusions

In sum, this study validated the source credibility factor and the general framework of PMT. It clearly illustrates the important role that risk communication plays in shaping an individual’s cognitive response to the threat of a coastal flood. In particular, trust in the sources that engage in risk communication to disseminate mitigation information—as well as mitigation-information-seeking activity triggered by such trust—is directly related to a lower level of perceived fear and a higher level of response efficacy in coping with a potential flood risk. As information-source trust has a direct influence on evacuation motivation, mitigation-information-seeking has an indirect effect on evacuation motivation via lower perceived vulnerability and greater response efficacy.

Furthermore, past experience with a similar weather-related risk often plays a role in an individual’s threat appraisal. For instance, Siegrist and Gutscher (2008) found that people who were more experienced with floods anticipated consequences of a future flood differently from those who were less experienced as people without flood experience strongly underestimated the effects of a flood risk. The Adeola (2008) post-Katrina study on prior experience with flooding indicated that influence from interpersonal connections, such as family members relaying evacuation messages, was more important than prior experience. Nonetheless, interpersonal connections, along with time living in the location, still predicted the odds of an individual’s evacuation behavior. This is consistent with previous research that suggested that experience plays an important role in influencing perceptions of a disaster (Weinstein 1989). It also speaks to the importance of tailoring the risk message for the experienced versus inexperienced individuals.

The current study has demonstrated the value of understanding the theoretical and empirical connections between risk communication and an individual’s processing of risk information, which could help to elicit the individual’s protection motivation, intention, and action. More important, weather-warning sources, whether they be weather forecasters, emergency management personnel, first responders, or state/local government officials, need to understand the importance of delivering tailored risk communication to the right target. A simple miscommunication from the message source and an innocuous misapprehension form the message recipient could mean life or death during a severe coastal flooding event.

Future research could retest the validity and reliability of the current study results. It is worth noting that flood risks are highly local in nature. Communicating those risks requires targeted strategic messaging that takes into account the relevant characteristics of the locale and the unique attributes of the population (including vulnerable populations). Understanding how smaller subgroups may react to risk messages before and after a flooding event by examining whether or how these communities perform mitigation- and evacuation-related behaviors will also improve future risk communication strategies in social marketing campaigns.

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REFERENCES


