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Vested interest: developing scales for assessing flooding preparedness

Bradley Adame
Hugh Downs School of Human Communication, Arizona State University, Tempe, Arizona, USA, and
Claude H. Miller
Department of Communication, University of Oklahoma, Norman, Oklahoma, USA

Abstract

Purpose – The purpose of this paper is to report research testing scales developed from a combination of vested interest (VI) theory and the extended parallel process model of fear appeals. The scales were created to measure variables specified by an expanded model of VI: certainty, salience, immediacy, self-efficacy, response-efficacy, and susceptibility.

Design/methodology/approach – A survey was designed with subscales for each element and combined with additional disaster and risk perception variables. Survey data were collected from two populations in the US state of Oklahoma. Results from scale development and regression analyses are reported.

Findings – Results show that the scales are robust and flexible to contextual modification. The scales return good to excellent reliabilities, providing evidence that the variables articulated by VI theory predict perceived salience and perceived preparedness.

Practical implications – This study adds to the research pointing to the efficacy of VI theory in providing insight into the perceptual barriers to preparedness. These results demonstrate that perceived vestedness can be a valuable tool in crafting messages to inform audiences of risks and motivate them to prepare.

Social implications – These results can facilitate the creation of more effective hazard and risk messages. Related research shows households that are prepared for natural and manmade hazards enjoy higher rates of survivability and lower levels of consequences.

Originality/value – This paper presents new results concerning perceived vestedness and the utility of the scales. The research should be of value to practitioners and policymakers concerned with motivating public audiences to prepare for natural and manmade hazards.

Keywords Disasters, Disaster management, Emergency response, Flooding, Natural hazard, Message design

Paper type Research paper

The relationship between disaster preparedness attitudes and actual disaster preparedness behaviors concerns questions central to both communication studies and social psychology: the relationship between attitudes and attitude-relevant behaviors; the attributes of such attitudes that are linked to behaviors; and the psychological dimensions motivating those who hold such attitudes. Attitudes are an expression of favor or disfavor toward a person, place, or thing; the focus of an attitude is described as the attitude object. Although the link between attitudes and behaviors can appear to be linear, research shows that it is multidimensional, including motivational features that are cognitive, affective, cultural, and contextual in nature.

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Vested interest (VI) theory (Crano and Prislin, 1995) proposes five variables (stake, salience, certainty, immediacy, and self-efficacy) as key to predicting attitude-behavior consistency, postulating that attitudes perceived as hedonically relevant consistently motivate pertinent behaviors. Moreover, VI asserts attitudes can be identified and manipulated using the five hypothesized components (Adame and Miller, 2015; De Dominics *et al.*, 2014). Incorporating elements of Witte's (1994) extended parallel process model (EPPM), Miller *et al.* (2013) developed scales to assess perceptions of vestedness related to earthquake and tornado hazard preparedness attitudes. Scales for predicting attitude-behavior consistency would be useful for researchers and policymakers wishing to optimize crisis management outcomes and communicate perceived risk of salient events (Douglas and David, 2001).

The aim of the present study is to test the reliability of these scales in a third context, flooding, with the goals of generalizing to international audiences and refining the scales, while providing insights into residents' of flood-prone areas information needs. Several communicative and perceptual hurdles to citizen-level hazard preparedness exist (McEntire and Myers, 2004). These include self-efficacy, and response-efficacy – preparedness as a mitigation strategy (Redlener *et al.*, 2006), financial considerations (Federal Emergency Management Agency (FEMA)) (FEMA, 2013), and motivational (Blessman *et al.*, 2007) problems that must be met with effective communication campaigns.

With a focus on motivating behaviors associated with risk, vulnerability, and hazard preparedness, we begin by reviewing research using VI as an effective tool for both audience analysis and message design. We then present an overview of current preparedness behaviors relevant to catastrophic flooding, and present findings from two studies designed to assess the perceptions and information needs of people living in flood-prone areas of the state of Oklahoma. Finally, we discuss recommendations for developing effective campaigns to motivate proactive disaster preparedness.

VI theory

A fundamental assumption of social science is that attitudes are linked to relevant behaviors, such that holding a particular attitude should inspire attitudinally consistent behavior (Allport, 1935). The association however, is not always reliable. Research has identified several variables, which can moderate attitude-behavior consistency (Glasman and Albarracan, 2006), or the chance that one's thoughts/feelings about a particular attitude object will influnce behavior. Focussing on hedonically relevant moderators, Crano and colleagues developed VI and demonstrated its reliability in targeting attitudes consistently predictive of attitude-relevant behavior (Lehman and Crano, 2002). VI then, is a more nuanced way of understanding one's personal investment in a particular attitude object, while vestdeness describes the degree to which an individual is invested in an attitude object.

VI posits the attitude-behavior relationship is a function of five dimensions of vestedness: stake, salience, certainty, immediacy, and self-efficacy. Drawing from the EPPM of fear appeals (Witte, 1994), Miller *et al.* (2013) have suggested the addition of response-efficacy to the framework.

The first component of vestedness is stake. According to VI, attitude holders' stake in a given attitude object is represented by their basic subjective perception of the personal gain/loss consequences associated with that object. Research has described stake as a global proxy for VI (Crano and Prislin, 1995; De Dominics *et al.*, 2014). Additionally, Adame and Miller (2015) have used it as a demographic characteristic, identifying individuals as stakeholders in a particular crisis context, based upon their

geographical location. Salience, describes the cognitive accessibility or visibility of a particular attitude object. Attitudes described as salient are those that are easily activated from memory (Dillard, 1993). Vestedness can be increased by accessibility priming, enhancing the perceived salience of consequences related to the attitude object (Crano and Prislin, 1995). The probability component of VI is certainty. Uncertain consequences are unlikely to motivate increased vestedness, whereas, consequences perceived to be certain can increase the likelihood of attitude-consistent behavior. The fourth component of VI involves the perception of temporal proximity of attitude-relevant consequences. Crano and Prislin (1995) assert that the relevance of an attitude object whose consequences are distant in time is not as substantial as one whose consequences are expected promptly. In other words, consequences perceived as immediate should influence behavior while those perceived as far away should weaken motivation to act in an attitude-consistent manner. Finally, self-efficacy, involves an individuals' perceptions of their ability to perform actions consistent with the consequences of the attitude object. If the actions required to behave in the attitude-consistent fashion are beyond the perceived capabilities and/or resources of the individual, efficacy is likely to be perceived as low, thus attenuating vestedness (Bandura, 1994).

Extending VI theory

Closely tied to self-efficacy is the concept response-efficacy, which describes individuals' perception of the effectiveness of a particular behavioral response (Witte, 1994). When confronted with a viable threat and a recommended response, individuals appraise perceptions of both their own abilities to mitigate the threat, as well as their beliefs in the effectiveness of the prescribed response. Although research has demonstrated response-efficacy is distinct from self-efficacy, the concepts are closely related, and both have been measured in a similar fashion (Miller *et al.*, 2013). Witte *et al.* (1996) used a single, six-item index that combined items measuring both response-efficacy and self-efficacy, and they did not report reliabilities for separate efficacy subscales (nor did they in any EPPM research we could find). The present research, however, uses two separate scales to measure both aspects of efficacy.

We believe a critical step in assessing flood hazard preparedness involves assessing citizens' perceptions of vestedness along each of the dimensions of vestedness listed above. Determining the VIs of stakeholders who may be vulnerable to flooding hazards should be useful in developing the types of appeals most likely to resonate with their informational and efficacy needs Blessman *et al.*, 2007), and thus more effectively motivate them to engage in preparedness actions. We propose the use and measurement of VI to both assess and target the key beliefs and attitudes associated with motivating adaptive behaviors, and to provide a framework for designing and optimizing influence messages that will effectively predict flood hazard preparedness.

To build on the effectiveness, and extend applicability of VI, Miller *et al.* (2013) developed and validated scales to measure the dimensions of VI for use as either criterion or predictor variables. Following VI theory, each dimension is assumed to be present in the minds of individuals, and to function in an additive manner. Vestedness then, moderates the relationship between attitudes and potential behaviors. The scales are thus designed to model this dynamic, and allow for both the testing of extant attitudes and/or the measurement of attitude change following stimulus exposure. Attitudes about hazard preparedness may be especially appropriate for testing measures of VI, since environmental hazards constitute a threat necessitating attitudinally consistent behavior.

Hazard preparedness

Agencies worldwide recommend three general preparedness behaviors; get a kit, make a plan, and stay informed (FEMA, 2009; McEntire and Myers, 2004). The all-hazards approach to preparedness informs the recommendations, arguing that by achieving a specific level of readiness, households are prepared for several hazards, regardless of contextual considerations. Sufficient preparedness includes a dedicated kit, with food, water, and first aid supplies, to be modified for individuals needs. Moreover, households should plan for escape routes and sheltering strategies, and finally, remain informed about salient hazards and threats. The US Government recommends households prepare for 72 hours without services or aid from any outside agency.

Nationwide figures indicate Americans recognize the value of preparedness (Decker, 2009). Nevertheless, actual levels of preparedness are alarmingly low (FEMA Citizen Corps, 2009; FEMA, 2013), with only about 31 percent of Americans having a hazard preparedness kit, and fully 66 percent of Americans indicating they feel underprepared for a hazard – citing a lack of knowledge about preparedness as the primary cause (Redlener *et al.*, 2006).

Relevant to US flood hazards, FEMA also subsidizes flood insurance for property owners at substantially reduced rates. Despite the benefits, this service appears to be underused as, within Oklahoma, over 87 percent of structures located within federally designated floodplains are without flood insurance (Holland, 2006), and across the Southern and Western regions of the USA, more than 50 percent of properties in high-risk areas are without insurance. Outside the high-risk areas, 99 percent of homeowners lack flood insurance, despite the fact that nearly 25 percent of flood insurance claims are filed in low to moderate risk areas (FEMA, 2007).

Certain demographic variables are known to influence preparedness behaviors; for instance, income, education, and vulnerability perceptions predict enhanced preparedness, as do perceptions of risk, which are a function of proximity to hazard prone areas, past experience, and the perceived probability of future events (Gregg *et al.*, 2004; Douglas and David, 2001; Eisenman *et al.*, 2006). Because these factors are associated with general preparedness behaviors regarding a variety of hazards, FEMA recommends an all-hazards approach to preparedness, where the basic level of preparedness is deemed effective for a wide range of potential hazards, including catastrophic flooding (FEMA, 2009).

Research indicates disaster kits and contingency plans can substantially enhance survivability rates (FEMA, 2004), and additional steps, such as participation in risk transfer programs, and obtaining flood insurance can also serve to mitigate the financial, emotional, and social stresses associated with catastrophic flooding (Luechinger and Raschky, 2009). Significant barriers to flood preparedness still remain, and they appear to be perceptual in nature. Thus, there is a serious need for designing, implementing, and assessing effective social action programs targeting hazard preparedness in general, and flood preparedness in particular.

Catastrophic flooding

Worldwide, catastrophic flooding is one of the deadliest and costliest hazard events (Stefanidis and Stathis, 2013). Between 1994 and 2013, flood events accounted for 43 percent of the total recorded natural disasters, affecting approximately 2.5 billion people. Flooding is also the primary cause of damage to relief facilities, including hospitals and clinics, especially in low-income countries (Wallemacq and Below, 2015). Further, worldwide data points to increased frequency and magnitude of climate

related disasters, including floods, due to planetary warming and human expansion to floodplain and alluvial land (Milly *et al.*, 2002).

In the USA, flooding is second only to wildfires in frequency, and it ranks first as the deadliest and costliest of disasters, causing approximately 9,000 deaths over the last century (over 2,300 between 1970 and 2000), and causing over $2 billion in property damage annually (FEMA, 2010; Knocke and Kolivras, 2007; Jonkman and Kelman, 2005; Zahran *et al.*, 2008). Flooding is defined as any instance of water inundating an area that is typically dry, whereas a flood disaster, is defined as flooding that significantly disrupts human and societal activity (Jonkman and Kelman, 2005). Every state, regardless of climate or topography is vulnerable to flooding (FEMA, 2010), and danger from flooding can develop slowly, over the course of hours or even days, or quickly, inundating large areas in no more than a few minutes – as in the case of flash flooding. In any event, effective preparedness is essential for mitigating the emotional and financial consequences involved (FEMA, 2010).

In Oklahoma, flooding accounts for a third of all Presidential disaster declarations, and despite the risks inherent with living in an active floodplain, evidence demonstrates most Oklahoma residents appear to be under-informed and unprepared for potential catastrophic flooding (Redlener *et al.*, 2006; Holland, 2006). This trend is evident in other areas of the USA as well. Recent flash floods in Phoenix, Arizona, and surrounding areas caught many residents off guard and remind us that even arid desert regions are susceptible to being inundated by water (*The Arizona Republic*, 2014).

Nationwide samples have assessed individual-level preparedness; however, most hazards tend to be unique to geographic regions. Moreover, regional media tend to focus on locally salient, highly visible vulnerabilities and issues. To address the specific issues and attributes relevant to flood preparedness, and assess the various dimensions of VI within populations unique to the geographic regions in which flooding is likely to occur, we chose two distinct forms of data collection. The first, via telephone polling of citizens living throughout the state of Oklahoma, and second, a sample of undergraduate college students at a medium-sized university located in Central Oklahoma. The two population samples are likely to provide essential differences in their knowledge, attitudes, and awareness of flooding because the citizen population is likely to be older and have higher rates of home ownership, but overall preparedness knowledge should be relatively similar across both samples, as evidenced by nationwide studies of functional preparedness knowledge (FEMA, 2009).

The state of Oklahoma is influenced from both cold, dry arctic weather patterns descending from the north, and warmer, humid air rising from the Gulf of Mexico. The constant contrast in meteorological conditions and clashing temperature patterns creates an environment perfectly suited for breeding severe weather conditions all year round, although conditions are particularly active between late March and early September, when storms and flooding can be severe. Throughout the region, citizens depend on the government for a myriad of resources related to flooding hazards, but as recent events along the Gulf Coast of the USA have shown, government responses, are not always immediate nor efficient. In the event of a serious flooding disaster, individual households may be left to their own devices for a periods as long as 72 hours (FEMA, 2009), creating as many or more casualties and damage in the aftermath as in the initial flooding. Hence, preparedness is not only wise; it is a vital civic responsibility. Citizens who are prepared for hazards are in a better position to immediately help

others around them who are less prepared and in greater need of assistance. Thus, they can be a boon to relief agencies and rescue workers, enabling them to focus their early efforts on those deemed most vulnerable (Chandra *et al.*, 2011).

Both researchers and policymakers will benefit from a well-informed, theoretically grounded approach to flood hazard preparedness. Therefore, VI may provide a valuable framework for both targeting the most appropriate attitudes for predicting people's susceptibility to catastrophic flooding, as well as measuring the gap between those attitudes and their connection to actual flood preparedness behaviors.

Method

Witte *et al.* (2001) have used a social marketing approach in their application of the EPPM within fear appeal campaigns. They developed the risk behavior diagnosis scale (RBDS) (Witte *et al.*, 1996), which can first be customized to fit certain threat scenarios, and then used to assess the essential components of the EPPM via four subscales measuring perceived severity, susceptibility, response-efficacy, and self-efficacy. Using the same format as the RBDS, Miller *et al.* (2013), developed three additional subscales to measure the perceived certainty, immediacy, and saliency of threatening outcomes associated with earthquakes and tornados. In the present study, the three subscales derived from VI were added to three of the four EPPM subscales (perceived severity was not assessed) and modified to address catastrophic flooding scenarios. Thus, a set of six subscales were prepared, each comprised of five to eight seven-point Likert-type items. These six subscales were then modified into two versions, one to assess perceptions about flooding within an online survey, and another adapted for use in a statewide telephone poll (see the Appendix).

Procedure and participants

Two separate samples of data were collected from the population of Oklahoma, an area of the country known for its climate variability and vulnerability to catastrophic flooding.

Sample 1. In exchange for course credit, participants ($n = 425$, mean age = 20.04, SD = 1.19) were recruited from a medium-size southwestern university. According to duration ($n = 61$ cases) were dropped from the data set resulting 363 (mean age = 19.99, SD = 1.78) cases being included in the final analyses with durations ranging from 4.6 to 25.95 minutes ($M = 9.61$, SD = 4.6, of whom 60.1 percent were female, 3.9 percent American Indian/Alaskan Native, 6.6 percent black, 79.9 percent white, 5.5 percent Asian/Pacific Islander, and 4.1 percent Hispanic/Latino). Participants were provided with a URL address, which led to an online, IRB approved consent screen. Upon consenting, participants were directed to the survey, which was detached from any personal identifiers.

Sample 2. Data for sample 2 were collected from residents of Oklahoma City and the surrounding areas, using a university-sponsored telephone polling service. Participants ($n = 258$, mean age = 59.67, SD = 14.97) were solicited via telephone, using a random digit dialer. Upon providing oral consent, participants were read questions and responded orally with data recorded using a telephone survey software system. In total, 11 percent of participants were excluded from the analysis for failing to complete over 50 percent of the survey, making the adjusted total number of participant 229, of whom, 34.9 percent were female, 5.6 percent were American Indian/Alaskan Native, 1.9 percent were black, 84.6 percent were white, 9 percent were Pacific Islander, 1.4 percent were Hispanic/Latino, and 4.2 percent failed to indicate their background.

Results

Instruments for Studies 1 and 2 were essentially identical and thus, condensed results for each of the subscales are provided below.

Perceived susceptibility

The susceptibility subscale adapted from Witte *et al.*'s (1996) RBDS, demonstrated good internal consistency across the data sets; five-item α: sample $1 = 0.866$; sample $2 = 0.845$; these results are comparable with the α reliability for this subscale typically found in EPPM research (e.g. Witte *et al.*, 1996; perceived susceptibility three-item $\alpha = 0.85$).

Perceived response-efficacy

The response-efficacy subscales, which were also adapted from the RBDS, likewise demonstrated good internal consistency across both data sets; seven-item α: sample $1 = 0.817$; sample $2 = 0.814$; these α reliabilities were as good or better then those reported for response-efficacy by others doing EPPM research. For example, Witte *et al.* (1996) report a six-item, response/self-efficacy reliability of $\alpha = 0.71$. This is a combined index; Witte *et al.* (1996) did not report separate reliabilities for each efficacy subscale (Rubin *et al.*, 2009).

Perceived self-efficacy

The self-efficacy subscales demonstrated good internal consistency across the data sets; six-item α: sample $1 = 0.840$; sample $2 = 0.861$; with α reliabilities superior to those reported for the RBDS.

Perceived certainty

The outcome certainty subscale demonstrated good internal consistency across the data sets, seven-item α: sample $1 = 0.835$; sample $2 = 0.833$ (item 5 deleted from both analyses).

Perceived immediacy

The immediacy of outcomes subscale also demonstrated good internal consistency across both data sets, five-item α: sample $1 = 0.812$; sample $2 = 0.799$ (item 1 deleted from both analyses).

Perceived salience

Finally, the threat salience subscale likewise demonstrated good internal consistency across both data sets, eight-item α: sample $1 = 0.871$; sample $2 = 0.874$.

Data reported here are virtually identical to results reported in previous research testing these scales in three populations across two hazard contexts (tornados and earthquakes). Further, confirmatory factor analysis (CFA) performed on previously published data indicates that the scales perform as predicted. See Miller *et al.* (2013) for the full results of the CFA.

VI as a predictor of perceived susceptibility

The EPPM argues that motivation to respond to a threat, danger control, is a function of both the perceived severity of the threat and one's perceived susceptibility to it. We can reasonably assume most people would agree that a catastrophic flood results in

severe outcomes; thus, the central question behind this context of study becomes one of perceptions of flood susceptibility.

Although susceptibility and certainty are similar constructs, certainty offers a more powerful measure. If an outcome is certain, people are likely to consider themselves more than susceptible, whereas, perceiving oneself to be susceptible to a given threat does not guarantee that the event will occur. Thus, we expect certainty to predict susceptibility but not the reverse. Moreover, we would also expect immediacy and salience to be predictive of susceptibility.

To examine this relationship, we performed a linear regression using the data from sample 2 – data collected from randomly sampled Oklahoma residents. We regressed the susceptibility scale on the three VI scales, and self-efficacy (an element of both the EPPM and VI). Predictors include certainty, salience, immediacy, and self-efficacy. Response-efficacy was excluded from this analysis; in both the EPPM and VI, response-efficacy addresses specific responses to a particular threat. One can perceive susceptibility (or certainty) of a threat without access to a mitigating response. Results indicate the four predictors explain 60.3 percent of the variance. For the full regression results, see Table I; correlations between the factors are reported in Table II. Certainty is highly correlated with susceptibility and, to a lesser extent, the other subscales, with the exception of self-efficacy. As shown in Table I, results for the regression show the VI variables to be significant predictors of susceptibility.

VI as a predictor of perceived preparedness

Recall VI argues that when all its elements are perceived at a high level, individuals will be highly vested. Therefore, we can assume that an individual highly vested in flood protection, also perceives a higher level of preparedness. We asked participants, on a 1-100 scale, the degree to which they felt prepared for a flood (adapted from Dillard and Shen, 2005). To test this relationship, we performed a regression, weighting income and

	B	SE	*β*
Constant	0.946	0.307	
Certainty	0.663***	0.056	0.624
Salience	0.230***	0.054	0.223
Self-efficacy	−0.090*	0.044	−0.089
Immediacy	−0.102**	0.037	−0.120

Notes: $n = 217$. $R^2 = 0.610$; adjusted $R^2 = 0.603$; $F(4, 216) = 83.02$. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table I. Regression analysis for perceptions of salience

	B	SE	*β*
Constant	−14.041	14.047	
Response-efficacy	−3.38*	1.643	−0.137
Self-efficacy	9.184***	1.89	0.336
Certainty	7.145*	3.105	0.263
Immediacy	3.513**	1.365	0.183
Salience	1.476	1.864	0.062
Susceptibility	−5.282	3.408	−0.191

Notes: $n = 200$. $R^2 = 0.215$; adjusted $R^2 = 0.191$; $F(6, 199) = 8.820$. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table II. Regression analysis for perceptions of preparedness

regressing the VI subscales on perceptions of flood preparedness. Recall that income has been shown to be a predictor of increased levels of preparedness (Ablah *et al.*, 2009). The model was significant, predicting 19.1 percent of the variance in perceptions of preparedness. Results for the regression are reported in Table III. Here, response-efficacy is included in the model because government agencies provide information and recommend responses to mitigate flood-related consequences, which likely has been effective for some citizens. Note that neither salience nor susceptibility is significant predictors in this model.

Discussion

The EPPM and VI both operate on the assumption that individuals act when they are sufficiently motivated to do so. According to social marketing theory, campaigners must first assess audience members' needs and perceptions to develop messages that effectively target and satisfy those needs (Andreasen, 2006). We posit that VI is a valuable tool in formative research for measuring audience vestedness relative to key campaign goals, and further, that the theory can then be used to design targeted messages to enhance the effectiveness of risk communication and reduce potential gaps between perceived and actual risk.

We can reasonably assume that mostly everyone would agree that natural hazards, in this case floods, carry the potential for severe consequences; thus, campaigners need not assess the perceived severity of floods. Likewise, flood susceptibility, is a question of weather, geographic and statistical calculations, which are summed into flood maps developed by FEMA (2010). Citizens' perceptions of salience, certainty, and immediacy related to floods, however, are of interest to stakeholders because citizens are not required to prepare for hazards. Likewise, both response-efficacy and self-efficacy play an important role in facilitating behavioral change, in this case, taking steps to mitigate the risk of potential flooding.

Measuring initial perceptions of vestedness related to flood preparedness, would allow researchers to identify areas of deficiency and develop messages that then target these informational and persuasive needs. Results from the second regression analysis (data from sample 2) show that perceptions of preparedness are a function of the VI variables with the exception of salience. These results indicate that individuals vested in flooding also report higher levels of perceived preparedness. That salience did not predict perceived preparedness could be due to Oklahoma's continuing severe drought (Heim, 2015). The weather in Oklahoma is characteristically unpredictable; despite coming out of the hottest summer in Oklahoma history (McManus, 2011), and continuing drought conditions across much of the state, the eastern half of the state has been under flash flood warnings (Kirin, 2012). Low citizen-level preparedness continues

	1	2	3	4	5	6
1. Susceptibility	–	0.307**	−0.053	0.737**	−0.148*	0.584**
2. Response-efficacy		–	0.190**	0.244**	0.032	0.320**
3. Self-efficacy			–	0.070	0.164*	0.088
4. Certainty				–	0.018	0.571**
5. Immediacy					–	−0.100
6. Salience						–

Note: *,**Correlation is significant at 0.05 and 0.01 levels, respectively (two-tailed)

Table III.
Correlations among subscales for sample 2

to be a problem, largely due to inaccurate perceptions of risk, the required mitigation behaviors, and the unawareness of the preparedness benefits (Decker, 2009; Hellman, 2015). Of note, 70 percent Study 2 participants reported having no flood insurance. We believe the data discussed here support the use of VI in formative research for preparedness campaigns to mitigate these perceptual barriers to preparedness.

The generalizability of these results is enhanced by the use of two different samples, which allowed us to access cross-sections of two populations. Data for sample 1 was collected using convenience sampling, whereas participants for sample 2 were sampled using a random digit dialer, approximating a true random sample. Participants in sample 1 provide data to inform the reliability and validity of the instrument, allowing us to optimize the scales. Data from sample 2 was used for this purpose and allowed us to approximate perceptions of individuals who are arguably more exposed to hazards, including severe flooding. As noted, the mean age for sample 2 participants ($M = 59.67$, $SD = 14.97$) characterizes a sample of reasonably mature adults who are likely to be targeted by risk communication messages. Regarding statistical analyses, the diversity evidenced in the two samples lends additional support to the reliability of the scales.

The purpose of this study has been to present evidence supporting a new set of metrics designed to integrate and measure central elements of VI and the EPPM. Evidence presented by Miller *et al.* (2013), shows that these scales functioned almost identically for three populations across two distinct hazard contexts (tornados in Oklahoma and earthquakes in California). Moreover, recent research in Italy demonstrates the potential for the generalizability of VI concepts across cultures (De Dominics *et al.*, 2014; Khodarahmi, 2009). Data presented here lend further evidence of the reliability and utility of these scales by adding an additional hazard context and two data samples.

Research shows the EPPM to be a useful tool in framing effective fear appeal messages (Witte and Allen, 2000). This study extends this area of research by providing scales for more nuanced measurement of key attitudes and perceptions, for use in risk communication messages beyond the context of fear appeals, to which the EPPM is limited. Measuring key attitudes related to vestedness will allow campaigners to formulate more persuasive and therefore, more effective risk messages, inspiring people to act rather than merely consider the issues (Moe and Pathranarakul, 2006).

Conclusion

A growing body of research continues to highlight the importance of hazard preparedness. US law compels government agencies to prepare; citizens however, must be persuaded. Research, and unfortunate, practical examples have shown that individual-level preparedness plays a crucial role in the resilience of a community after a disaster (Norris *et al.*, 2008). As Redlener *et al.* (2006) argue, the importance, benefits, and methods of preparedness are lost on a great majority of citizens. The value of this research then, resides in its ability to target attitudes and perceptions that present barriers to preparedness and address them with effective risk campaign messages. We hope campaign and community resilience researchers and practitioners find these scales useful for these purposes.

We believe the VI model provides valuable insight into the cognitive processes that mediate persuasion and the relationship between attitudes and behaviors, independent of the topic in question. Data supporting the malleability of these scales suggest that they will be useful in contexts beyond hazard preparedness. Health risk-related areas

such as smoking cessation, obesity, cancer prevention, and other global health issues could benefit from the insights VI offers. Messages targeted to audience-specific needs have the ability to persuade individuals to make changes that benefit not only themselves, but society as well.

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Further reading

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Appendix

Susceptibility

Susceptibility is defined as being vulnerable to harm or at risk for a particular threat.

Please answer the following questions regarding how susceptible and vulnerable you feel living in Oklahoma, a region of the country know to have frequent floods:

1. How susceptible are you to getting injured in a flood?

   Not susceptible 1 2 3 4 5 6 7 Highly susceptible

2. How susceptible is your property to getting damaged in a flood?

   Not susceptible 1 2 3 4 5 6 7 Highly susceptible

3. What is the possibility your property will get damaged in a flood?

   Not possible 1 2 3 4 5 6 7 Highly possible

4. How at risk is your community for being affected by a flood?

   Not at risk 1 2 3 4 5 6 7 Highly at risk

5. Given that you live in Oklahoma, what is your risk for being affected by a flood?

   Low risk 1 2 3 4 5 6 7 High risk

Response-efficacy

Response efficacy is defined as the ability of a tool or procedure to produce a desired result.

The Oklahoma Office of Homeland Security recommends the use emergency supply kits, which commonly include such things as a three day supply of water, non-perishable food, radio, first aid kit, matches, etc. Please answer to the following questions regarding how effective various related responses may be to a flood:

1. How effective is an emergency kit at minimizing the negative consequences of flooding?

   Not effective 1 2 3 4 5 6 7 Highly effective

2. How effective would an emergency kit be to reduce the damage caused by a flood?

   Not effective 1 2 3 4 5 6 7 Highly effective

3. How effective do you think an emergency kit will be at lowering distress following a flood?

   Not effective 1 2 3 4 5 6 7 Highly effective

4. How effective is an emergency kit at minimizing damage from a flood to your property or belongings?

   Not effective 1 2 3 4 5 6 7 Highly effective

5. How effective is an emergency kit at reducing the impact of flooding?

   Not effective 1 2 3 4 5 6 7 Highly effective

6. How effective is planning ahead of time at reducing the potential harm caused by flooding?

   Not effective 1 2 3 4 5 6 7 Highly effective

7. How effective are emergency alert radio messages at helping respond to a flood?

   Not effective 1 2 3 4 5 6 7 Highly effective

Self-efficacy

Self-efficacy is defined as your ability to effectively produce a desired result.

Please answer to the following questions regarding how effective you think you can be at preparing for and responding to a flood:

1. How capable are you at effectively preparing an emergency kit to help respond to a flood?

   Not capable 1 2 3 4 5 6 7 Highly capable

2. How able are you to take the time to prepare an emergency kit for use in the event of a flood?

   Not able 1 2 3 4 5 6 7 Very able

3. Can you afford to buy the items needed for an emergency kit in case of a flood?

   Cannot afford 1 2 3 4 5 6 7 Can easily afford

4. How easy would it be for you to prepare an emergency kit for use in a flood?

   Not easy 1 2 3 4 5 6 7 Very easy

5. How much knowledge do you have about using an emergency kit in response to a flood?

   No knowledge 1 2 3 4 5 6 7 Great knowledge

6. How effective are you at using an emergency kit in case of a flood?

   Not effective 1 2 3 4 5 6 7 Highly effective

Perceived certainty

Certainty is defined as the perceived probability of an event or outcome occurring.

Please answer the following questions regarding your perceptions of the certainty of a flood:

1. How likely is a flood to occur in your community?

   Not likely 1 2 3 4 5 6 7 Highly likely

2. What is the chance of you being affected by a flood?

   Small chance 1 2 3 4 5 6 7 Large chance

3. What are the odds you will be injured in a flood?

   Not likely 1 2 3 4 5 6 7 Highly likely

4. What are the odds your property will be damaged in a flood?

   Not likely 1 2 3 4 5 6 7 Highly likely

5. How certain are you that you can avoid injury if there is a flood?

   Not certain 1 2 3 4 5 6 7 Very certain

6. How certain are the risks of property damaged due to a flood?

   Not certain 1 2 3 4 5 6 7 Very certain

7. How likely are injuries to occur as a result of a flood?

   Not likely 1 2 3 4 5 6 7 Highly likely

8. How likely is loss of belongings or property damage to occur as a result of a flood?

   Not likely 1 2 3 4 5 6 7 Highly likely

Perceived outcomes

Immediacy is defined as the perceived amount of time before the consequences of an event may come about.

Please answer to the following questions regarding how immediate you think the consequences of a flood will occur:

1. How soon might a flood occur?*

   Not soon 1 2 3 4 5 6 7 Very soon

2. How far in the future might a flood affect you?

   Not far 1 2 3 4 5 6 7 Very far

3. How long do you think it will be before a flood occurs in your area?

   Not long 1 2 3 4 5 6 7 Very long

4. How long do you think it will be before a flood damages your belongings or property?

   Not long 1 2 3 4 5 6 7 Very long

5. How long do you have to prepare for a flood?

   Not long 1 2 3 4 5 6 7 Very long

6. How much time do you expect before a flood affects your area?

   Short time 1 2 3 4 5 6 7 Long time

Perceived salience

Salience is defined as your awareness of the presence or prominence of a potentially threatening event.

Please answer to the following questions regarding how salient of an event floods are for you:

1. How often do you think about a potential flood?

   Not often 1 2 3 4 5 6 7 Very often

2. How concerned are you about potential flooding?

   Not concerned 1 2 3 4 5 6 7 Very concerned

3. How prominent of an issue does flooding represent?

   Not prominent 1 2 3 4 5 6 7 Very prominent

4. How obvious is the threat of flooding to you?

   Not obvious 1 2 3 4 5 6 7 Very obvious

5. How often do you think about the threat of floods?

   Not often 1 2 3 4 5 6 7 Very often

6. How aware do you think the public is concerning the issue of flooding?

   Not aware 1 2 3 4 5 6 7 Very aware

7. How often do you think about preparing for the possibility of a flood?

   Not often 1 2 3 4 5 6 7 Very often

8. How much do you care about flooding?

   Not much 1 2 3 4 5 6 7 Very much

Corresponding author

Bradley Adame can be contacted at: badame@asu.edu